Thieme

Diagnosis and management of acute lower gastrointestinal bleeding: European Society of Gastrointestinal Endoscopy (ESGE) Guideline

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MAIN RECOMMENDATIONS

1 ESGE recommends that the initial assessment of patients presenting with acute lower gastrointestinal bleeding should include: a history of co-morbidities and medications that promote bleeding; hemodynamic parameters; physical examination (including digital rectal examination); and laboratory markers. A risk score can be used to aid, but should not replace, clinician judgment.
Strong recommendation, low quality evidence.

2 ESGE recommends that, in patients presenting with a self-limited bleed and no adverse clinical features, an Oakland score of ≤ 8 points can be used to guide the clinician decision to discharge the patient for outpatient investigation.
Strong recommendation, moderate quality evidence.

3 ESGE recommends, in hemodynamically stable patients with acute lower gastrointestinal bleeding and no history of cardiovascular disease, a restrictive red blood cell transfusion strategy, with a hemoglobin threshold of ≤ 7 g/dL prompting red blood cell transfusion. A post-transfusion target hemoglobin concentration of 7–9 g/dL is desirable.
Strong recommendation, low quality evidence.

4 ESGE recommends, in hemodynamically stable patients with acute lower gastrointestinal bleeding and a history of acute or chronic cardiovascular disease, a more liberal red blood cell transfusion strategy, with a hemoglobin threshold of ≤ 8 g/dL prompting red blood cell transfusion. A post-transfusion target hemoglobin concentration of ≥ 10 g/dL is desirable.
Strong recommendation, low quality evidence.

5 ESGE recommends that, in patients with major acute lower gastrointestinal bleeding, colonoscopy should be performed sometime during their hospital stay because there is no high quality evidence that early colonoscopy influences patient outcomes.
Strong recommendation, low quality of evidence.

6 ESGE recommends that patients with hemodynamic instability and suspected ongoing bleeding undergo computed tomography angiography before endoscopic or radiologic treatment to locate the site of bleeding.
Strong recommendation, low quality evidence.

7 ESGE recommends withholding vitamin K antagonists in patients with major lower gastrointestinal bleeding and correcting their coagulopathy according to the severity of bleeding and their thrombotic risk. In patients with hemodynamic instability, we recommend administering intravenous vitamin K and four-factor prothrombin complex concentrate (PCC), or fresh frozen plasma if PCC is not available.
Strong recommendation, low quality evidence.

8 ESGE recommends temporarily withholding direct oral anticoagulants at presentation in patients with major lower gastrointestinal bleeding.
Strong recommendation, low quality evidence.

9 ESGE does not recommend withholding aspirin in patients taking low dose aspirin for secondary cardiovascular prevention. If withheld, low dose aspirin should be resumed, preferably within 5 days or even earlier if hemostasis is achieved or there is no further evidence of bleeding.
Strong recommendation, moderate quality evidence.

10 ESGE does not recommend routinely discontinuing dual antiplatelet therapy (low dose aspirin and a P2Y12 receptor antagonist) before cardiology consultation. Continuation of the aspirin is recommended, whereas the P2Y12 receptor antagonist can be continued or temporarily interrupted according to the severity of bleeding and the ischemic risk. If interrupted, the P2Y12 receptor antagonist should be restarted within 5 days, if still indicated.
Strong recommendation, low quality evidence.

SOURCE AND SCOPE

This Guideline is an official statement of the European Society of Gastrointestinal Endoscopy (ESGE). It provides guidance on the diagnosis and management of acute lower gastrointestinal bleeding. The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) system was adopted to define the strength of recommendations and the quality of evidence.

1 Introduction

This European Society of Gastrointestinal Endoscopy (ESGE) Guideline aims to summarize the available evidence and provide guidance regarding the diagnosis and management of acute lower gastrointestinal bleeding (LGIB) focusing on the risk stratification of patients, the role of endoscopy and other modalities (interventional radiology, surgery) (▶ **Fig. 1**), and on the appropriate management of antithrombotic agents in patients presenting with acute LGIB. All recommendations in this Guideline apply in patients with major LGIB as defined in section 4 of this document.

ABBREVIATIONS

APC	argon plasma coagulation
AUROC	area under the receiver operating characteristic curve
BSG	British Society of Gastroenterology
CTA	computed tomography angiography
DAPT	dual antiplatelet therapy
DOAC	direct oral anticoagulant
EBL	endoscopic band ligation
EDSL	endoscopic detachable snare ligation
ESGE	European Society of Gastrointestinal Endoscopy
FFP	fresh frozen plasma
GRADE	Grading of Recommendations Assessment, Development and Evaluation
Hb	hemoglobin
LGIB	lower gastrointestinal bleeding
NICE	National Institute for Health and Clinical Excellence
NSAID	nonsteroidal anti-inflammatory drug
OR	odds ratio
PCC	prothrombin complex concentrate
PEG	polyethylene glycol
PICO	population, intervention, comparison, and outcome
RBC	red blood cell
RCT	randomized controlled trial
RR	relative risk
UGIB	upper gastrointestinal bleeding

2 Methods

The ESGE commissioned this clinical Guideline (ESGE Guideline Committee chair, J.v.H.) and appointed a guideline leader (K.T.). The guideline leader established four task forces each with its own leader (K.O., I.G., G.M., F.R.). Key questions were prepared by the coordinating team (K.T., K.O., I.G., G.M., F.R., P.G.) and divided amongst the four task forces (**Appendix 1 s**, see online-only Supplementary material). Each task force performed a structured systematic literature search using keywords in English-language articles until August 31, 2020 in Ovid MEDLINE, EMBASE, Google Scholar, and the Cochrane Database of Systematic Reviews. The hierarchy of studies included in this evidence-based guideline was, in decreasing order of evidence level, published systematic reviews/meta-analyses, randomized controlled trials (RCTs), prospective and retrospective observational studies, case series.

Evidence on each key question was summarized in tables (**Tables 1s-17 s**), using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system, wherever applicable [1]. Grading of the evidence depends on the balance between the benefits and risk or burden of any health intervention. Further details on ESGE guideline development have been previously published [2].

The results of the literature search and answers to the PICO questions were presented to all guideline group members during two online meetings conducted on September 26 and 27, 2020. Subsequently, drafts were created by each task force leader and distributed between the task force members for revision and online discussion. In November 2020, a full draft prepared by K.T., P.G. and the four task force leaders was sent to all guideline group members. After the agreement of all members had been obtained, the manuscript was reviewed by two independent external reviewers. The manuscript was then sent for further comments to all ESGE member societies and individual members. The final revised manuscript, having been agreed upon by all the authors, was submitted to the journal *Endoscopy* for publication.

This ESGE Guideline was issued in 2021 and will be considered for update in 2026. Any interim updates will be noted on the ESGE website: http://www.esge.com/esge-guidelines.html.

3 Definition, epidemiology, and risk factors

For the purposes of this guideline, the term "lower gastrointestinal bleeding" will be used for any bleeding deriving from a site distal to the ileocecal valve and including the rectum [3, 4]. The majority of LGIB causes are summarized in ▶ **Table 1** [4, 5] and its most common clinical presentation is hematochezia.

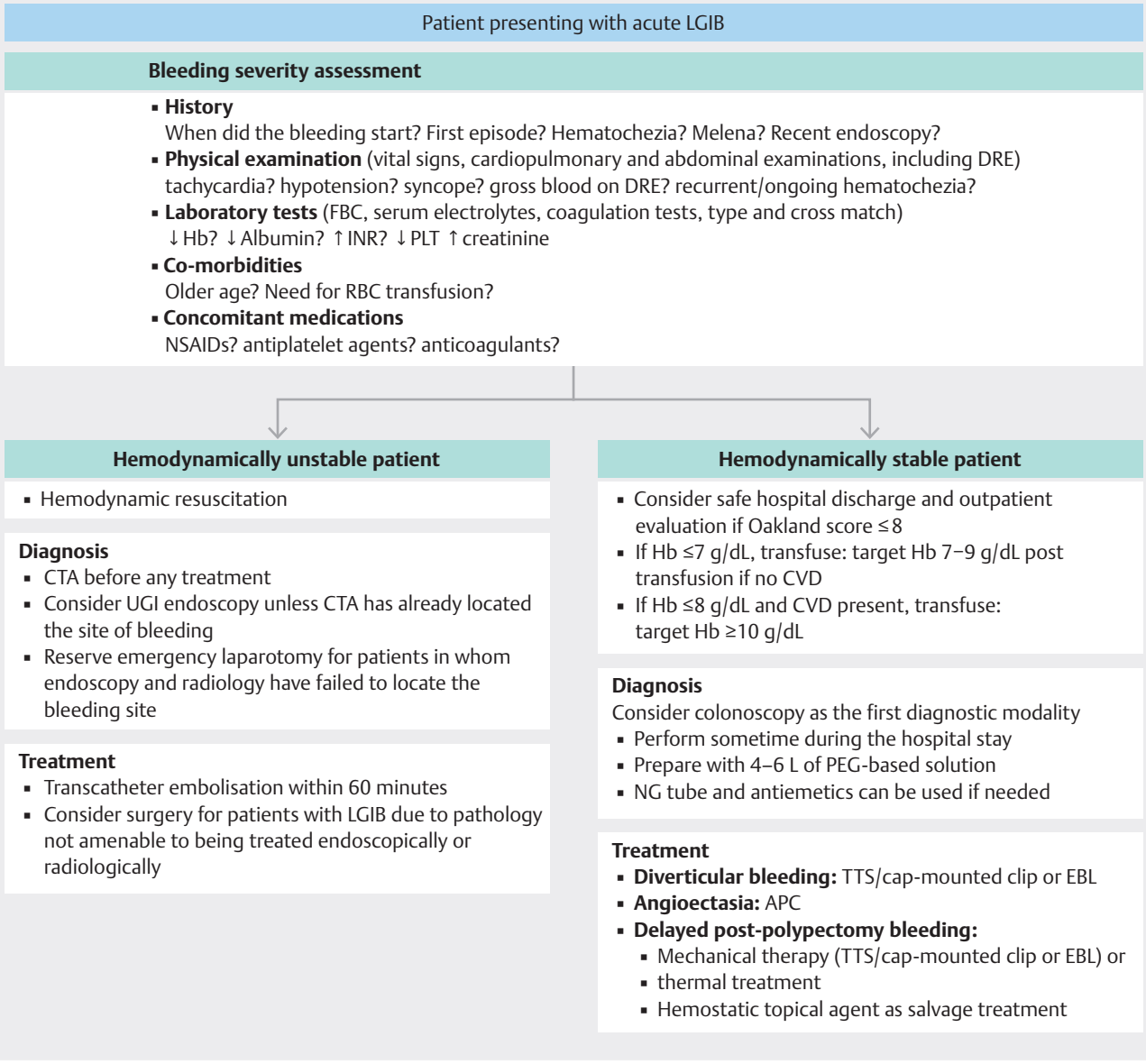
Diverticular bleeding is the commonest cause of LGIB with an incidence exceeding 20 % among patients admitted to hospital [6]. The incidence of definitive diverticular bleeding (high risk stigmata at endoscopy or bleeding diverticula on computed tomography angiography [CTA] or classic angiography) was 20 %, but increased to 34 % when presumptive diverticular bleeding (diagnosis of diverticular disease with lack of any other evident bleeding source in the endoscopy or complementary work-up) was taken into account [7].

Anorectal diseases are the second most frequent cause of LGIB. Hemorrhoidal bleeding is diagnosed in 12 %–21 % of patients admitted to hospital with a presenting complaint of LGIB, which is usually small in amount and self-limited [6]. However, massive hemorrhoidal bleeding in elderly patients receiving anticoagulants has been described [8].

Other causes of LGIB include different types of colitis (e. g. ischemic), radiation proctitis, iatrogenic-induced bleeding (e. g. post-polypectomy), vascular malformations (e. g. angioectasias), and colorectal cancer, among others, while no finding was recently reported in 22.8 % of patients with acute LGIB [6].

Different risk factors may trigger LGIB (**Table 1 s**). Alcohol consumption, smoking index ≥ 400, nonsteroidal anti-inflammatory drugs (NSAIDs), low dose aspirin, and non-aspirin antiplatelet drugs have been identified as independent risk factors for diverticular bleeding (odds ratio [OR] ≥ 1.9) [9], while bilateral diverticular location, nonselective NSAIDs, low dose aspirin, and anticoagulants were associated with an increased risk of diverticular bleeding (OR ≥ 2.23) in a case–control study [10]. Finally, a meta-analysis of six studies concluded that both NSAIDs and aspirin significantly increased the relative risk (RR) for diverticular bleeding (RR ≥ 1.73) [11].

The incidence of LGIB in patients receiving low dose aspirin in a UK-based, large (more than 199 000 new low dose aspirin users; mean follow-up of 5.4 years) population study was 1.22



▶ **Fig. 1** Algorithm for assessment, stratification, and management of patients presenting with acute lower gastrointestinal bleeding (LGIB). APC, argon plasma coagulation; CTA, computed tomography angiography; CVD, cardiovascular disease; DRE, digital rectal examination; EBL, endoscopic band ligation; FBC, full blood count; Hb, hemoglobin; INR, international normalized ratio; NG, nasogastric; NSAID, nonsteroidal anti-inflammatory drugs; PEG, polyethylene glycol; PLT, platelets; RBC, red blood cell; TTS, through the scope; UGI, upper gastrointestinal.

(95% confidence interval [CI] 1.16–1.29) per 1000 person-years, being significantly higher than the incidence rate for upper gastrointestinal bleeding (UGIB) (0.39 [95%CI 0.36–0.43]) [12]. A study from Taiwan showed that low dose aspirin users presented more often with LGIB during their first year of follow-up (0.20%) [13]. Finally, a meta-analysis of 43 RCTs showed that the oral anticoagulants dabigatran and rivaroxaban were related to an increased risk of major gastrointestinal bleeding compared with conventional anticoagulants (vitamin K antagonists) (OR≥1.27); however, the overall risk for LGIB did not differ between the two groups (OR 0.88) [14].

▶ **Table 1** Overview of causes of acute lower gastrointestinal bleeding.

Benign diseases	Diverticular disease	
	Anorectal conditions	Hemorrhoids
		Anal fissure
		Solitary rectal ulcer
		Rectal prolapse
		Radiation proctopathy
		Trauma
	Vascular lesions	Angioectasias
		Hereditary hemorrhagic telangiectasia
		Dieulafoy's lesion
		Colonic or rectal varices
	Colitis	Inflammatory bowel disease (ulcerative colitis, Crohn's disease)
		Ischemic colitis
		Infectious colitis
		Undetermined colitis
	Polyps	Adenomas, hamartomas
	Iatrogenic	Post-endoscopic intervention (polypectomy, EMR, ESD)
		Post-surgical
	Chronic anastomotic ulcer	
Malignant diseases	Colorectal cancer	
	Anal cancer	
	Metastatic/invasive lesions	

EMR, endoscopic mucosal resection; ESD, endoscopic submucosal dissection.

4 Triage, risk stratification, and blood transfusion

4.1 How should patients with lower gastrointestinal bleeding be stratified according to severity?

4.2 What should be the initial assessment of patients with lower gastrointestinal bleeding according to the severity of the bleeding?

RECOMMENDATION

ESGE recommends that the initial assessment of patients presenting with acute lower gastrointestinal bleeding should include: a history of co-morbidities and medications that promote bleeding; hemodynamic parameters; physical examination (including digital rectal examination); and laboratory markers. A risk score can be used to aid, but should not replace, clinician judgment.

Strong recommendation, low quality evidence.

Risk factors for poor LGIB outcome include hemodynamic instability at presentation (tachycardia, hypotension, syncope), ongoing bleeding (gross blood on initial digital rectal examination, recurrent hematochezia), co-morbidities, older age, laboratory findings (hemoglobin, creatinine, albumin, prothrombin time), blood transfusion requirement, and concomitant medication (NSAIDs, antiplatelet agents, and anticoagulants) [158]. When stratifying patients with LGIB according to their severity, their vital signs and the findings of cardiopulmonary, respiratory, abdominal, and digital rectal examination should be included in the initial physical examination.

Although comparatively less well established than in UGIB, risk stratification scores do exist for LGIB. Some have been developed to predict adverse outcomes, including the ABC score [19], Strate score [15], NOBLADS [20], Sengupta score [16], BLEED [17], Birmingham score [21], Severe Acute LGIB (SALGIB) [22] score, and the HAKA score [23]; whilst others have been developed to identify patients at low risk of adverse outcomes: Oakland score [24] and SHA_2PE [25]. Additionally, scores developed for use in UGIB, such as the Glasgow–Blatchford bleeding score (GBS) [26] and Rockall score [27] have also been shown to have predictive ability in LGIB. No risk score has been directly compared with clinician judgment, therefore the clinical data available at the time of initial patient presentation is the best option to identify patients at high risk for severe bleeding and other adverse outcomes (**Table 2s**).

4.3 What are the indications to admit a patient with acute lower gastrointestinal bleeding to the hospital?

4.4 When can a patient with acute lower gastrointestinal bleeding be discharged and followed-up as an outpatient?

RECOMMENDATION

ESGE suggests that no single risk score should be used in isolation to predict adverse outcomes and determine the need for hospital admission in acute lower gastrointestinal bleeding.

Weak recommendation, low quality evidence.

RECOMMENDATION

ESGE recommends that, in patients presenting with a self-limited bleed and no adverse clinical features, an Oakland score of ≤ 8 points can be used to guide the clinician decision to discharge the patient for outpatient investigation.

Strong recommendation, moderate quality evidence.

External validation studies of available tools [15, 17, 19, 20, 26, 28] to assess the risk of adverse outcomes in acute LGIB have found that no score reliably identifies all outcomes of interest [24, 29]. Oakland et al. assessed risk scores in a prospective study of 2336 LGIB patients: the best predictors of

▶ **Table 2** The performance of the BLEED, NOBLADS, Strate, Glasgow–Blatchford, AIM-65, and ABC scores in the prediction of adverse outcomes in lower gastrointestinal bleeding (LGIB).

Score	Author (year)	External validation population	Population size	Mortality	Rebleeding	RBC transfusion
				Sensitivity Specificity AUROC	Sensitivity Specificity AUROC	Sensitivity Specificity AUROC
BLEED	Oakland (2017)	All cases of LGIB, UK	2336	NR NR 0.68	NR NR 0.63	NR NR 0.63
NOBLADS	Oakland (2017)	All cases of LGIB, UK	2336	NR NR 0.72	NR NR 0.62	NR NR 0.66
	Aoki (2018)	All cases of LGIB, Japan	511	NR NR 0.83	NR NR 0.74	NR NR 0.71
Strate	Oakland (2017)	All cases of LGIB, UK	2336	NR NR 0.67	NR NR 0.66	NR NR 0.73
Glasgow–Blatchford	Oakland (2017)	All cases of LGIB, UK	2336	NR NR 0.73	NR NR 0.74	NR NR 0.86
AIMS-65	Oakland (2017)	All cases of LGIB, UK	2336	NR NR 0.78	NR NR 0.63	NR NR 0.63
	Laursen (2020)	All cases of LGIB with AIMS-65 ≥ 2, UK	2336	58 % 81 % 0.75	NR NR NR	NR NR NR
ABC	Laursen (2020)	All cases of LGIB with ABC ≥ 8, UK	2336	22 % 97 % 0.84	NR NR NR	NR NR NR

RBC, red blood cell; AUROC, area under the receiver operating characteristic curve; NR, not reported. Adapted from Oakland K [30].

mortality, rebleeding, and red blood cell (RBC) transfusion were AIMS-65 (area under the receiver operating characteristic curve [AUROC] 0.78), the Oakland and the GBS (both AUROCs 0.74), and the Oakland score (AUROC 0.92), respectively; however, no score reliably predicted intervention to treat bleeding (AUROCs 0.52–0.65) [24]. ▶ **Table 2** summarizes the performance of different available scores for the prediction of mortality, rebleeding, and need for RBC transfusion in patients with LGIB [30]. In a multicenter international study, the ABC score was found to be superior to the AIMS-65 score in predicting mortality (AUROC 0.84 vs. 0.75) [19]. The analysis of other scores and other important adverse outcomes, such as severe bleeding, need for endoscopic hemostasis, embolization, surgery, or RBC transfusion, has been limited to small single-center studies [29, 31, 32].

The Oakland [24] (▶ **Table 3**) and SHA_2PE [32] scores have been specifically designed to identify low risk patients. The Oakland score was validated in a retrospective study of 38 067 patients admitted to 140 hospitals in the USA [33]. It comprises seven variables and has been designed to predict "safe discharge," a composite outcome defined as the absence of in-hospital rebleeding, RBC transfusion, therapeutic intervention, in-hospital death, and readmission with subsequent LGIB within 28 days. A score threshold of ≤ 8 points has a 95 % probability of safe discharge and is the threshold recommended to identify patients for discharge [24, 34]. Therefore, any self-limited LGIB with an Oakland score ≤ 8 should be considered as minor, and such patients can be considered for early hospital discharge, while all others, presenting with or without hemodynamic instability, should be considered as having a major LGIB.

Oakland et al. assessed the NOBLADS, Strate score, GBS, AIM-65 and pre-endoscopy Rockall score in predicting safe hospital discharge. All scores had an AUROC < 0.65, except the Strate score (AUROC 0.69), GBS (0.80), and Oakland score (0.84) [24]. The ABC score can be used to identify patients with a low risk of death: a threshold of ≤ 3 points is associated with a sensitivity of 73 %, specificity of 84 %, with a mortality rate of 0.6 % [19].

▶ **Table 3** The Oakland score for predicting the safe discharge of patients presenting with acute lower gastrointestinal bleeding (LGIB).

Variable	Score
Age, years	
▪ <40	0
▪ 40–69	1
▪ >70	2
Sex	
▪ Female	0
▪ Male	1
Previous LGIB admission	
▪ No	0
▪ Yes	1
Digital rectal examination findings	
▪ No blood	0
▪ Blood	1
Heart rate, bpm	
▪ <70	0
▪ 70–89	1
▪ 90–109	2
▪ >110	3
Systolic blood pressure, mmHg	
▪ 50–89	5
▪ 90–119	4
▪ 120–129	3
▪ 130–159	2
▪ >160	0
Hemoglobin, g/dL	
▪ 36–69	22
▪ 70–89	17
▪ 90–109	13
▪ 110–129	8
▪ 130–159	4
▪ >160	0

bmp, beats per minute.
Adapted from Oakland K et al. [24].

4.5 When should patients with acute lower gastrointestinal bleeding be given a blood transfusion?

RECOMMENDATION

ESGE recommends, in hemodynamically stable patients with acute lower gastrointestinal bleeding and no history of cardiovascular disease, a restrictive red blood cell transfusion strategy, with a hemoglobin threshold of ≤ 7 g/dL prompting red blood cell transfusion. A post-transfusion target hemoglobin concentration of 7–9 g/dL is desirable. Strong recommendation, low quality evidence.

RECOMMENDATION

ESGE recommends, in hemodynamically stable patients with acute lower gastrointestinal bleeding and a history of acute or chronic cardiovascular disease, a more liberal red blood cell transfusion strategy, with a hemoglobin threshold of ≤ 8 g/dL prompting red blood cell transfusion. A post-transfusion target hemoglobin concentration of ≥ 10 g/dL is desirable.
Strong recommendation, low quality evidence.

A 2015 UK audit of 2528 patients admitted with LGIB found that 26.7 % received RBC transfusion, with 80 % of these transfusions being considered, eventually, as avoidable [35]. The American College of Gastroenterology [36], British Society of Gastroenterology [34], and NICE [37] guidelines, and an international consensus conference [38] have recommended that restrictive transfusion thresholds (Hb 7–8 g/dl) should be used in hemodynamically stable patients with acute gastrointestinal bleeding, whilst the threshold should be higher for patients with cardiovascular diseases.

These recommendations are based mainly on evidence deriving from UGIB studies, which have shown that a restrictive blood transfusion strategy is associated with higher survival, lower length of stay, and less RBC transfusion requirement [39–41]. However, a post-hoc analysis of the UK audit of acute LGIB [35, 42] found no difference between liberal and restrictive transfusion strategies for the odds of rebleeding or in-hospital mortality. Similarly, in both a systematic review of RCTs and an overview of systematic reviews, mortality did not differ between restrictive and liberal transfusion strategies for most of the populations [43, 44] (**Table 3 s**).

On the other hand, elderly patients and patients with cardiovascular disease may have a different response to restrictive transfusion when compared with liberal transfusion. A systematic review and meta-analysis of outcomes in patients with cardiovascular disease in a non-cardiac surgery setting showed that the risk of acute coronary syndrome in patients managed with restrictive compared with liberal transfusion was significantly increased (RR 1.78 [95 %CI 1.18–2.70]) [45]. Finally, in a meta-analysis of nine RCTs evaluating restrictive vs. liberal transfusion strategies in older adults, the risk of both 30-day and 90-day mortality was significantly higher in the restrictive transfu-

sion group (RR 1.36 [95 %CI 1.05–1.74] and RR 1.45 [95 %CI 1.05–1.98], respectively) [46]. These findings are particularly relevant to patients presenting with acute LGIB as many of them have either cardiovascular morbidity or are elderly, with a median age of 74 years [6].

5 Diagnosis and management of lower gastrointestinal bleeding: the role of endoscopy

5.1 When should colonoscopy be the first diagnostic modality in patients with acute lower gastrointestinal bleeding?

RECOMMENDATION

ESGE recommends that colonoscopy should be the first diagnostic modality for hemodynamically stable patients with acute lower gastrointestinal bleeding because of the therapeutic options it offers.

Strong recommendation, very low-quality evidence.

Colonoscopy allows diagnosis, tissue sampling, and treatment during the same session and is proposed by other current guidelines as the first-line procedure for the majority of patients with acute LGIB [34, 36]. Colonoscopy is estimated to have a diagnostic accuracy ranging from 42 % to 100 %, while hemostatic therapy is performed in 10 % to 63 % of patients [36, 47]. Unlike CTA, colonoscopy does not require active bleeding for diagnosis and avoids radiation exposure and contrast-induced toxicity.

In a meta-analysis of 22 studies, the overall sensitivity and specificity of CTA in the diagnosis of acute LGIB were 85.2 % (95 %CI 75.5 %–91.5 %) and 92.1 % (95 %CI 76.7 %–97.7 %), respectively [48]. The accuracy of tagged RBC scintigraphy is lower than CTA [49] and varies widely in the literature [36, 48, 49]. Angiography achieves a high rate of immediate hemostasis (86 %–100 %), but is usually reserved as a second-line procedure owing to its invasiveness and rate of adverse events (0 %–60 %) [50].

An RCT by Green et al. compared urgent colonoscopy (< 8 hours) to a standard protocol that included tagged RBC scintigraphy, followed by visceral angiography when positive, or elective colonoscopy when negative [51]. A definitive source of bleeding was found more often in the urgent colonoscopy group, but the two approaches did not differ in safety, rebleeding, mortality, or transfusion requirements. Early colonoscopy had a significantly higher diagnostic yield (85 % vs. 45 %; P = 0.005) and was associated with shorter length of stay and lower transfusion requirements compared with early radiographic procedures in a retrospective study [47].

Moreover, a recent systematic review compared the diagnostic and therapeutic yields of endoscopy, CTA, and angiography [49]. Among the included studies that compared CTA with tagged RBC scintigraphy, one study demonstrated a higher diagnostic yield for CTA, while the other two reported no difference. A lack of studies precluded the performance of analyses of colonoscopy vs. CTA and colonoscopy vs. first-line angiography.

Clerc et al. found that active bleeding was identified significantly more often with CTA compared with lower gastrointestinal endoscopy (31 % vs. 15 %; P = 0.03) [52], whereas Lee et al. reported a similar yield for both modalities [53]. Miyakuni et al. performed a nationwide study in Japan selecting patients with severe LGIB who underwent angiography or urgent colonoscopy within 1 day of admission [54]. After propensity score matching, in-hospital mortality was similar (RR 1.14 [95 %CI 0.95–1.36]), but the need for surgery within 1 day was lower in the angiography group (RR 0.44 [95 %CI 0.29–0.67]).

None of the reviewed studies reported a cost–benefit analysis or showed a significant difference in rebleeding rates, adverse events, 30-day mortality, 30-day surgery rate, hospital length of stay, or transfusion requirements (**Tables 4s–6s**).

To conclude, low quality evidence indicates that CTA and colonoscopy have comparable diagnostic yields and safety profiles. Colonoscopy has the advantage of allowing diagnosis and treatment simultaneously, whereas CTA does not require bowel preparation and might be preferred for selected patients with severe LGIB.

5.2 What is the appropriate timing for colonoscopy in patients with acute lower gastrointestinal bleeding?

RECOMMENDATION

ESGE recommends that, in patients with major acute lower gastrointestinal bleeding, colonoscopy should be performed sometime during their hospital stay because there is no high quality evidence that early colonoscopy influences patient outcomes.

Strong recommendation, low quality evidence.

Available evidence comparing early vs. elective colonoscopy in the management of patients with acute LGIB consists of seven systematic reviews with meta-analyses [55–61], four RCTs [51, 62–64], and 16 observational studies [65–80] (**Table 7s**). Patients with “minor” LGIB managed as outpatients and patients with an UGIB source were excluded from the RCTs [51, 62–64] and most of the observational studies [66, 67, 69, 71–78]. Early or urgent colonoscopy was defined as a colonoscopy performed within 24 hours of presentation in most studies [62–64, 65–78]. In RCTs, delayed or elective colonoscopy was defined as that performed between 24 hours and 96 hours from the time of hospital admission [51, 62–64].

Two recent meta-analyses of observational studies suggested that early colonoscopy reduces all-cause mortality (OR 0.86 [95 %CI 0.75–0.98]), the need for surgery (OR 0.52 [0.42–0.64]), blood transfusion requirements (OR 0.81 [0.75–0.87]), and hospital length of stay (mean difference −1.7 days), with no significant differences in terms of rebleeding, identification of the source of bleeding, adverse events, or need for endoscopic therapy or interventional radiology [55, 56]. One RCT also

found that early colonoscopy was associated with shorter hospital length of stay, but with an increased rate of recurrent bleeding [64], while another RCT revealed that a definitive source of bleeding was more often detected in the urgent colonoscopy group [51].

However, two RCTs did not show any significant differences in the clinical outcomes between early and elective colonoscopy [62, 63]. Similarly, three meta-analyses that included the four available RCTs did not show any differences regarding rebleeding, mortality, need for additional therapy, length of stay, transfusion requirements, or any other clinical outcome [55–57]. Moreover, subgroup analyses assessing colonoscopy performed within 12 hours from the time of hospital admission and a post-hoc meta-regression intended to determine the impact of hemodynamic instability on clinical outcomes did not find any differences between the groups [55, 57].

We considered the certainty of evidence to be low, despite the significant number of studies evaluating the appropriate timing of colonoscopy. All but one [80] of the observational studies were retrospective [65–79], and the definitions and selection criteria were heterogeneous. All RCTs were non-blinded, with some concerns regarding bias (**Tables 7 s** and **8 s**), and two trials were terminated before reaching the pre-planned sample size [51, 63]. The low number of RCTs and their limited sample sizes led to wide confidence intervals for all outcomes assessed in the meta-analyses and impeded accurate evaluation of publication bias. Finally, moderate to high heterogeneity was found for the pooled data of hospital length of stay and units of blood transfused, altogether leading to imprecision, inconsistency, and uncertain risk of publication bias in the available evidence (**Table 8 s**).

To conclude, studies comparing early (< 24 hours) vs. delayed (> 24 hours) colonoscopy have focused on patients with major acute LGIB in whom colonoscopy was performed during hospitalization. Retrospective data suggest that early colonoscopy may reduce all-cause mortality, the need for surgery, blood transfusion requirements, and hospital length of stay. However, meta-analyses of the RCTs have not confirmed these findings and suggest that both groups have similar clinical outcomes. It remains unclear whether selected acute LGIB patients could benefit from early colonoscopy.

5.3 Is there a role for unprepped sigmoidoscopy/colonoscopy in patients presenting with acute lower gastrointestinal bleeding?

RECOMMENDATION

ESGE does not recommend unprepped lower gastrointestinal endoscopy (e. g. colonoscopy, sigmoidoscopy) in patients with acute lower gastrointestinal bleeding.
Strong recommendation, low quality evidence.

Comparative studies on colonoscopy with and without bowel cleansing in acute LGIB patients are lacking (**Table 9 s**). Current guidelines recommend that colonoscopy should only be performed following adequate bowel preparation [34, 36]. Two recent prospective cohort studies in patients with severe LGIB reported the use of “hydro flush colonoscopy” in 12 and 33 patients, respectively [81, 82], where colonoscopy was performed after a tap-water enema and the bowel was further cleansed using water or polyethylene glycol (PEG) solution delivered by a water-jet pump and suction during colonoscopy. The bleeding source in many cases of acute LGIB is located proximal to the rectum and sigmoid colon [82, 83]; complete colonoscopy should therefore be the aim. However, in cases where CTA has identified a bleeding source in the rectum or sigmoid colon, flexible sigmoidoscopy can be considered.

5.4 Should upper gastrointestinal endoscopy be performed in patients presenting with acute lower gastrointestinal bleeding?

RECOMMENDATION

ESGE recommends that upper gastrointestinal endoscopy be performed in patients presenting with acute lower gastrointestinal bleeding and hemodynamic instability unless computed tomography angiography has already been performed showing a definitive bleeding source in the lower gastrointestinal tract.
Strong recommendation, low quality evidence.

There are no studies comparing upper GI endoscopy vs. no upper GI endoscopy in patients with acute LGIB (**Table 10 s**). Overall, in 8 %–9 % of patients presenting with LGIB, the source of bleeding is found in the upper GI tract [6, 84], whereas in patients with severe hematochezia and hemodynamic instability up to 15 % have an upper bleeding source [63, 85]. A past medical history of portal hypertension, peptic ulcer, and antiplatelet medication are known risk factors for UGIB [63, 85, 86]. An elevated blood urea/creatinine ratio (> 30) has also been found to be indicative of UGIB [86]. The British Society of Gastroenterology (BSG) recommends that an upper GI endoscopy should be performed immediately if no source is identified by initial CTA, while gastroscopy may be the first investigation if the patient stabilizes after initial hemodynamic resuscitation [34]. Similarly, the American College of Gastroenterology recommends upper GI endoscopy be performed in patients with hematochezia and hemodynamic instability [36].

5.5 In patients with acute lower gastrointestinal bleeding undergoing colonoscopy, what is the recommended bowel preparation?

RECOMMENDATION

ESGE suggests bowel preparation using large volume (4–6 L) PEG-based solution. Use of a nasogastric tube combined with an antiemetic agent may facilitate bowel preparation in patients who are intolerant of oral intake.
Strong recommendation, moderate quality evidence.

Adequate preparation of the colon in the setting of acute LGIB facilitates endoscopic visualization, diagnosis, and treatment, and may reduce the risk of bowel perforation. The available data are mostly from studies on acute LGIB using large volume bowel preparation (4–6 L of PEG solution within 3–4 hours), with colonoscopy performed within 1–2 hours of the completion of bowel preparation [51, 63, 74, 87] (**Table 11 s**).

The use of lower volume or alternative colon preparation solutions in the setting of LGIB has not been specifically addressed, but preliminary data appear encouraging [88–90]. A prospective study [91] used 2 L of PEG solution added to the water-jet tank, starting from the left side of the colon up to the cecum, in elderly patients (n = 33). The mean Boston Bowel Preparation Scores during scope insertion and withdrawal were 2.6 and 7.2, respectively; the mean (standard deviation) withdrawal time exceeded the insertion time (28.7 [6.9] minutes vs. 17.1 [4.9] minutes), and the source of bleeding was found in 90.9 % of patients.

In studies of urgent colonoscopy, one-third of patients required a nasogastric tube to facilitate rapid bowel preparation [87]; therefore, a nasogastric tube can be placed to facilitate this process as long as the risk of aspiration is low. Few studies have addressed bowel preparation-related adverse events in acute LGIB. In an age- and sex-matched controlled retrospective study (n = 161) using PEG solution or enema for those who could not completely consume the PEG solution, 16 LGIB patients (9 %) experienced an adverse event (7 % hypotension, 2 % vomiting) [92].

5.6 What are the endoscopic hemostasis treatments for acute lower gastrointestinal bleeding?

The summary of evidence is available in **Table 12 s**.

5.6.1 Diverticular bleeding

RECOMMENDATION

ESGE suggests mechanical therapy (e. g. through-the-scope/cap-mounted clip or endoscopic band ligation) as the preferred treatment for diverticular hemorrhage.

Weak recommendation, moderate quality evidence.

Endoscopic treatment for diverticular bleeding has typically included thermal coagulation, endoscopic clipping (through-the-scope or cap-mounted), endoscopic band ligation (EBL), ligation using an endoscopic detachable snare (EDSL), and administration of epinephrine local injection. Owing to the lack of strong, clear evidence on which hemostasis modality is more effective and/or safer, recommendations depend on a combination of case reports, case series, and prospective and retrospective studies, rather than RCTs and systematic reviews.

5.6.1.1 Injection/thermal contact therapy Injection therapy is used in conjunction with other types of therapy, such as thermal contact methods. Reports have shown their effectiveness for diverticular bleeding [87, 93]. Thermal contact therapies include heater probe therapy and bipolar coagulation, with or without adrenalin injection [51, 87, 93]. However, thermal therapy poses the risk of perforation owing to the thin wall of the colon. Injection of epinephrine alone should not be used as definitive hemostasis therapy.

5.6.1.2 Endoscopic clipping Endoscopic clipping is the method used most often and typically poses less risk of tissue injury. The through-the-scope method of clipping has been the recommendation in previous guidelines [34, 36].

5.6.1.3 Endoscopic ligation An historical control study done by Okamoto et al. showed EBL to be superior to clipping, based on its significantly lower rebleeding rates after 1 year of follow-up for patients with bleeding colonic diverticula ($P < 0.01$) [94]. A recent systematic review and meta-analysis compared several endoscopic modalities, including ligation therapy, coagulation, and clipping, in patients with colonic diverticular bleeding. The results suggested that ligation therapy was more effective compared with clipping, in terms of avoiding transcatheter arterial embolization or surgery. However, there were no significant differences in the rates of initial hemostasis and early rebleeding (≤ 30 day) between the coagulation (n = 33), clipping (n = 192), and ligation groups (n = 156). Pooled analysis showed that the efficacy of band ligation to treat diverticular bleeding was up to 99 % (95 %CI 95 %–100 %), with the early recurrent bleeding rate being 9 % (95 %CI 4 %–15 %) [95].

A recently published review on treatment trends for colonic diverticular bleeding in Japan, which assessed five studies (n = 510), concluded that EBL is ultimately superior to endoscopic clipping in terms of short- and long-term rebleeding rates and that the proportion of patients needing transcatheter arterial embolization or surgery after EBL is significantly lower than that for patients who underwent endoscopic clipping [96].

While EBL is considered safe and effective [97–99], there have been reports suggesting that EBL carries the risk of serious complications, such as delayed perforation, especially for right-sided lesions [100–103].

5.6.1.4 Endoscopic detachable snare ligation EDSL has also been used to ligate a bleeding diverticulum, similarly to endoscopic band ligation. In a retrospective study, sustained hemostasis was achieved in 7/8 patients (88 %), with early rebleeding occurring in one patient [104].

5.6.1.5 Hemostatic topical agents Only small studies and case series have evaluated the efficacy and safety of hemostatic topical agents in the treatment of LGIB. In a multicenter prospective study, the EndoClot polysaccharide hemostatic system (EndoClot Plus Inc., Santa Clara, California, USA) was used to treat diverticular bleeding; successful hemostasis was achieved in 83 % of the patients, while the remaining two cases (17 %) rebled secondary to malignancy and a cecal ischemic ulcer [105]. A systematic review by Chen et al. [106] and two small studies [107, 108] also described encouraging results for Hemospray (Cook Medical, Bloomington, Indiana, USA) in cases of actively bleeding LGIB lesions.

5.6.2 Angioectasia

RECOMMENDATION
ESGE recommends treatment of bleeding angioectasia using argon plasma coagulation.
Strong recommendation, low quality evidence.

Argon plasma coagulation (APC) is considered the treatment of choice for angioectasia in the upper and lower gastrointestinal tract because it is associated with lower complication rates and less need for RBC transfusion [109–112]; however, comparative studies are lacking. Injection of a saline–adrenaline solution prior to APC is suggested when treating right-sided colonic lesions, which present a higher risk for perforation [111]. The optimal settings in terms of thermal effect intensity, gas flow, and duration of the application depend on the site and size of the area that is being treated, but typically the power ranges from 20–60 W and the gas flow rate from 1–2.5 L/minute [109–112].

5.6.3 Delayed post-polypectomy bleeding

RECOMMENDATION
ESGE recommends the use of mechanical therapy (e.g. through-the-scope/cap-mounted clips) and/or contact thermal coagulation as the primary treatment options of delayed post-polypectomy bleeding.
Strong recommendation, low quality evidence.

RECOMMENDATION
ESGE suggests that hemostatic topical agents be used as a secondary treatment option (e.g. rescue therapy) in cases of inadequate/failed hemostasis with ongoing bleeding.
Weak recommendation, low quality evidence.

The modality used most often to treat delayed post-polypectomy bleeding is through-the-scope clips; however, the use of novel modalities, such as topical hemostatic agents and cap-mounted clips, has also been reported [113]. Through-the-scope clips achieve successful hemostasis in most patients, but evidence is based on clinical experience [113–115]. Treatment using bipolar coagulation, and non-contact coagulation therapy with APC have also been reported [116]. Regarding hemostatic topical agents, a prospective multicenter study of patients with active LGIB (n = 50) showed that hemostatic powder, as either monotherapy, combination therapy, or rescue therapy, successfully induced hemostasis in 98 % of the patients; however, five patients (10 %) experienced recurrent bleeding within 30 days [117].

6 Diagnosis and treatment of lower gastrointestinal bleeding: the role of interventional radiology and surgery

6.1 When should computed tomography angiography be the initial diagnostic modality in patients presenting with acute lower gastrointestinal bleeding?

RECOMMENDATION
ESGE recommends that patients with hemodynamic instability and suspected ongoing bleeding undergo computed tomography angiography before endoscopic or radiologic treatment to locate the site of bleeding.
Strong recommendation, low quality evidence.

RECOMMENDATION
ESGE does not recommend red blood cell scintigraphy in the setting of acute lower gastrointestinal bleeding because of its limited accuracy in identifying the location of the bleeding site and logistical constraints.
Strong recommendation, low quality evidence.

No RCT has been published on the accuracy of CTA in detecting LGIB. Retrospective clinical studies report the sensitivity and specificity of CTA for LGIB to be 79 %–95 % and 95 %–100 %, respectively [118, 119]. If extravasation of contrast agent is detected at CTA, patients can then undergo angiography and selective mesenteric embolization. Among 20 patients with LGIB, CTA was positive in 9/13 patients (69.2 %) who were hemodynamically unstable and only in 1/7 of the patients (14.3 %) who were hemodynamically stable [120].

Diverticular bleeding is diagnosed more often in patients undergoing CTA prior to endoscopic examination than in those not undergoing CTA (35.7 % vs. 20.6 %) [121]. Furthermore, precise identification of the bleeding diverticulum is significantly higher in patients with extravasation observed on CTA than in those without this (68 % vs. 20 %; $P < 0.001$) [122]. Three studies in patients undergoing either CTA or RBC scintigraphy prior to selective angiography did not detect any difference in the incidence of contrast-induced nephropathy between the two diagnostic approaches [123–125]. Recently, Zink et al. demonstrated that CTA and RBC scintigraphy had similar sensitivities in terms of LGIB detection (85.2 % vs. 94.4 %) [124]. However, CTA had a positive correlation with catheter-guided angiography compared with RBC scintigraphy (67.7 % vs. 29.3 %). Jacovides et al. reported equivalent sensitivity and specificity of RBC scintigraphy and CTA, but the bleeding site located by CTA was more precise and consistent with the angiography findings [123]. Similarly, Feuerstein et al. showed that CTA located the site of LGIB more often compared with RBC scintigraphy (53 % vs. 30 %) [126]. Finally, CTA is readily available at most hospitals, while RBC scintigraphy requires more time to be performed (radiotracer preparation, with 60 to 90 additional

minutes needed for image acquisition after injection) and has more complicated logistics [123] (**Table 13 s**).

6.2 When should interventional radiology be used for the treatment of patients with lower gastrointestinal bleeding?

RECOMMENDATION

ESGE recommends that transcatheter arterial embolization should be reserved for the treatment of acute, potentially life-threatening, lower gastrointestinal bleeding either in hemodynamically unstable patients with active bleeding as demonstrated by computed tomography angiography or in patients with brisk and ongoing bleeding not amenable to or not effectively treated by endoscopic interventions.

Strong recommendation, low quality evidence.

RECOMMENDATION

ESGE recommends providing embolization within 60 minutes for a hemodynamically unstable patient, because time has been proven to be a significant factor influencing patient outcome.

Strong recommendation, low quality evidence.

Selective transcatheter endovascular therapy using microcatheters aims to decrease arterial perfusion to the bleeding site, ensuring super-selective embolization of arteries < 1 mm. The choice of the embolizing agent, including absorbable gelatin sponges, cyanoacrylate glue, ethylene, or polyvinyl alcohol, and microcoils, is based upon operator experience and local availability.

Transcatheter arterial embolization as the first step in the management of acute LGIB should be reserved for patients demonstrating brisk and ongoing bleeding not amenable to or not effectively treated by endoscopic means. Hemodynamic instability, a drop in hemoglobin of ≥ 5 g/dL from admission, and blood transfusion requirement of ≥ 5 RBC units within 24 hours have been associated with the ability to locate the source of LGIB at selective mesenteric angiography [127].

A systematic review found that super-selective angiographic embolization achieved immediate hemostasis in 40 %–100 % of cases of diverticular bleeding, with rebleeding rates ranging from 0–50 % [128]. The likelihood of identifying active bleeding was eight-fold higher if angiography was performed within 90 minutes of CTA, as shown in a retrospective study [129], and decreased when its performance following RBC scintigraphy was delayed [130]. Therefore, embolization should be provided within 60 minutes in hemodynamically unstable patients wherever an interventional radiology team is available. The risk of transcatheter embolization-induced bowel ischemia is 1 %–4 % and is related to the inability to achieve super-selective embolization [131, 132] (**Table 14 s**).

6.3 When should surgery be used as a diagnostic or therapeutic modality in patients with acute lower gastrointestinal bleeding?

RECOMMENDATION

ESGE recommends that, except under exceptional circumstances, no patient should proceed to emergency exploratory laparotomy unless every effort has been made to locate the site of bleeding by endoscopic or radiological modalities.

Strong recommendation, low quality evidence.

RECOMMENDATION

ESGE recommends that surgery should only be undertaken if the lower gastrointestinal bleed is due to underlying pathology that is not amenable to endoscopic or radiological treatment, or if these modalities have failed.

Strong recommendation, low quality evidence.

No RCTs or non-randomized interventional studies have directly assessed laparotomy (open or minimally invasive) as the first diagnostic modality in comparison to radiological or endoscopic modalities in LGIB. Moreover, only a few prospective observational studies have assessed such management protocols in LGIB [49] (**Table 15 s**). In the UK prospective audit, only six patients (0.2 %) underwent laparotomy for LGIB, with one of these following mesenteric artery embolization, and in only one case had laparotomy been the initial intervention [6]. In general, complications following emergency laparotomy for severe LGIB are common, including death [6, 133]; therefore, surgical intervention should be undertaken only once all interventional radiologic and endoscopic measures have been exhausted. Even though the need for emergency laparotomy for LGIB is rare, there are indications where surgery may be justified (e. g. aortoenteric fistula or bleeding Meckel's diverticulum identified on Meckel's scan or at laparoscopy).

7 Management of antithrombotic agents in patients with lower gastrointestinal bleeding

Anticoagulant and antiplatelet use is reported in up to 30 % of patients with acute LGIB, with 2 %–5 % of patients receiving complex antithrombotic therapies, including dual antiplatelet therapy (DAPT) or a combination of anticoagulant and antiplatelet agents [6, 134]. The management of antithrombotic agents often requires a multidisciplinary approach that considers the severity of bleeding, the risk of rebleeding, and the patient's thrombotic risk. The ESGE recommendations in this guideline on the management of antithrombotic agents are in line with those reported in the ESGE guideline on non-variceal UGIB [135, 136], as the majority of evidence derives from UGIB studies.

7.1 Management of vitamin K antagonists in patients with lower gastrointestinal bleeding

RECOMMENDATION
ESGE suggests not interrupting oral anticoagulation with vitamin K antagonists in patients presenting with minor self-limited bleeding (i. e. Oakland score ≤ 8).
Weak recommendation, low quality evidence.

RECOMMENDATION
ESGE recommends withholding vitamin K antagonists in patients with major lower gastrointestinal bleeding and correcting their coagulopathy according to the severity of bleeding and their thrombotic risk. In patients with hemodynamic instability, we recommend administering intravenous vitamin K and four-factor prothrombin complex concentrate (PCC), or fresh frozen plasma if PCC is not available.
Strong recommendation, low quality evidence.

RECOMMENDATION
ESGE recommends restarting anticoagulant therapy following lower gastrointestinal bleeding in patients with an indication for long-term anticoagulation.
Strong recommendation, moderate quality evidence.

RECOMMENDATION
ESGE suggests restarting anticoagulation at the earliest from day 7 after the interruption of a vitamin K antagonist in patients at low thrombotic risk.
Weak recommendation, low quality evidence.

RECOMMENDATION
In those at high thrombotic risk, an earlier resumption of anticoagulation with heparin bridging, preferably within 72 hours, is recommended.
Strong recommendation, very low quality evidence.

In patients presenting with minor self-limited bleeding (Oakland score ≤ 8), oral anticoagulation can be continued, while its discontinuation is the "standard of care" in patients with major LGIB. Vitamin K, prothrombin complex concentrate (PCC), or fresh frozen plasma (FFP) can be used for rapid correction of vitamin K antagonist-related coagulopathy, but the use of reversal agents (e. g. vitamin K) has been associated with thromboembolism in patients at high thrombotic risk (i. e. those with a mechanical heart valve) [137]. The correction of coagulopathy should not delay urgent therapeutic interventions [138], which can be safely performed at therapeutic levels of anticoagulation [34, 139].

Data from observational studies [140–143] and three meta-analyses [144–146] in the management of UGIB or GI bleeding highlight the net clinical benefit of restarting anticoagulation after the bleeding event, in lowering the risk of thromboembolism and death, despite increasing the risk of rebleeding (**Table 16 s**). Because the thromboembolic risk increases over time, it is reasonable to restart warfarin as soon as possible from day 7 onward following its interruption. In patients at high thrombotic risk (prosthetic metal mitral heart valve, atrial fibrillation with prosthetic heart valve or mitral stenosis, or less than 3 months after venous thromboembolism) [147], cardiology societies recommend resumption of anticoagulation, with rapid titration of prophylactic doses of low molecular-weight heparin to therapeutic doses within 48–72 hours [148]. If the risk of resuming anticoagulation outweighs its benefits, consultation with a specialist (hematologist, neurologist, and/or cardiologist) is advised [148].

7.2 Management of direct oral anticoagulants in patients with lower gastrointestinal bleeding

RECOMMENDATION
ESGE suggests not interrupting direct oral anticoagulants in patients presenting with minor self-limited bleeding (i. e. Oakland score ≤ 8).
Weak recommendation, low quality evidence.

RECOMMENDATION
ESGE recommends temporarily withholding direct oral anticoagulants at presentation in patients with major lower gastrointestinal bleeding.
Strong recommendation, low quality evidence.

RECOMMENDATION
ESGE suggests the use of reversal agents (idarucizumab in dabigatran patients and andexanet or four-factor PCC in anti-factor Xa-treated patients) in coordination/consultation with the local hematologist if bleeding is ongoing and/or there is recurrent hemodynamic instability.
Weak recommendation, low quality evidence.

RECOMMENDATION
ESGE suggests restarting direct oral anticoagulant drug treatment following major lower gastrointestinal bleeding as soon as possible from day 7.
Weak recommendation, low quality evidence.

Direct oral anticoagulants (DOACs) have a relatively short half-life, so that their anticoagulant effect rapidly wanes over 12–24 hours. Most cases of major LGIB can be managed by withholding the drug and waiting for the anticoagulant effects to dissipate. However, in hemodynamically unstable patients,

acute reversal of anticoagulation may be required [6, 134, 148]. Vitamin K, FFP, and protamine administration are ineffective. Specific antagonists are available as first-line reversal agents in DOAC patients presenting with life-threatening/uncontrolled bleeding or requiring emergency surgery. Idarucizumab reverses dabigatran-related coagulopathy within a few minutes and lasts for about 24 hours in more than 98 % of patients, and has a low thrombotic complication rate (6 % at 90 days) [149]. Andexanet alfa, an inactive form of factor-Xa that neutralizes circulating factor-Xa inhibitors, has recently been approved as an antidote to apixaban and rivaroxaban in patients with life-threatening bleeding. Its clinical use is hindered by its limited availability, high cost, and safety concerns regarding its procoagulant effect [150]. Four-factor PCC at a fixed dose of 2000 IU may represent an alternative to andexanet alpha, with similar efficacy, yet with a lower thromboembolic risk [151–153].

Data regarding the optimal timing of DOAC resumption following LGIB cessation are lacking, but similarly to warfarin, restarting the DOAC as soon as possible from day 7 onward after its interruption seems reasonable. DOAC resumption results in full re-anticoagulation within 2–4 hours, therefore early resumption should be undertaken with caution.

7.3 Management of antiplatelet agents in patients with acute lower gastrointestinal bleeding

RECOMMENDATION

ESGE does not recommend routine platelet transfusion for patients with lower gastrointestinal bleeding taking antiplatelet medications.

Strong recommendation, low quality evidence.

RECOMMENDATION

ESGE recommends withholding aspirin during the bleeding event in patients taking low dose aspirin for primary cardiovascular prevention and considering its permanent discontinuation unless clinically indicated after discussion with the referring specialist.

Strong recommendation, low quality evidence.

RECOMMENDATION

ESGE does not recommend withholding aspirin in patients taking low dose aspirin for secondary cardiovascular prevention. If withheld, low dose aspirin should be resumed, preferably within 5 days or even earlier if hemostasis is achieved or there is no further evidence of bleeding.

Strong recommendation, moderate quality evidence.

RECOMMENDATION

ESGE does not recommend routinely discontinuing dual antiplatelet therapy (low dose aspirin and a P2Y12 receptor antagonist) before cardiology consultation. Continuation of the aspirin is recommended, whereas the P2Y12 receptor antagonist can be continued or temporarily interrupted according to the severity of bleeding and the ischemic risk. If interrupted, the P2Y12 receptor antagonist should be restarted within 5 days, if still indicated.

Strong recommendation, low quality evidence.

There is limited evidence to guide the management of antiplatelet therapy in LGIB (**Table 17 s**). No drugs directly reversing platelet dysfunction exist and higher mortality, with a similar risk of rebleeding, has been reported in GI bleeding patients on antiplatelet therapy receiving platelet transfusion in a retrospective study [154].

A retrospective study of 295 LGIB patients on aspirin showed that continuing aspirin was associated with an almost three-fold increased risk of recurrent LGIB, but also with a 1.6-fold reduced risk of serious cardiovascular events and more than three-fold reduced risk of death within 5 years [155]. A prospective analysis (n = 2528) evaluated the short-term outcomes of antithrombotic drug interruption in patients hospitalized for LGIB. The in-hospital rebleeding rate was higher in patients on antiplatelet therapy, with most bleeding events occurring within 5 days from the time of admission. This incidence was comparable for patients who continued antiplatelet therapy throughout their hospitalization and those who had it withheld for fewer than 5 days [18]. Another cohort study, including 416 patients with gastrointestinal bleeding (162 LGIB), found no difference in rebleeding rates when the cutoff for resuming the antiplatelet agent was set at ≤ 7 days [156].

According to these studies, continuing antiplatelet therapy during hospitalization may be appropriate in most patients with high cardiovascular risk, who cannot discontinue aspirin therapy, even for a short time. However, when temporary interruption is necessary (i. e. severe and persisting bleeding), antiplatelet therapy should be resumed within 5 days, after which time about 50 % of circulating platelets are new and capable of producing thromboxane [157]. In patients at low thrombotic risk on primary cardiovascular prevention, discontinuation of aspirin at admission is recommended to reduce rebleeding without increasing the risk of cardiovascular events. Permanent discontinuation of aspirin should also be considered in liaison with the referring specialist.

Data regarding the management of LGIB patients taking DAPT are lacking. DAPT is mainly prescribed in patients undergoing percutaneous coronary intervention with stent placement. The management of such patients requires a careful assessment of their ischemic risk and a cardiology consultation is mandatory. DAPT is associated with a five-fold increased risk of in-hospital rebleeding, but not with bleeding-associated mortality [18, 158]. However, discontinuing DAPT during the

first 30 days following coronary stenting and during the first 90 days following acute coronary syndrome is associated with an increased risk of myocardial infarction and death [159]. Therefore, in patients at high ischemic risk, every effort should be made to continue antiplatelet therapy. Similarly to acute UGIB, in cases of severe LGIB, continuing aspirin as a single antiplatelet therapy appears to be reasonable, while withholding the non-aspirin antiplatelet agent for no more than 5–7 days [136]. A large systematic review examined the safety of short-term antiplatelet discontinuation among patients with drug-eluting stents and found very few cases of stent thrombosis within 10 days of thienopyridine interruption. Because the risk of rebleeding associated with DAPT is high, the required duration of DAPT should be reassessed after an LGIB event [160].

7.4 Is there any role for antifibrinolytic medications in patients with acute lower gastrointestinal bleeding?

RECOMMENDATION

ESGE does not recommend the use of tranexamic acid in patients with lower gastrointestinal bleeding.

Strong recommendation, high quality evidence.

In a large (n = 78 291), nationwide, retrospective, propensity score-matched cohort study, tranexamic acid administration did not reduce in-hospital mortality among patients with diverticular bleeding [161]. Moreover, an RCT (the HALT-IT study) that evaluated 12 009 patients with gastrointestinal bleeding (1328 LGIB) showed that intravenous tranexamic acid was associated with an increased risk of venous thromboembolic events, without reducing mortality [162].

Disclaimer

The legal disclaimer for ESGE guidelines [163] applies to this Guideline.

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Competing interests

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Supplementary material

Diagnosis and Management of Lower Gastrointestinal Bleeding: European Society of Gastrointestinal Endoscopy (ESGE) Clinical Guideline

Appendix 1s. PICO Questions and Literature Search

Task Force 1

Task Force Nr 1: Triage and Risk Stratification - Blood Transfusion

Task Force Leader: Kathryn Oakland
Task Force Members: Kostas Triantafyllou, Paraskevas Gkolfakis, Marine Camus, Tony Tham

A. Which are the risk factors for LGIB?

P: Patients with lower gastrointestinal bleeding (or haematochezia or colonic bleeding or rectal bleeding)
I: non applicable
C: non applicable
O: risk factor (or precipitating factor or predisposing factor or trigger factor)

B. How should patients with LGIB be stratified according to their severity? *(= should a risk score be used?)*

P: adult patients presenting with acute LGIB at admission
I: Clinician judgment
C: Externally validated risk scores (Oakland score, GBS, pRS, Strate score, BLEED, NOBLADS, Sengupta score, AIMS-65, ABC score)
O: accuracy at determining severity – statistical: (AUROC and c-statistic) – clinical: number and type of misclassifications (including low risk misclassified as high risk and high risk misclassified as low risk defined as need for RBC transfusion, endoscopic, radiological or surgical haemostasis, rebleeding, ICU admission or death)

C. Which should be the initial assessment of patients with LGIB according to the severity of the bleeding? *(=how should the risk score be used and are there any other markers of severity that should also be assessed?)*

P: adult patients presenting with acute LGIB at admission
I: Use only risk score to determine severity
C: clinical or biological parameters: haemoglobin, hemodynamic parameters (including shock index), clinical examination findings, digital rectal examination, coagulopathy, anticoagulation/antiplatelet agents, severe comorbidities, bedside proctoscopy/rigid sigmoidoscopy findings

O: need for RBC transfusion, endoscopic, radiological or surgical haemostasis, rebleeding, ICU admission or death

D. Which are the indications to admit a patient in the hospital? (= *which risk score threshold should be used to guide admission)*

P: adult patients presenting with acute LGIB at admission
I: Oakland score >8
C: any other Oakland score threshold, any other externally validated risk score threshold (GBS, pRS, Strate score, BLEED, NOBLADS, Sengupta score, AIMS-65, ABC score), any other clinical parameter (haemoglobin threshold, shock index threshold, other indicator as identified in question 5)
O: sensitivity and specificity of the intervention to predict need for RBC transfusion, endoscopic, radiological or surgical haemostasis, rebleeding, ICU admission or death

E. When can a patient with LGIB be discharged and followed-up as outpatient? (=*which risk score threshold should be used to guide discharge)*

P: adult patients presenting with acute LGIB at admission
I: Oakland score <=8
C: any other Oakland score threshold, any other externally validated risk score threshold (GBS, pRS, Strate score, BLEED, NOBLADS, Sengupta score, AIMS-65, ABC score), any other clinical parameter (haemoglobin threshold, shock index threshold, other indicator as identified in question 5)
O: sensitivity and specificity of the intervention to predict *safe discharge* defined as an absence of ALL of need for RBC transfusion, endoscopic, radiological or surgical haemostasis, rebleeding, ICU admission or death

F. When should patients be given a blood transfusion?
P: Patients who have had a lower gastrointestinal bleed
I: Red Blood Cell transfusion
C: Patients who underwent liberal blood transfusion or restrictive blood transfusion based on haemoglobin
O: Complications, mortality, cardiovascular morbidity, death

Search: **((lower gastrointestinal tract) AND (gastrointestinal hemorrhage)) AND (risk assessment OR risk factor OR risk score)** Sort by: **First Author**

((("lower gastrointestinal tract"[MeSH Terms] OR (("lower"[All Fields] AND "gastrointestinal"[All Fields]) AND "tract"[All Fields])) OR "lower gastrointestinal tract"[All Fields]) AND ((("gastrointestinal haemorrhage"[All Fields] OR "gastrointestinal hemorrhage"[MeSH Terms]) OR ("gastrointestinal"[All Fields] AND "hemorrhage"[All Fields])) OR "gastrointestinal hemorrhage"[All Fields])) AND ((((("risk assessment"[MeSH Terms] OR ("risk"[All Fields] AND "assessment"[All Fields])) OR "risk assessment"[All Fields]) OR ((((("risk factors"[MeSH Terms] OR ("risk"[All Fields] AND "factors"[All Fields])) OR "risk factors"[All Fields]) OR ("risk"[All Fields] AND "factor"[All Fields])) OR "risk factor"[All Fields])) OR (("risk"[MeSH Terms] OR "risk"[All Fields]) AND (((((("score"[All Fields] OR "score s"[All Fields]) OR "scored"[All Fields]) OR "scores"[All Fields]) OR "scoring"[All Fields]) OR "scorings"[All Fields])))

Translations

lower gastrointestinal tract: "lower gastrointestinal tract"[MeSH Terms] OR ("lower"[All Fields] AND "gastrointestinal"[All Fields] AND "tract"[All Fields]) OR "lower gastrointestinal tract"[All Fields]

gastrointestinal hemorrhage: "gastrointestinal haemorrhage"[All Fields] OR "gastrointestinal hemorrhage"[MeSH Terms] OR ("gastrointestinal"[All Fields] AND "hemorrhage"[All Fields]) OR "gastrointestinal hemorrhage"[All Fields]

risk assessment: "risk assessment"[MeSH Terms] OR ("risk"[All Fields] AND "assessment"[All Fields]) OR "risk assessment"[All Fields]

risk factor: "risk factors"[MeSH Terms] OR ("risk"[All Fields] AND "factors"[All Fields]) OR "risk factors"[All Fields] OR ("risk"[All Fields] AND "factor"[All Fields]) OR "risk factor"[All Fields]

risk: "risk"[MeSH Terms] OR "risk"[All Fields]

score: "score"[All Fields] OR "score's"[All Fields] OR "scored"[All Fields] OR "scores"[All Fields] OR "scoring"[All Fields] OR "scorings"[All Fields]]

Results : 376

#1	("lower gastrointestinal tract") (Word variations have been searched)	200,782
#2	("gastrointestinal Hemorrhage") (Word variations have been searched)	56,386
#3	("risk assessment") (Word variations have been searched)	492,626
#4	("risk factor") (Word variations have been searched)	492,626
#5	("risk" "score") (Word variations have been searched)	237,568
#6	#1 AND #2	5,539
#7	#1 AND #2 AND #3	113
#8	(#1 AND #2) AND (#3 OR #4)	359
#9	(#1 AND #2) AND (#3 OR #4 OR #5)	376

1- *A second pubmed search was conducted to focus on scoring system for LGIB more than the general risk assessment, with the following MeSH terms :*

Lower GI bleeding – Score

Search: **(lower gi bleeding) AND (score)** Sort by: **Most Recent**

(((((("lower"[All Fields] OR "lowered"[All Fields]) OR "lowering"[All Fields]) OR "lowerings"[All Fields]) OR "lowers"[All Fields]) AND ((((("gastrointestinal hemorrhage"[MeSH Terms] OR ("gastrointestinal"[All Fields] AND "hemorrhage"[All Fields])) OR "gastrointestinal

hemorrhage"[All Fields]) OR ("gi"[All Fields] AND "bleeding"[All Fields])) OR "gi bleeding"[All Fields])) AND (((("score"[All Fields] OR "score s"[All Fields]) OR "scored"[All Fields]) OR "scores"[All Fields]) OR "scoring"[All Fields]) OR "scorings"[All Fields])

Translations

lower: "lower"[All Fields] OR "lowered"[All Fields] OR "lowering"[All Fields] OR "lowerings"[All Fields] OR "lowers"[All Fields]

gi bleeding: "gastrointestinal hemorrhage"[MeSH Terms] OR ("gastrointestinal"[All Fields] AND "hemorrhage"[All Fields]) OR "gastrointestinal hemorrhage"[All Fields] OR ("gi"[All Fields] AND "bleeding"[All Fields]) OR "gi bleeding"[All Fields]

score: "score"[All Fields] OR "score's"[All Fields] OR "scored"[All Fields] OR "scores"[All Fields] OR "scoring"[All Fields] OR "scorings"[All Fields]

Results : 466

A- Cochrane Central Register of Controlled Trials (CENTRAL) – Search 10/08/2020

#1	("lower gastrointestinal bleeding") (Word variations have been searched)	47 Trials 1 Cochrane Reviews
#2	("risk assessment") (Word variations have been searched)	23275 Trials 42 Cochrane Reviews
#3	("risk score") (Word variations have been searched)	3195 Trials 10 Cochrane Reviews
#4	("risk factor") (Word variations have been searched)	3195 Trials 10 Cochrane Reviews
#5	#1 AND #2	0
#6	#1 AND #3	1 Trial 0 Cochrane Reviews
#7	#1 AND #4	6 Trial 0 Cochrane Reviews

Results:6

Results of the bibliographic searches: 376 + 466 +6 = 848

Excluded studies

After elimination of the duplicates (n= 23), 37 studies were considered potentially relevant (title), the other studies were excluded because they were either irrelevant or reviews (n=789).

After abstract screening, 23 studies were selected to be read in full text. After full text reading, 5 articles from bibliographies were added, and 28 articles are reported in the PICO table.

= 28 results

Task Force 2

Task Force Nr 2: Endoscopy: Diagnosis - Treatment

Task Force Leader: Ian Gralnek
Task Force Members: Enrique Rodriguez, Peter Thelin Schmidt, Mostafa Ibrahim

A. When should colonoscopy be the first diagnostic modality in patients with acute LGIB / haematochezia?

P: Patients presenting with acute LGIB (or haematochezia, colonic bleeding or rectal bleeding)
I: colonoscopy
C: vs. other intervention (e.g., radiographic CTA, angiography, tagged RBC scan) or vs nothing
O: diagnosis of terminal ileal or colorectal bleeding source, application of endoscopic therapy if indicated

PubMed - Search 15/09/2020

A. Colonoscopy vs RBCT scintigraphy

("colonoscopy"[MeSH Terms] OR "colonoscopy"[All Fields] OR "colonoscopies"[All Fields]) AND ("technetium"[MeSH Terms] OR "technetium"[All Fields] OR "TC99"[All Fields] OR ("radioisotopes"[MeSH Terms] OR "radioisotopes"[All Fields] OR "radionuclide"[All Fields] OR "radionuclides"[All Fields] OR "radionuclid"[All Fields] OR "radionuclide s"[All Fields] OR "radionuclidic"[All Fields] OR "radionuclidically"[All Fields] OR "radionuclids"[All Fields]) OR ("erythrocyte count"[MeSH Terms] OR ("erythrocyte"[All Fields] AND "count"[All Fields]) OR "erythrocyte count"[All Fields] OR "rbc"[All Fields]) OR ("radionuclide imaging"[MeSH Terms] OR ("radionuclide"[All Fields] AND "imaging"[All Fields]) OR "radionuclide imaging"[All Fields] OR "scintigraphies"[All Fields] OR "scintigraphy"[All Fields]) OR ("radionuclide imaging"[MeSH Terms] OR ("radionuclide"[All Fields] AND "imaging"[All Fields]) OR "radionuclide imaging"[All Fields] OR ("nuclear"[All Fields] AND "medicine"[All Fields]) OR "nuclear medicine"[All Fields] OR "nuclear medicine"[MeSH Terms] OR ("nuclear"[All Fields] AND "medicine"[All Fields]))) AND ("bleedings"[All Fields] OR "hemorrhage"[MeSH Terms] OR "hemorrhage"[All Fields] OR "bleed"[All Fields] OR "bleeding"[All Fields] OR "bleeds"[All Fields])

Results: 224

Embase

#1 colonoscopy AND bleeding AND (scintigraphy OR technetium OR tc99 OR radionuclide OR 'nuclear medicine')

Results: 401

B. Colonoscopy vs CTA/Angiography

PubMed - Search 18/09/2020
("colonoscopy"[MeSH Terms] OR "colonoscopy"[All Fields] OR "colonoscopies"[All Fields]) AND ("bleedings"[All Fields] OR "hemorrhage"[MeSH Terms] OR "hemorrhage"[All Fields] OR "bleed"[All Fields] OR "bleeding"[All Fields] OR "bleeds"[All Fields]) AND ("MDCT"[All Fields] OR "CT scan"[All Fields] OR "CT"[All Fields] OR "angiography"[All Fields] OR "computed tomography"[All Fields])
Results: 1,165

Embase
#1 colonoscopy:ti,ab,kw AND bleeding:ti,ab,kw AND (mdct:ti,ab,kw OR 'ct scan':ti,ab,kw OR 'ct':ti,ab,kw OR 'angiography':ti,ab,kw OR 'computed tomography':ti,ab,kw) AND ([article]/lim OR [article in press]/lim OR [data papers]/lim)

Results: 602

C. Colonoscopy vs no diagnostic intervention

PubMed - Search 19/09/2020

("colonoscopy"[MeSH Terms] OR "colonoscopy"[All Fields] OR "colonoscopies"[All Fields] OR "lower endoscopy"[All Fields]) AND ("bleedings"[All Fields] OR "hemorrhage"[MeSH Terms] OR "hemorrhage"[All Fields] OR "bleed"[All Fields] OR "bleeding"[All Fields] OR "bleeds"[All Fields]) AND ("no intervention"[All Fields] OR "conservative"[All Fields] OR "non-invasive"[All Fields])
Results: 214

Embase - Search 19/09/2020

(colonoscopy OR 'lower endoscopy') AND bleeding AND ('no intervention' OR 'conservative' OR 'non-invasive') AND ([english]/lim OR [spanish]/lim) AND [2000-2020]/py
Results: 511

Results of the bibliographic searches

After removing duplicates (Search A =102, Search B = 408, Search C = 86), 2,521 titles and abstracts were screened (Search A =523, Search B = 1,359, Search C = 639). 29 studies were considered potentially relevant and acquired in full text. Reasons for exclusion were:

- Case report or included less than 10 patients
- Only presented as abstract, insufficient information
- Article only in Danish, German, or Japanese
- Reported findings of scintigraphy and endoscopy, but no valid comparison for the PICO question

B. When should we perform diagnostic colonoscopy in patients with LGIB? What is the appropriate timing for performing colonoscopy in acute LGIB / haematochezia?

P: Patients presenting with acute LGIB (or haematochezia, colonic bleeding or rectal bleeding)
I: timing of colonoscopy
C: early colonoscopy (defined generally as within 12-24 hours of patient presentation / hospitalization) vs. delayed colonoscopy (beyond 24 hours or when there is an open slot for colonoscopy while the patient is hospitalized or colonoscopy as an ambulatory examination after hospital discharge)
O: colonoscopy diagnosis (definitive vs probable diagnosis), hospital length of stay, costs, need for surgery, blood transfusions, need for endoscopic therapy

Bibliographic search
Bibliographic search strategies were performed in **PubMed and Embase** from inception**.** References of the included articles were also reviewed manually. Search strategies:
PubMed - Search 07/09/2020
("urgent"[All Fields] OR "urgently"[All Fields] OR "emerg*"[All Fields] OR "early"[All Fields] OR "24h"[All Fields] OR ("24"[All Fields] AND "hour"[All Fields])) AND ("colonoscopy"[MeSH Terms] OR "colonoscopy"[All Fields] OR "colonoscopies"[All Fields]) AND ("bleedings"[All Fields] OR "hemorrhage"[MeSH Terms] OR "hemorrhage"[All Fields] OR "bleed"[All Fields] OR "bleeding"[All Fields] OR "bleeds"[All Fields])

Results: 1072

Embase - Search 07/09/2020
('colonoscopy'/exp OR 'colonoscopy') AND ('bleeding'/exp OR bleeding) AND (early OR 24h OR urgent)

Results: 2077

Duplicates: 387 (eliminated using EndNote)

Total after duplicates: 2,761
Results of the bibliographic searches
After removing duplicates (n=387), 2,761 titles and abstracts were screened. 29 studies were considered potentially relevant and acquired in full text, two of whom were retrieved through manual review of the included articles. 2 studies were excluded, one was in Chinese, and one included patients with upper GI bleeding in the same analysis.

C. Should upper GI endoscopy be performed in patients presenting with acute LGIB / haematochezia?

P: Patients presenting with acute LGIB (or haematochezia, colonic bleeding or rectal bleeding)
I: performance of upper endoscopy
C: not performing upper endoscopy
O: diagnosis of upper GI bleeding source as cause of acute LGIB, haematochezia
Bibliographic search

Bibliographic search strategies were performed in **PubMed, Cochrane** from database inception using the following search strategies:
PubMed - Search 2/9/2020
((lower AND (gastrointest* OR GI) AND bleed*) OR rectal bleed* OR hematoche*) AND ((upper AND endoscopy) OR gastroscopy) AND (acute OR urgent)
Results: 268

Cochrane Central Register of Controlled Trials (CENTRAL) – Search 2/9/2020
((lower AND (gastrointest* OR GI) AND bleed*) OR rectal bleed* OR hematoche*) AND ((upper AND endoscopy) OR gastroscopy)

D. Is there a role for sigmoidoscopy/proctoscopy in patients presenting with acute LGIB / haematochezia? Is there a role / danger for unprepped sigmoidoscopy / colonoscopy in patients presenting with acute LGIB / haematochezia?

P: Patients presenting with acute LGIB (or haematochezia, colonic bleeding or rectal bleeding)
I: performance of sigmoidoscopy, proctoscopy or unprepped sigmoidoscopy / colonoscopy
C: not performing these examinations
O: adverse events, missed diagnoses with use of sigmoidoscopy, proctoscopy, unprepped colon examinations, need for repeat examination (e.g., colonoscopy) using colonic prep

Bibliographic search
Bibliographic search strategies were performed in **PubMed, Cochrane** from database inception using the following search strategies:
PubMed - Search 2/9/2020
(Acute OR urgent) AND unprep* AND (colonoscopy* OR sigmoidoscop* OR rectoscop* OR proctoscopy*) AND ((lower AND (gastrointest* OR GI) AND bleed*) OR rectal bleed* OR hematoche*)
Results: 3
Cochrane Central Register of Controlled Trials (CENTRAL) – Search 2/9/2020
Results: 0
(Acute OR urgent) AND (colonoscopy* OR sigmoidoscop* OR rectoscop* OR proctoscopy*) AND ((lower AND (gastrointest* OR GI) AND bleed*) OR rectal bleed* OR hematoche*)
PubMed - Search 2/9/2020
Results: 87
Cochrane Central Register of Controlled Trials (CENTRAL) – Search 2/9/2020
Results: 54

E. In patients with acute LGIB / haematochezia undergoing colonoscopy, what is the preferred / recommended bowel preparation?

P: Patients presenting with acute LGIB (or haematochezia, colonic bleeding or rectal bleeding)
I: colonic bowel preparations (e.g., oral preps, enemas, through the scope intracolonic washing)
C: different types of bowel preps

O: ease of use, adequate bowel cleanliness, cecal intubation as proxy for successful colonoscopy with prep, adverse events, missed diagnoses due to inadequate bowel prep, need for repeat examination (e.g., colonoscopy)

F. Which are the endoscopic haemostasis treatments for acute LGIB / haematochezia? -per finding or per endoscopic treatment?

P: Patients presenting with acute LGIB (or haematochezia, colonic bleeding or rectal bleeding)
I: endoscopic haemostasis therapy (e.g., thermal therapy both contact and non-contact, injection therapy, mechanical therapy including TTS clips and OTS clips, band ligation, haemostasis sprays / powders
C: between the different types of endoscopic haemostasis modalities; this can be per lesion type or by endoscopic treatment
O: success of primary haemostasis, rebleeding rate, need for blood transfusions, need for interventional radiology when endoscopic therapy ineffective, need for surgery, hospital length of stay, costs

PubMed - Search 01/09/2020

Variants of the following searches were conducted:

1. (lower gastrointestinal tract* OR lower gastro-intestinal tract* OR lower GI tract* OR large intestin* OR mesenteric arter* OR lower gastrointestinal) AND (hemorrhag* OR haemorrhag* OR bleed* OR re-bleed* OR rebleed* OR blood loss* hematochezia OR melena OR melaena OR colonic angiodysplasia OR proctorrhagi* OR rectocolic* OR rectorrhagi* OR bleeding)
2. Diverticular bleeding
3. Angioectasia
4. Angiodysplasia
5. Endoscopic clipping
6. (Endoscopic clips OR endoscopic band ligation) AND (colon OR lower gastrointestinal bleeding OR diverticul*)
7. Post-polypectomy bleeding

Task Force 3

Task Force Nr 3: Diagnosis and treatment of LGIB: interventional radiology – surgery treatments

Task Force Leader: Gianpiero Manes
Task Force Members: Daniele Regge, Ziv Neeman, Kathryn Oakland, Richard Guy

A. When should CTA be the first diagnostic modality in patients with LGIB?

P: Adults patients presenting with LGIB
I: CT and other diagnostic radiological techniques
C: Endoscopic and clinical-laboratory assessment
O: Diagnostic accuracy in LGIB: diagnosis, definition of the site of bleeding, definition of prognostic indices, indications for treatment

Bibliographic search
Bibliographic search strategies were performed in **PubMed, Cochrane** from database inception using the following search strategies:
PubMed - Search 18/09/2020
2,lower gastrointestinal bleeding and computed tomography angiography and scintigraphy and,Publication Date,,"(""lower""[All Fields] OR ""lowered""[All Fields] OR ""lowering""[All Fields] OR ""lowerings""[All Fields] OR ""lowers""[All Fields]) AND (""gastrointestinal hemorrhage""[MeSH Terms] OR (""gastrointestinal""[All Fields] AND ""hemorrhage""[All Fields]) OR ""gastrointestinal hemorrhage""[All Fields] OR (""gastrointestinal""[All Fields] AND ""bleeding""[All Fields]) OR ""gastrointestinal bleeding""[All Fields]) AND (""computed tomography angiography""[MeSH Terms] OR (""computed""[All Fields] AND ""tomography""[All Fields] AND ""angiography""[All Fields]) OR ""computed tomography angiography""[All Fields]) AND (""radionuclide imaging""[MeSH Terms] OR (""radionuclide""[All Fields] AND ""imaging""[All Fields]) OR ""radionuclide imaging""[All Fields] OR ""scintigraphies""[All Fields] OR ""scintigraphy""[All Fields])"

Results: 38

#1	("Lowe r gastrointestinal bleeding") (Word variations have been searched)	6768
#2	("computed tomography angiography") (Word variations have been searched)	19115
#3	("scintigraphy") (Word variations have been searched)	34450
#4	#1 AND #2 AND #3	**38**

B. When should interventional radiology be used for the treatment of patients with LGIB?

P: Adults patients presenting with LGIB
I: Interventional radiology (different techniques)
C: Clinical conservative/endoscopic/surgical treatment
O: Success rate in stopping bleeding; safety; feasibility

Bibliographic search
PubMed - Search 19/09/2020 – 5 years back.

1) **Interventional radiology and treatment and lower gastrointestinal bleeding – results: 52**

2) **Endovascular and treatment and lower gastrointestinal bleeding – results : 28**
3) **Interventional radiology and therapy and lower gastrointestinal bleeding – results: 43**

4) **Endovascular and therapy and lower gastrointestinal bleeding – results : 24**
5) **Embolotherapy and lower gastrointestinal bleeding – results: 79**

C. When should surgery (laparotomy) be used as the first diagnostic modality in patients with LGIB?

P: Adults patients presenting with LGIB
I: Urgent laparotomy, diagnostic laparoscopy, EUA rectum
C: Endoscopic, radiological and clinical-laboratory assessment
O: Diagnostic accuracy in LGIB: diagnosis, definition of the site of bleeding, definition of prognostic indices, indications for treatment, complications of the intervention

Bibliographic search
Bibliographic search strategies were performed in PubMed, Cochrane from database inception using the following search strategies:

B- PubMed - Search 12/09/2020

To answer these 2 questions one pubmed search was conducted

1- First pubmed search with the following MeSH terms :

Lower - Gastrointestinal Tract – Hemorrhage - Risk Assessment - Risk Factor - Risk Score

Search: **((lower gastrointestinal tract) AND (gastrointestinal hemorrhage)) AND (risk assessment OR risk factor OR risk score)** Sort by: **First Author**

((("lower gastrointestinal tract"[MeSH Terms] OR (("lower"[All Fields] AND "gastrointestinal"[All Fields]) AND "tract"[All Fields])) OR "lower gastrointestinal tract"[All Fields])

AND ((("gastrointestinal haemorrhage"[All Fields] OR "gastrointestinal hemorrhage"[MeSH Terms]) OR ("gastrointestinal"[All Fields] AND "hemorrhage"[All Fields])) OR "gastrointestinal hemorrhage"[All Fields]))

AND “laparotomy"[MeSH Terms]” OR “"colectomy"[MeSH Terms] OR "colectomy"[All Fields] OR "colectomies"[All Fields] OR "celiotomies"[All Fields] OR "laparotomy"[MeSH Terms] OR "laparotomy"[All Fields]

OR "celiotomy"[All Fields] OR "laparoscopie"[All Fields] OR "laparoscopy"[MeSH Terms] OR "laparoscopy"[All Fields] OR "laparoscopies"[All Fields] OR ("examination s"[All Fields] OR "examinator"[All Fields] OR "examinators"[All Fields] OR "examiner"[All Fields] OR "examiner s"[All Fields] OR "examiners"[All Fields] OR "physical examination"[MeSH Terms] OR ("physical"[All Fields] AND "examination"[All Fields]) OR "physical examination"[All Fields] OR "examination"[All Fields] OR "examinations"[All Fields]) AND "under"[All Fields] AND ("anaesthesia"[All Fields] OR "anesthesia"[MeSH Terms] OR "anesthesia"[All Fields] OR "anaesthesias"[All Fields] OR "anesthesias"[All Fields]) AND ("rectum"[MeSH Terms] OR "rectum"[All Fields] OR "rectums"[All Fields]) AND ("EUA"[All Fields] AND "rectum"[MeSH Terms])

Translations

lower gastrointestinal tract: "lower gastrointestinal tract"[MeSH Terms] OR ("lower"[All Fields] AND "gastrointestinal"[All Fields] AND "tract"[All Fields]) OR "lower gastrointestinal tract"[All Fields]

gastrointestinal hemorrhage: "gastrointestinal haemorrhage"[All Fields] OR "gastrointestinal hemorrhage"[MeSH Terms] OR ("gastrointestinal"[All Fields] AND "hemorrhage"[All Fields]) OR "gastrointestinal hemorrhage"[All Fields]

laparotomy: "laparotomy"[MeSH Terms]" OR ""colectomy"[MeSH Terms] OR "colectomy"[All Fields] OR "colectomies"[All Fields] OR "celiotomies"[All Fields] OR "laparotomy"[MeSH Terms] OR "laparotomy"[All Fields] OR "celiotomy"[All Fields] OR "laparoscopie"[All Fields] OR "laparoscopy"[MeSH Terms] OR "laparoscopy"[All Fields] OR "laparoscopies"[All Fields]

EUA Rectum: ("examination s"[All Fields] OR "examinator"[All Fields] OR "examinators"[All Fields] OR "examiner"[All Fields] OR "examiner s"[All Fields] OR "examiners"[All Fields] OR "physical examination"[MeSH Terms] OR ("physical"[All Fields] AND "examination"[All Fields]) OR "physical examination"[All Fields] OR "examination"[All Fields] OR "examinations"[All Fields]) AND "under"[All Fields] AND ("anaesthesia"[All Fields] OR "anesthesia"[MeSH Terms] OR "anesthesia"[All Fields] OR "anaesthesias"[All Fields] OR "anesthesias"[All Fields]) AND ("rectum"[MeSH Terms] OR "rectum"[All Fields] OR "rectums"[All Fields]) AND ("EUA"[All Fields] AND "rectum"[MeSH Terms])

Results : 618

#1	("lower gastrointestinal tract") (Word variations have been searched)	201,108
#2	("gastrointestinal Hemorrhage") (Word variations have been searched)	56,491
#3	("laparotomy") (Word variations have been searched)	180,859
#4	("EUA rectum") (Word variations have been searched)	3
#5	#1 AND #2	5,545
#6	#1 AND #2 AND #3	89
#7	(#1 AND #2) AND (#3 OR #4)	618

C- Cochrane Central Register of Controlled Trials (CENTRAL) – Search 12/09/2020

#1	("lower gastrointestinal hemorrhage") (Word variations have been searched)	940 Trials 14 Cochrane Reviews
#2	("laparotomy") (Word variations have been searched)	3314 Trials 51 Cochrane Reviews
#3	("laparoscopy") (Word variations have been searched)	7702 Trials 94 Cochrane Reviews
#4	("EUA rectum") (Word variations have been searched)	2 Trials 0 Cochrane Reviews
#5	#1 AND #2	0
#6	#1 AND #3	0
#7	#1 AND #4	0

Results:0

Results of the bibliographic searches: 618 + 0 = 618

Question 3: When should surgery (laparotomy) be used as the first diagnostic modality in patients with LGIB?

Excluded studies
181 reports in infants or children removed = 437
38 narrative reviews or case reports removed = 399

After abstract screening, 12 studies were selected to be read in full text, all but three were further excluded (see evidence table).
= 3 results

D. When should surgery be used for the treatment of patients with LGIB?

P: Adults patients presenting with LGIB
I: Urgent laparotomy, minimally invasive surgery (laparoscopic and endovascular), EUA rectum
C: Clinical conservative/endoscopic/interventional radiology treatment
O: Success rate in stopping bleeding; safety; feasibility; post-procedure complications, post-procedure death

Question 4. When should surgery be used for the treatment of patients with LGIB?
181 reports in infants or children removed = 437
38 narrative reviews or case reports removed = 399
After abstract screening, 15 studies were selected to be read in full text, all but two were further excluded (see evidence table).
= 2 results

Task Force 4

Task Force Nr 4: Management of Coagulopathy/ Antithrombotic treatment in LGIB patients

Task Force Leader: Franco Radaelli
Task Force Members: Dimitrios Christodoulou, Marcus Hollenbach, Evgeny Fedorov

* Each paragraph should include:
  i) initial management
  ii) indication to reversal (if any)
  iii) timing of interventions according to coagulopathy
  iv) timing of resumption
  v) management of anti-thrombotic therapy in patients without a definite diagnosis

Burden of anti-thrombotic therapy in LGIB patients. Initial management and the treatment of LGIB patients with coagulopathy and/or thrombocytopenia

A. Burden of anti-thrombotic therapy in LGIB patients.
P: Patients with coagulopathy and / or thrombocytopenia presenting with LGIB
I: N/A
C: N/A
O: success of primary haemostasis, rebleeding rate, need for blood transfusions, need for endoscopic therapy/interventional radiology/surgery, thrombosis, death

Pubmed Search

#1
"lower gastrointestinal bleeding"[Title] OR "lower gastrointestinal hemorrhage"[Title] OR "lower gastrointestinal haemorrhage"[Title] OR "diverticular bleeding"[Title]
818

#2
"warfarin"[MeSH Terms] OR "warfarin"[All Fields] OR "warfarin s"[All Fields] OR "warfarinization"[All Fields] OR "warfarinized"[All Fields] OR "warfarins"[All Fields] OR (("vitamin k"[MeSH Terms] OR "vitamin k"[All Fields]) AND ("antagonist"[All Fields] OR "antagonists and inhibitors"[MeSH Subheading] OR ("antagonists"[All Fields] AND "inhibitors"[All Fields]) OR "antagonists and inhibitors"[All Fields] OR "antagonists"[All Fields])) OR "vka"[All Fields]
27,841

#3
"aspirin"[MeSH Terms] OR "aspirin"[All Fields] OR "aspirins"[All Fields] OR "aspirin s"[All Fields] OR "aspirine"[All Fields] OR ("clopidogrel"[MeSH Terms] OR "clopidogrel"[All Fields] OR "clopidogrel s"[All Fields]) OR ("thienopyridin"[All Fields] OR "thienopyridine"[Supplementary Concept] OR "thienopyridine"[All Fields] OR "thienopyridines"[MeSH Terms] OR "thienopyridines"[All Fields]) OR ("dual"[All Fields] AND ("antiplatelet"[All Fields] OR "antiplatelets"[All Fields]) AND ("therapeutics"[MeSH Terms] OR "therapeutics"[All Fields] OR "therapies"[All Fields] OR "therapy"[MeSH Subheading] OR "therapy"[All Fields] OR "therapy s"[All Fields] OR "therapys"[All Fields]))
49,230
#1 AND #2 15

#1 AND #3 49
49 articles were found, but 33 were excluded as data on prevalence of patients on anticoagulants and/ or antiplatelet therapy were not reported.
16 studies were included

B. Initial (at resuscitation, before diagnostic/ therapeutic intervention) management of LGIB patients with anticoagulant-related coagulopathy
P: Patients with coagulopathy and / or thrombocytopenia presenting with LGIB
I: correction of anticoagulant-related coagulopathy at resuscitation
C: no correction
O: success of primary haemostasis, rebleeding rate, need for blood transfusions, need for endoscopic therapy/interventional radiology/surgery, thrombosis, death

C. Initial management (at resuscitation, before diagnostic/ therapeutic intervention) of LGIB patients with thrombocytopenia
P: Patients with thrombocytopenia presenting with LGIB
I: correction of thrombocytopenia at resuscitation
C: no correction
O: success of primary haemostasis, rebleeding rate, need for blood transfusions, need for endoscopic therapy/interventional radiology/surgery, thrombosis, death

Management of Vitamin K antagonists (VKAs) in low/high thrombotic risk patients

D. Initial Management of Vitamin K antagonists (VKAs)
P: Adults patients presenting with LGIB on VKAs
I: stop VKAs
C: don't stop VKAs
O: success of primary haemostasis, rebleeding rate, need for blood transfusions, need for endoscopic therapy/interventional radiology/surgery, thrombosis, death

E. Reversal of Vitamin K antagonists (VKAs)
P: Adults patients presenting with LGIB on VKAs
I: reverse VKAs
C: don't reverse VKAs
O: success of primary haemostasis, rebleeding rate, need for blood transfusions, need for endoscopic therapy/interventional radiology/surgery, thrombosis, death

F. Timing of interventions (endoscopic/radiologic/surgical) according to VKAs-related coagulopathy
P: Adults patients presenting with LGIB on VKAs
I: Early (before coagulopathy correction) intervention
C: Late (after coagulopathy correction)- or no intervention
O: rebleeding rate, need for blood transfusions, need for endoscopic therapy/interventional radiology/surgery, thrombosis, death

G. Resumption of Vitamin K antagonists (VKAs)
P: Adults patients presenting with LGIB on VKAs with low thrombotic risk
I: No resumption
C: Resumption
O: Rebleeding rate, need for readmission, thrombosis, death

H. Timing of resumption of Vitamin K antagonists (VKAs)

P: Adults patients presenting with LGIB on VKAs with low thrombotic risk
I: Early resumption (within 7 days from index bleeding)
C: Late Resumption (after 7 days from index bleeding)
O: Rebleeding rate, need for hospitalization, thrombosis, death

I. Management of Vitamin K antagonists (VKAs) in LGIB patients without a definite diagnosis
P: Adults patients presenting with LGIB on VKAs without a definite diagnosis of bleeding
I: Resumption of anticoagulation
C: No resumption/ other alternative interventions (i.e. left atrial appendage occlusion in AF patients, vena cava filter in VTE patients)
O: Rebleeding rate, need for hospitalization, thrombosis, death

Pubmed Search

Search Query Results
#1
"warfarin"[Title] OR "vitamin k antagonist"[Title] OR "vka"[Title]
7767

#2
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bleeding"[All Fields])
13,662
1# AND #2 99
Of 99 articles, 29 were informative about VKA management in GI bleeding setting (see text)

Management of Direct Oral Anticoagulants (DOACs) in low/high thrombotic risk patients

Initial Management of Direct Oral Anticoagulants (DOACs)
J. P: Adults patients presenting with LGIB on DOACs
I: stop DOACs
C: don't stop DOACs
O: success of primary haemostasis, rebleeding rate, need for blood transfusions, need for endoscopic therapy/interventional radiology/surgery, thrombosis, death

K. Reversal of Vitamin Direct Oral Anticoagulants (DOACs)
P: Adults patients presenting with LGIB on DOACs
I: reverse DOACs
C: don't reverse DOACs

O: success of primary haemostasis, rebleeding rate, need for blood transfusions, need for endoscopic therapy/interventional radiology/surgery, thrombosis, death

L. Timing of interventions (endoscopic/radiologic/surgical) according to DOAC-related coagulopathy
P: Adults patients presenting with LGIB on DOACs
I: Early (before coagulopathy correction) intervention
C: Late (after coagulopathy correction)- or no intervention
O: rebleeding rate, need for blood transfusions, need for endoscopic therapy/interventional radiology/surgery, thrombosis, death

M. Resumption of DOACs
P: Adults patients presenting with LGIB on DOACs
I: No resumption
C: Resumption
O: Rebleeding rate, need for readmission, thrombosis, death

N. Timing of resumption of DOACs
P: Adults patients presenting with LGIB on DOACs
I: Early resumption (within 7 days from index bleeding)
C: Late Resumption (after 7 days from index bleeding)
O: Rebleeding rate, need for hospitalization, thrombosis, death

O. Management of DOACs in LGIB patients without a definite diagnosis
P: Adults patients presenting with LGIB on DOACs without a definite diagnosis of bleeding
I: Resumption of anticoagulation
C: No resumption or other alternative interventions (i.e. left atrial appendage occlusion in AF patients, vena cava filter in VTE patients)
O: Rebleeding rate, need for hospitalization, thrombosis, death

Pubmed Search

Search Query Results
#1
"direct oral anticoagulant"[Title] OR "DOAC"[Title] OR "dabigatran"[Title] OR "rivaroxaban"[Title] OR "apixaban"[Title] OR "edoxaban"[Title] OR "novel oral anticoagulant"[Title] OR "noac"[Title]
5593

#2
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"bleeding"[All Fields]) OR "diverticular bleeding"[All Fields])
13,662

1# AND #2 84
Of 84 articles, 17 about DOAC management in the GI bleeding setting

Management of antiplatelet agent (ASA, P2Y12 antagonists, dual antiplatelet therapy-DAPT)

P. Initial Management of Antiplatelet Agent (APA) in LGIB patients on primary prophylaxis
P: Adults patients presenting with LGIB on APA for primary prophylaxis
I: stop APAs
C: don't stop APAs
O: success of primary haemostasis, rebleeding rate, need for blood transfusions, need for endoscopic therapy/interventional radiology/surgery, thrombosis, death

Q. Initial Management of Antiplatelet Agent (APA) in LGIB patients on secondary prophylaxis
P: Adults patients presenting with LGIB on APA for primary prophylaxis
I: stop APAs
C: don't stop APAs
O: success of primary hemostasis, rebleeding rate, need for blood transfusions, need for endoscopic therapy/interventional radiology/surgery, thrombosis, death

R. Initial Management of Dual Antiplatelet Therapy (DAPT) in LGIB patients
P: Adults patients presenting with LGIB on APA for primary prophylaxis
I: stop DAPT
C: don't stop DAPT
O: success of primary haemostasis, rebleeding rate, need for blood transfusions, need for endoscopic therapy/interventional radiology/surgery, thrombosis, death

S. Reversal of APA-related coagulopathy
P: Adults patients presenting with LGIB on APAs
I: platelet transfusion
C: no platelet transfusion
O: success of primary haemostasis, rebleeding rate, need for blood transfusions, need for endoscopic therapy/interventional radiology/surgery, thrombosis, death

T. Resumption of APAs in LGIB patients on primary prophylaxis
P: Adults patients presenting with LGIB on APAs with low thrombotic risk
I: No resumption
C: Resumption
O: Rebleeding rate, need for readmission, thrombosis, death

U. Resumption of APAs in LGIB patients on secondary prophylaxis
P: Adults patients presenting with LGIB on APAs with high thrombotic risk
I: No resumption
C: Resumption
O: Rebleeding rate, need for readmission, thrombosis, death

V. Resumption of DAPT in LGIB patients
P: Adults patients presenting with LGIB on APAs with high thrombotic risk
I: No resumption

C: Resumption
O: Rebleeding rate, need for readmission, thrombosis, death

W. Timing of resumption of APAs in LGIB patients
P: Adults patients presenting with LGIB on DOACs with low thrombotic risk
I: Early resumption (within 3-5 days from index bleeding)
C: Late Resumption (after 3-5 days from index bleeding)
O: Rebleeding rate, need for hospitalization, thrombosis, death

X. Timing of resumption of DAPT in high thrombotic risk patients
P: Adults patients presenting with LGIB on DOACs with high thrombotic risk
I: Early resumption (within 3-5 days from index bleeding)
C: Late Resumption (after 3-5 days from index bleeding)
O: Rebleeding rate, need for hospitalization, thrombosis, death

Pubmed Search
Search Query Results
#1
"aspirin"[Title] OR "clopidogrel"[Title] OR "thienopyridine"[Title] OR "agent"[Title] OR "antiplatelet therapy"[Title] OR "dual antiplatelet therapy"[Title] OR "DAPT"[Title]
47,990

#2
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13,662

#3
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#1 AND #2 136
#1 AND #2 AND #3 6
Of 136 articles, 56 were informative about antiplatelet therapy management in the GI bleeding setting
Of 9 articles

Diagnosis and Management of Lower Gastrointestinal Bleeding: European Society of Gastrointestinal Endoscopy (ESGE) Clinical Guideline

Tables 1s to 17s. Summary of Evidence

Task Force 1

Table 1s. Summary of Evidence for Task Force 1 - Questions A					
Author (Year)	**Country**	**Study Design**	**Diverticular bleeding cases (n)**	**Comparator cases (n)**	**Risk factors for bleeding (refers to multivariable analysis)**
Jansen (2009)	Germany	Retrospective	30	110 nonbleeding diverticular disease	Steroids use, Hyperuricemia, Calcium channel blockers
Strate (2011)	USA	Prospective	256	NA	Aspirin≥2/weeks: RR(95%CI): 1.70 (1.21–2.39); NSAIDs: 1.74; 95% CI, 1.15–2.64
Tsuruoka (2011)	Japan	Case-control	51	102 inpatients with no LGIB	NSAIDs: OR (95%CI): 9.87 (2.05–47.54)
Niikura (2011)	Japan	Retrospective	72	NA	Antiplatelet drugs: HR(95%CI): 2.39 (1.01–5.67); hypertension: 4.16(1.22–14.2)
Okamoto (2012)	Japan	Retrospective	62	124 nonbleeding diverticular disease	Diabetes mellitus: OR(95%CI): 2.40(1.11–5.18); Vascular disease: 4.24 (1.65–11.32); NSAIDs: 3.73 (1.26–11.60)
Suzuki (2012)	Japan	Retrospective	103	103 nonbleeding diverticular disease	Diverticular location (bilateral): OR(95%CI): 3.11 (1.51–6.4)
Nagata (2014)	Japan	Retrospective	427	27765 non diverticular bleeding cases	Age 40-59 years: OR(95%CI): 24.9 (3.47–179.0); age≥60: 37.3 (5.23–265.0); male: 1.25 (1.02–1.54)
Yuhara (2014)	NA	Meta-analysis	6 studies		NSAIDs: RR(95%CI): 2.24(1.63–3.09); 5 studies; aspirin 1.73 (1.31–2.30); 3 studies
Nagata (2014)	Japan	Prospective	153	758 nonbleeding diverticular disease	Light drinker: OR(95%CI): 3.4(1.4-8.1); moderate drinker: 3.3(1.3-8.5), smoking index≥400: 2.0(1.1-3.6); NSAIDs 4.6(2.7-7.8); low-dose aspirin: 1.9(1.3-3.3); non-aspirin antiplatelet drugs: 2.2(1.2-4.0)
Niikura (2015)	Japan	Retrospective	35	55 non diverticular bleeding cases	Age≥70 years: OR(95%CI): 3.70(1.62-8.50); diverticular location (bilateral): 2.4(1.11-5.41)
Sugihara (2016)	Japan	Retrospective	72	149 nonbleeding diverticular disease	NSAIDs: OR(95%CI): 14.70(3.89-55.80); cerebrovascular disease: 8.66(2.33-32.10); hyperuricemia: 15.5(1.74-138.0)
Jalil (2019)	USA	Retrospective	93	152 diverticulitis cases	Cerebrovascular accident, coronary artery disease, diabetes mellitus, obstructive sleep apnea, NSAIDs, use of anti-thrombotics, anticoagulants, calcium channel blockers, bilateral diverticulosis *(only univariate analysis performed)*
Taki (2017)	Japan	Case-control	100	200 asymptomatic diverticular disease	Diverticular location (bilateral): OR(95%CI): 3.00(1.77–5.10); nonselective NSAIDs: 3.47(1.33–9.04); low-dose aspirin: 2.23(1.11–4.48); anticoagulants: 3.09(1.35–7.09)

Table 2s. Summary of Evidence for Task Force 1 - Questions B-E									
Author, publication year	**Study Objective**	**Participants/ Setting**	**Intervention**	**Comparison**	**Outcome**	**Study Type**	**Results**	**Limitations Conclusion**	**Quality assessment**
Oakland 2020	to externally validate the Oakland Score in a large population of patients with acute LGIB from the United States and compare the performance of the Oakland Score at 2 score thresholds (≤8 points vs ≤10 points)	Retrospective review of 38, 067 patients admitted with LGIB to 140 hospitals in the US between June 2016 and Oct 2018	***Oakland score***	Clinical outcomes at different score thresholds	Safe discharge: the absence of all of the following after hospital presentation: in-hospital rebleeding (defined as a decrease in hematocrit concentrations of 20% or more after 24 hours of clinical stability[10]); RBC transfusion; therapeutic colonoscopy, mesenteric embolization, or laparotomy for bleeding; in-hospital death (all causes); and readmission with subsequent LGIB within 28 days	External validation of prognostic indicator	AUROC 0.87 safe discharge RBC transfusion: 0.90 Re-bleeding: 0.46 Death: 0.63 Hospital re-admission: 0.60 3305 of 38 067 patients (8.7%) scored <=8 points with sensitivity of 98.4% and a specificity of 16.0% for safe discharge A sensitivity of 96.0% for safe discharge was maintained to a score threshold of 10 points or lower, with a specificity of 31.9%. At a threshold of <=8, 1.1% in-hospital death and 5.5% any adverse outcome, at <=10 1.4% in-hospital death and 7.5% any adverse outcome	More accurately assessment of modified Oakland as did not include DRE variable	NOS score: 6 DRE value not available and significant missing data in transfusion outcome
Smith 2020	to identify risk factors for adverse outcomes from LGIB and subsequently develop and validate a risk stratification tool	Retrospective review of LGIB admissions Four hospitals in UK between 2010 and 2018 469 in development cohort 180 in validation cohort	***The Birmingham Score*** male gender and admitting Hb	Comparison with GBS, rockall and 'modified Oakland' (no DRE or previous history of bleeding variables)	blood transfusion, endoscopic intervention, CT angiography, surgical intervention, re-bleeding and mortality plus a composite of the above		For composite adverse outcome, development dataset Birmingham score AUROC 0.86 GBS 0.81 mOakland 0.84 Rockall 0.60 AIMS-65 0.55 For composite adverse outcome, validation dataset Birmingham AUROC 0.80 GBS 0.77	Could not calculate full Oakland score, small validation cohort	NOS: 5 Two variables of Oakland score missing and selection domain downgraded due to small sze of validation

							mOakland 0.77 rockall 0.67 AIMS-65 0.61 Threshold for discharge <2 birmingham score, 6.9% had adverse outcome		populatio n
Laursen 2020	Developmen t and validation of a new risk score for upper and lower GIB	Development: 3012 patients presenting with UGIB to six hospitals across US, UK, Denmark, Singapore, New Zealand (prospective data) Validation: 2336 patients presenting with LGIB to 143 hospitals in the UK (prospective data)	ABC score	AIMS-65, GBS, Oakland Score	Mortality	Assessment of prognostic indicator (risk score) Multicenter prospective	Mortality AUROCs: ABC score 0.84 (0.79 to 0.89), AIMS-65 0.75 (0.68 to 0.83), GBS 0.74 (0.67 to 0.81), Oakland score 0.69 (0.61 to 0.77) <u>LOW risk</u> AIMS-65 <=1 found in 80%, sensitivity 81%, spec 58%, PPV 99%, NPV 7.3% ABC <=3 found in 71%, sensitivity 73%, spec 84%, PPV 99%, NPV 7.6% Oakland score <=8 found in 11%, sens, spec, PPV, NPV not reported GBS<=1 found in 32%, sens, spec PPV, NPV not reported <u>High risk</u> AIMS-65 >=2 found in 20%, sensitivity 58%, specificity 81%, PPV 7.3%, NPV 99% ABC >=8 found in 3.1%, sensitivity 22%, specificity 97%, PPV 18%, NPV 98% GBS<=5 found in 55%, sens, spec, PPV, NPV not reported	AIMS-65 identifies more patients at high risk of death than ABC, with a higher sensitivity for predicting mortality. AIMS-65 also identifies more patients at low risk of death in comparison to ABC, with a higher sensitivity for predicting mortality. This study only partially reported performance of GBS and the Oakland score. Author conclusion: ABC superior to other scores	NOS score: 8 Cohorts had a different follow up period, controlled for missing data and used multiple imputatio n

Quach DT et al. 2020	Develop and validate a scoring system to predict severe Acute LGIB in Vietnamese	Patients aged ≥ 16 years with symptoms suggesting of ALGIB (i.e., red or maroon colored stools, blood mixed in with the stools, clots per rectum or the passage of melena without hematemesis) who were admitted and underwent lower gastrointestinal endoscopy were recruited. Retrospective development cohort of 357 patients (1 center) Validation in a prospective cohort of 324 patients (6 centers) Multiple logistic regression model to develop the risk score Se, SP, NPV, PPV, AUROC analysis	***SALGIB score*** composed with 4 factors associated with severe ALGIB: heart rate ≥ 100/min, systolic blood pressure < 100 mmHg, hematocrit < 35%, and platelets ≤ 150 Å~ 103/µL.	Clinical outcomes	Severe LGIB = persistent bleeding within the first 24 h and/or recurrent bleeding after 24 h of stability accompanied by a further decrease in hematocrit of ≥ 20%, and/or requirement of ≥ 2 units of packed red blood cells Death	Retrospective single center (development cohort) then prospective multicenter (validation cohort)	AUC values of 0.91 and 0.86 in the derivation and validation cohorts, respectively. A SALGIB score < 2 associated with low risk of severe ALGIB in both cohorts (3.7% and 1.2%; respectively).	Only Vietnamese population No comparison with other scores The outcome of rebleeding or surgery or embolization not tested Very few severe ALIGB in the validation cohort	NOS score: 6
Tapaskar 2019	To compare the ability of existing validated clinical risk scores to predict relevant outcomes in LGIB	170 Patients admitted with LGIB who underwent colonoscopy, single centre in US, retrospective review of prospective database	Risk score validation	NOBLADS, Oakland, Sengupta, Strate, AIMS-65, GBS, Charlson-Co-morbidity Index	Primary outcome 'severe bleeding' Secondary outcomes in-hospital recurrent bleeding, RBC transfusion, haemostatic intervention, LOS, ICU admission	Comparative assessment of prognostic indicators (risk scores)	Strongest predictors: Severe bleeding = oakland (AUROC 0.74), Sengupta (0.69) Re-bleeding = Strate (0.66), Sengupta (0.65) Endoscopic intervention = strate (0.62), Charlson Index (0.61) RBC transfusion = GBS (0.87), Oakland (0.86) ICU admission = sengupta (0.74), GBS (0.72)	No score accurately predicted all adverse outcomes	NOS score: 7 Downgraded for selection as all participants had colonoscopy
Hreinsson et al 2019	Develop a risk score to predict not requirement of hospital-based intervention	Patients ≥ 18 years presenting at emergency room (ER) for LGIB (rectal bleeding (bright or maroon colored) From 2010 to 2013 583 patients train (70%) and (30%) test data. Multiple logistic regression model to develop the risk score Se, SP, NPV, PPV, AUROC analysis	***SHA2PE score*** Systolic pressure ≥100mmHg, Hb <12g/dl, hb 10.5-12.0g/dl, no antiplatelets, no anticoagulant, pulse ≤100/min, visible bleeding in ER	Clinical outcomes	Hospital based intervention = blood transfusion, endoscopie haemostasis , arterial embolization, surgery	Retrospective population based study Single center	Train data : 72% non-intervention On test validation 2% (4/181) were wrongly predicted to be low risk Application of the score would have reduced 31% of admission NPV 96% PPV 53% Se 91%, Sp 75% AUROC 0.76	Only Iceland population No comparison with other scores Retrospective	NOS score: 6

Xavier 2018	identify risk factors for severe ALGIB and access the validity of available scores	132 Emergency consecutive admissions for ALGIB retrospectively reviewed From 2010 to 2017 The k statistic was used to assess agreement between severity score and severity outcome.	***STRATE and BLEED scores***	Clinical outcome	Severe ALGIB = transfusion of ≥ 2 units of blood and/or a haematocrit decrease of ≥ 20% within the first 24 h and/or recurrent bleeding after 24 h of stability	retrospective, single-centre cohort study	no significant association between outcomes with either the STRATE (P = 0.72) or BLEED scores (P = 0.05) risk factors identified = lower systolic (P = 0.02) and diastolic blood pressures on admission (P < 0.01), lower admission haemoglobin (P < 0.01), diverticular bleeding (P < 0.01), angioectasias (P = 0.02) and radiation colitis (P < 0.02)	Retrospective Small ample	NOS score: 5
Ur-Rahman 2018	To evaluate the performance of full or modifed GBS and modifed GBS in prediction of major clinical outcomes in patients with lower GI bleeding	A retrospective study of patients admitted to a tertiary care center with either non-variceal upper GI bleeding or lower GI bleeding (LGIB n=464)	Risk score validation	Full and modified GBS	Composite endpoint of inpatient mortality, rebleed in the hospital, need for blood transfusion, or need for any endoscopic, radiologic, or surgical intervention	Comparative assessment of prognostic indicators (risk scores)	GBS AUROC 0.77 (0.73 to 0.81) mGBS AUROC 0.78 (0.74 to 0.83) <u>Low risk</u> GBS<=1 found in 10.9% patients, sensitivity 97.8%, specificity 16% mGBS<=1 found in 13.3% patients, sensitivity 95.7%, specificity 18.4%	mGBS and GBS accurately predicted the composite adverse endpoint, but identified only a small number of patients as low risk	NOS score: 5 Downgraded for selection – included a NVUGIB population
Aoki et al 2018	Evaluate the generalizability of NOBLADS score prediction model of severe LGIB previously described in 2016 (see ref 10)	511 patients Emergently hospitalized for acute LGIB (rectal bleeding (bright or maroon colored) From 2009 to 2016 AUROC analysis Then AUROC comparison with internal derivation and validation cohort from the previous study published in 2016 (see ref 10)	***NOBLADS score*** Non-steroidal anti-inflammatory drug use, no diarrhea, no abdominal tendemess, blood pressure ≤100mmHg, antiplatelet drug use, albumin <3.0g/dl,	Clinical outcomes	Severe LGIB = (i) continuous bleeding during the first 24h (transfusion of ≥ 2 units of packed RBC and/or decrease in hematocrit of ≥20%) and/or (ii) recurrent bleeding after initial colonoscopy (rectal bleeding accompanied by a further decrease in hematocrit ≥20% and/or	Retrospective population based study External validation cohort Single center	Severe LGIB 44 patients Prediction of severe LGIB : AUROC 0.74 (comparison 2016 : derivation cohort 0.77) Secondary outcomes : Prediction of blood transfusion need : AUC 0.71	Only Japanese population External validation study not fully independent (same investigators) No inclusion of inpatient-onset patients and patients who	NOS score: 6

			disease score ≥2 (Charlson comorbidity index) and syncope		additional bleed transfusion) Secondary outcomes : blood transfusion requirement, LOS, intervention (endoscopy, radiology, surgery), in-hospital mortality		Not adequate for predicting intervention need AUC, 0.54 In-hospital mortality rate was higher in patients with a score ≥ 5 than in those with a score < 5 (AUC, 0.83)	were discharged form ER Retrospective No comparison with other scores	
Wada 2018	to clarify who should undergo colonoscopy as well as appropriate methods of initial managemen t in Colonic diverticular bleeding patients	Retrospective review of 285 consecutive patients who were diagnosed as CDB and hospitalized for the first time from March 2004 to October 2015 in a single centre		Associatio n between re-bleeding and various presenting factors Second, we analyzed examinatio n conditions that influenced bleeding point identificatio n	Re-bleeding, Bleeding point identification was defined as finding of active bleeding, a non-bleeding visible vessel, or an adherent clot by colonoscopy	Cohort study	Multivariate analysis independent predictors for re-bleeding: history of CBD (OR 2.1), CKD (OR 2.3) NB antiplatelets, anticoagulants and NSAIDs not predictive.	'a history of CDB and CKD are risk factors for re-bleeding' no formal scoring deployed	NOS score: 5 Study limited to diverticul ar bleeds
Oakland et al. 2017	Develop and externally validate a risk score to identify patients with LGIB who could safely avoid hospital admission	Data from National comparative audit of lower GI bleeding 143 hospitals in UK in 2015 (development cohort – 2336 prospectively identified admissions) (aged ≥ 16 years) 288 patients (validation cohort) (2 centers-retrospective) LGIB = bright, dark red blood mixed with stool, or melaena without hematemesis Multiple logistic regression model to develop the risk score AUROC analysis	***Oakland score*** Age, sex, previous admission for LGIB, rectal examination findings, heart rate, systolic blood pressure, Hb,	Clinical outcomes Other risk scores : preRockall, Blactchford , Strate, BLEED, AIM65, and NOBLADS	Safe discharge = absence of rebleeding (additional blood transfusion or further decreased in Ht ≥20% or more after 24h clinical stability), blood transfusion, therapeutic intervention (endoscopic, radiologic or surgericak hemostasis), 28-day readmission or in-hospital death	National prospectively collected database And retrospective external bi-centers validation cohort	1599 (68%) of admissions were safely discharged in development cohort AUROC 0.84 (development cohort) 0.79 (validation cohort) Score was better than the others tested A score of 8 or less predicts 95% of safe discharge	Only UK population Retrospective validation cohort Validation study not fully independent	NOS score: 8 Missing data in some varaibles required to calculate risk scores
Sengupta 2017	to derive and	Retrospective cohort hospitalized with LGIB to a	***Sengupta score***	Clinical outcomes	30-day mortality	Prognostic indicator	Development AUROC 0.74, validation 0.72	No external validation, no	NOS score: 8

	internally validate a simple clinical prediction tool for 30-day mortality	single centre from 2008 to 2015, identified using administrative codes – derivation in 4044, validation in 2060				development and internal validation	Score quartiles: -10 to 1 4.4% mortality rate 2 to 4 7.3% 5 to 8 9.1% 9 to 26 26% in validation data	comparison with other scores No score threshold recommended Retrospective, single centre	
Aoki et al 2016	Develop and validate a risk score to determine severe LGIB	439 patients (derivation retrospective cohort) From 2009 to 2013 and 161 patients (validation prospective cohort) form 2014 to 2015 emergently hospitalized for acute LGIB were assessed by colonoscopy Multiple logistic regression model to develop the risk score AUROC analysis	***NOBLADS score*** Non-steroidal anti-inflammatory drug use, no diarrhea, no abdominal tendemess, blood pressure ≤100mmHg, antiplatelet drug use, albumin <3.0g/dl, disease score ≥2 (Charlson comorbidity index) and syncope		Severe LGIB = (i) continuous bleeding during the first 24h (transfusion of ≥ 2 units of packed RBC and/or decrease in hematocrit of ≥20%) and/or (ii) recurrent bleeding after initial colonoscopy (rectal bleeding accompanied by a further decrease in hematocrit ≥20% and/or additional bleed transfusion) Secondary outcomes : blood transfusion requirement, LOS, intervention (endoscopy, radiology, surgery)	Retrospectiv e population based study Single center	29% and 35% of severe LGIB in derivation cohort and validation cohort, respectively AUROC 0.77% in derivation cohort AUROC 0.76 in validation cohort The rates of severe bleeding with 0, 1, 2, 3, 4, and ≥ 5 predictors were 0%, 20.0%, 25.0%, 40.0%, 50.0%, and 92.9%, respectively (p < 0.001 for trend) The score also discriminated patients requiring blood transfusion, a longer hospital stay and intervention and rates of required intervention	Only Japanese population No inclusion of inpatient-onset patients and patients who were discharged form ER Retrospective No comparison with other scores	NOS score: 7
Kwak 2016	to identify the clinical outcomes and the predictors of poor outcomes for patients with LGIB, compared to outcomes for patients with UGIB	UGIB and LGIB who had OGD/colonoscopy identified July 2006 to Feb 2013, single centre LGIB cohort = 101 patients retrospective	***Pre-endoscopy Rockall and GBS***	Clinical outcomes	30-day rebleeding (defined by recurrent hematemesis, hematochezia, fresh anal bleeding or both, together with either the development of hemodynamic instability or a decrease in hemoglobin concentration at least 2 g/L following initial successful treatment	Propensity matched UGIB and LGIB, log univariate regression to identify risk factors for clinical outcomes	For 30-day rebleeding, no risk factors were identified in the LGIB cohort For 30-day mortality, the Rockall score (OR = 2.081, 95% CI, 1.170-3.700; P = 0.013) and CRP levels (OR = 1.174, 95% CI, 1.002-1.376; P = 0.047) were identified as risk factors in the LGIB group	Single centre retrospective Univariate analysis No true statistical assessment of the performance of GBS or pRS in LGIB	NOS score: 6

					and stabilization within 30 days of the initial bleeding episode) and 30-day mortality was defined as any death occurring within 30 days of the initial bleeding episode.				
Camus et al 2016	Comparison of accuracies of 3 risk prognostic scores for the prediction of 30-day rebleeding, surgery and death in severe LGIB	Data from prospective 235 consecutive patients admitted for severe LGIB From 2006-2011 (aged ≥ 18 years) clinically significant bleeding with signs of severity (hypotension, shock, orthostatic changes in systolic blood pressure and/or pulse, or repeated bleeding); and either a decrease of hemoglobin by more than 2 grams from baseline or transfusion of 2 or more units of packed red blood cell (PRBC). Se, SP, NPV, PPV, AUROC analysis	***CURE Hemostasis prognosis score*** Age ≥ 65 years, hypotension or shock at presentation, any comorbidity, any severe comorbidity, rebleeding during hospitalization (prior to GI consultation), PRBC transfusion more than 5 units for initial resuscitation	Clinical ouctomes 3 risk scores CURE Hemostasis prognosis score, Charlson index morbidity ASA	30 rebleeding, surgery or death	Data from prospectively consecutive registered patients Two tertiary centers	Accuracies of each score never reached 70% (or AUROC 0.72) for rebleeding or surgery The ASA score had a highest accuracy for predicting death (83.5%)	Negative findings	NOS score: 7
Chong 2016	to investigate factors that predict severe LGIB and develop a clinical predictor tool to accurately triage LGIB in the emergency department	Retrospective single centre patients presenting to ED with LGIB in 2011 in NZ Study population = 410 patients LGIB was defined as bright red bleeding from the rectum on history and confirmed on digital rectal exam or sigmoidoscopy	***HAKA score*** ***Hb <10*** ***Aspirin*** ***Collapse/dizziness*** ***Albumin <38***	Clinical outcomes	severe LGIB, defined as continued bleeding within the first 24 h, (requirement of at least 2 units of red blood cells and/or a decrease in haematocrit of at least 20%) and/or recurrent bleeding after 24 h of clinical stability and/or readmission to hospital with LGIB within one week	Multivariate logistic regression, prognostic indicator development	HAKA thresholds: low risk (score 0 -1) and high risk (score >=2) for severe bleeding thresholds: >=2 admit to hospital: sensitivity for severe bleeding 59%, spec 82%, PPV 44%, NPV 88%	No AUROC assessment of score, only sensitivity, spec No internal or ext validation Small single centre	NOS Score: 6
Niikura et al 2015	Investigate the in-hospital mortality of	30,846 patients identified from Diagnosis Procedure Combination database (discharge abstract and	Clinical outcomes	-	In-hospital death Secondary outcome : blood transfusion	Descriptive studied on a large database	782 patients died in hospitals (2.5%) 8,060 (26.1%) needed blood transfusion	Only Japanese population	NOS score: 7

	patients with LGIB and elucidate factors associated with it	administrative claims database of inpatient admissions to acute care hospitals in Japan -45% of the total inpatients admissions in Japan) patients admitted with visible blood in stool From 2010 to 2012 Multiple logistic regression model to identify independent risk factors					Factors associated with in-hospital death : Being older and male, comorbidities including congestive heart failure, renal disease, and mild to severe liver disease ; the cause of bleeding ; a non-academic hospital ; nonstreroidal anti-inflammatory drug ; lower BMI, requirement for blood trabsfusion ; interventional radiology ; and surgery Factors associated with blood transfusion requirement : advanced age; comorbidities, including peripheral vascular disease, rheumatoid disease, diabetes with and without chronic complications, renal disease, and mild to severe liver disease; an academic hospital; use of antithrombotic drugs; use of NSAIDs; lower BMI; and requirements for endoscopy, interventional radiology, and surgery.	Descriptive study	
Sengupta 2015	to report 30-day readmission rates in patients hospitalized for LGIB and to describe clinical risk factors that predict 30-day hospital	Prospective observational cohort study of 271 consecutive patients admitted with LGIB or developing LGIB in the hospital. single center, from April 1, 2013, to March 30, 2014.		Clinical outcomes	30-day hospital readmission, recurrent bleeding, and mortality	Uni and multivariable Cox proportional hazards model	patients with in-hospital LGIB had a higher rate of 30-day readmission (HR, 2.26; 95% CI, 1.08–4.28; P=.03). Additional predictors of 30-day readmission included systemic anticoagulation at the time of LGIB (HR, 1.82; 95% CI, 1.05–3.10; P=.03), active malignancy (HR, 2.33;	Headline: inpatient bleeds have higher risk or re-admission and death	NOS score: 6

	readmission, recurrent bleeding, and mortality						95% CI, 1.11–4.42; P=.03), an initial hospital LOS greater than 4 days (HR, 1.78; 95% CI, 1.05–3.04; P=.03), and the number of medications on hospital discharge (HR, 1.07; 95% CI, 1.02–1.11; P=.005). Patients with in-hospital LGIB had a greater risk of dying within 30 days of hospital discharge (odds ratio [OR], 11.5; 95% CI, 2.56–52.0; P=.002). Patients with a higher Charlson score had a higher odds of postdischarge mortality (OR, 1.57; 95% CI, 1.25–2.08; P		
Ayaru 2015	to test whether the Gradient Boosting algorithm was able to accurately predict clinical outcomes in patients presenting to emergency departments with ALGIB using non-endoscopic variables an d to compare to Strate and BLEED score	Retrospective review of patients admitted to two hospitals between Jan 2007 and dec 2011 170 in development cohort 130 external validation cohort	***Gradient boosting model***	BLEED, Strate	therapeutic intervention (endoscopic, angiographic, surgical), Severe bleeding (defined as continued bleeding in the first 24 hours of hospitalisation (defined as a RBC transfusion of ≥2 units, and/or a haematocrit decrease of ≥20%), or recurrent bleeding after 24 hours of stability (defined as more than one transfusion of RBCs, a further haematocrit decrease of ≥20%, or readmission for ALGIB within 1 week of discharge). Recurrent bleeding was defined as recurrent haematochezia after 24 hours of stabilisation during which no active	Development and external validation of a prognostic indicator	GB good at predicting need for intervention: sens 80%, spec 89%, ppv 44%, npv 98% on development dataset BLEED did not perform well over any of the three outcomes Strate cut off >3 good specificity (>90%) but poor sensitivity (<20%) for all outcomes	GB algorithm contains 39 variables!!! Did not statistically compare the scores	NOS score: 6

					bleeding was observed, associated with any of the following as a new finding: decrease in haemoglobin of ≥2g/dl, decrease in haematocrit of ≥5%, haemodynamic instability, or having an additional RBC transfusion (≥2 units received in total).				
Newman et al 2012	Assess BLEED criteria in a UK population and elucidate factors that can be implemented for early risk stratification	161 patients with LGIB identified from a prospectively maintained surgical admission database at a central teaching hospital in London Multiple logistic regression model to identify independent risk factors AUROC	Score based on the independent predictors found on multivariate analysis	Clinical outcomes BLEED score	Severe bleeding = persistente bleeding within the first 24h, blood transfusion, a decrease in Ht ≥ 20% or recurrent bleeding after ≥24h of stability) Adverse outcomes = emergency surgery, ICU admission or death		Severe bleeding 64% Adverse outcome 11.6% Death 5.4% Independent predictors of severe LGIB = Ht <35% ; bright-red rectal bleeding, age >60 years Independent predictors of adverse outcomes = creatinine > 150µmol/l (p=0.002); age > 60 years (p=0.001) ; abnormal haemodynamic parameters on presentation (p=0.05) ; persistent bleeding within 24h (p=0.05) Association of these 4 criteria AUROC =0.79 better than the BLEED criteria (AUROC = 0.60)	Surgical database Retrospective No validation cohort for the score developed only comparison to BLEED score	NOS Score: 5
Hashash 2009	Our hypothesis is that in patients with LGIB, use of antiplatelet/anticoagulant drugs is an independent predictor of severity and	Retrospective single centre review of 166 patients admitted with LGIB between 1994 and 2006	Antiplatelet/anti coagulant use	Clinical outcomes	Severe LGIB defined as (1) hypotension, defined as systolic blood pressure <100 on admission, (2) tachycardia defined as pulse >100 beats per minute (bpm) on admission, or (3) transfusion requirement	A multivariate binary logistic regression was conducted to test for factors associated	no association between mean age, the presence of diabetes mellitus, hypertension, CAD, chronic renal failure, cancer, or dyslipidemia and severe LGIB, or age. No difference between patients receiving antiplatelets or	Single centre retrospective small population	NOS score: 5

	adverse clinical outcomes.				for more than 2 units of pRBC during admission.	with severe bleeding	anticoagultants in terms of in-hospital complications, mean LOS, re-bleeding, death, but there was association with severity of bleeding		
Strate 2005	to prospectively evaluate the Strate score's performance in a new patient population	prospective, observational cohort study of 275 consecutive patients with ALIB admitted to two Hospitals between July 1, 2001 and March 31, 2003 compared to the development cohort of 252 patients described in Strate 2003 paper	***Strate score*** HR>=100, SBP <=115, syncope, non-tender abdo exam, rectal bleeding within 1st 4 hours, aspirin, >2 co-morbid illness Patients with no risk factors were considered low risk for severe bleeding, those with 1–3 risk factors moderate risk, and those with more than 3 risk factors high risk		severe bleeding as defined as continued bleeding in the first 24 h (transfusion of at least 2 units of packed red blood cells and/or a decrease in hematocrit of at least 20%) and/or (ii) recurrent bleeding after 24 h of clinical stability (rectal bleeding accompanied by a further decrease in hematocrit of at least 20%, and/or additional blood transfusions, and/or readmission for ALIB within 1 wk of discharge	External validation of prognostic indicator	Development AUROC 0.76 Validation AUROC 0.75 Six percent of patients with no risk factors (low risk) had severe bleeding, 43% with 1–3 risk factors (moderate risk), and 79% with more than 3 risk factors (high risk)	Did not perform specificity, sensitivity etc	NOS Score: 6
Velayos et al 2004	Identify risk factors for severe LGIB and for significant adverse outcomes	448 patients prospectively identified Multiple logistic regression model to identify independent risk factors	Clinical predictors available in the first hour of evaluation	-	Severe LGIB = gross blood per rectum after leaving the emergency department associated with either abnormal vital signs (systolic blood pressure <100Hmmg or heart rate >100/min) or more than a 2-unit blood transfusion during the hospitalization Secondary ouctomes = adverse outcomes = death, myocardial infarction, development	Prospective study	39% of severe LGIB Independent risk factors for severe LGIB = Ht ≤ 35% ; abnormal vital signs 1 hour after initial medical evaluation; gross blood on initial rectal examination 20% adverse outcome, 3 deaths Main independent predictor for adverse outcomes = severe LGIB	No risk score	NOS Score: 6

					or exacerbation of congestive heart failure, precipitation or worsening of dysarthymia, stroke, onset of respiratory failure, development of an infection requiring intravenous antibiotic, onset delirium/encephalopathy, or onset of any acute medical condition prolonging hospitalization, stay after admission for GI bleeding				
Strate et al 2003	Identify risk factors for severe LGIB	252 consecutive patients prospectively identified Multiple logistic regression model to identify independent risk factors From 1996 to 1999	24 Clinical factors available in the 4 hours of evaluation	-	Severe LGIB = continued bleeding within the first 24 hours of hospitalization (transfusion of ≥ 2 units of blood and/or hematocrit decrease of ≥20%) and/or recurrent bleeding after 24 hours of stability (additional transfusions, further hematocrit decrease of ≥20%, or readmission for LIB within 1 week of discharge)	Prospective study	Severe LGIB 123 patients -49% Risk factors = heart rate ≥100/min, systolic blood pressure ≥115mmHg, syncope, nontender abdominal examination, bleeding per rectum during the first 4 hours of evaluation, aspirin use, and more than 2 active comorbid conditions	No risk score	NOS Score 6
Das et al. 2003	Investigate whether artificial neural networks (ANN) models using information available during triage could predict clinical outcome in acute LGIB	Non-endoscopic data of patients admitted with acute LGIB ANN model training (n=120) and validation (n=70) Then ANN model externally validated bycomparison with multiple logistic regression models on an independent institution in another US state (n=142)	***ANN model***	BLEED score Clinical outcomes	recurrent bleeding, death therapeutic intervention	Prospective study	ANN model had higher accuracy than BLEED score in predictive accuracy in internal validation group for death 87% vs 21%; for recurrent bleeding 89% vs 41%; and for intervention 96% vs 46%) and similar to multiple logistic regression models . External validation : ANN performed well in predicting death (97%),	Only Japanese population Software needed to calculate ANN model	NOS score: 5

							recurrent bleeding (93%), and need for intervention (94%), and it was superior to multiple logistic regression models (70%, 73%, and 70%, respectively).		
Kollef et al. 1997	To develop an outcome prediction tool for clinical use in patients with either acute UGIB or acute LGIB	465 patients admitted with either acute upper or LGIB at the ER 2 private university-affiliated teaching hospitals	***BLEED model*** ongoing bleeding, low systolic blood pressure, elevated prothrombin time, erratic mental status, unstable comorbid disease	Clinical outcomes	In-hospital complications defined as recurrent GI hemorrhage, surgery to control the source of hemorrhage, and hospital mortality	Cohort study 2 centers	Patients classified as high-risk had significantly greater rates of inhospital complications at both Barnes Hospital (relative risk, 2.47; 95% confidence interval, 1.38 to 4.44; $p < .001$) and Jewish Hospital (relative risk, 8.94; 95% confidence interval, 3.92 to 20.41; $p < .001$) compared with patients classified as low-risk. Patients classified as high-risk at either hospital were significantly more likely to develop additional organ system derangements, require a greater number of transfused units of packed red blood cells, and have longer hospital stays compared with patients classified as low-risk ($p < .006$). The BLEED classification also identified a greater frequency of intensive care admission for both low-risk (RR, 4.21; 95% CI, 2.24 to 7.89) and high-risk (relative risk, 1.58; 95% confidence interval, 1.23 to 2.02) patients at Barnes Hospital compared with those patients at Jewish Hospital, although no	No external validation No comparison with other scores	NOS score: 6

							beneficial effects on patient outcome were reported.		
Newstead 1991	Descriptive study	2268 Consecutive patients presenting with non-urgent rectal bleeding were seen and interviewed by the author. Most were assigned to one of three groups for assessment: colonoscopy, flexible rectosigmoidoscopy, rigid rectosigmoidoscopy From 1986 and 1989	-	-	Clinical Outcomes Bleeding source Rebleeding Death	Descriptive study	Flexible sigmoidoscopy (n = 936) eliminated or identified proximal bleeding in most (n = 882; 94.23%) and was confirmed to be generally specific for sigmoid assessment by “blinded” image intensifier confirmation of the level reached. No cancers are known to have been missed by clinical categorization of patients. Significant secondary bleeding occurred in 9 patients (0.43%) and moderate to severe pain in 45 (2.13%) No deaths occurred.	Non-urgent bleeding Old study Non-comparative study No randomization	NOS Score: 4

Table 3s. Summary of Evidence for Task Force 1 - Question F

Reference	Study Design	Patients and Interventions	Outcomes	Results	Level of Evidence	Conclusion and comments
National comparative audit of lower gastrointestinal bleeding and the use of blood: results from a national audit May 2016. https://www.acpgbi.org.uk/content/uploads/2016/07/National-Lower-Gastrointestinal-Bleed-Audit-Results-2016.pdf	Audit, descriptive study, multicentre	2528 patients presenting with lower gastrointestinal bleed (LGIB) in the UK between 1/9 and 1/12/15 to UK hospitals. Data collected on characteristics, aetiology and management of patients.	Number with shock. Number who received a red cell transfusion	Despite the small numbers of patients with shock, 25% patients receive a red cell transfusion, many of these transfusions may be deemed inappropriate	Very low – cohort study	Largest audit of LGIB. Many of these transfusions may be inappropriate.
Villanueva C, Colomo A, Bosch A, Concepción M, Hernandez-Gea V, Aracil C, Graupera I, Poca M, Alvarez-Urturi C, Gordillo J, Guarner-Argente C, Santaló M, Muñiz E, Guarner C.Transfusion strategies for acute upper gastrointestinal	Randomised controlled trial	921 patients with severe acute upper gastrointestinal bleeding randomly	Survival, re-bleeding, adverse events	The probability of survival at 6 weeks was higher in the restrictive-strategy group	Moderate – randomised controlled trial but LGIB was not included	As compared with a liberal transfusion strategy, a restrictive strategy significantly improved outcomes in patients with

bleeding. N Engl J Med. 2013 Jan 3;368(1):11-21. doi: 10.1056/NEJMoa1211801		assigned to a restrictive strategy (transfusion when Hb <7 g/dl) versus a liberal strategy (transfusion when Hb <9 g/dl).		than in the liberal-strategy group (95% vs. 91%; hazard ratio for death with restrictive strategy, 0.55; 95% confidence interval [CI], 0.33 to 0.92; P=0.02). Further bleeding occurred in 10% of the patients in the restrictive-strategy group as compared with 16% of the patients in the liberal-strategy group (P=0.01), and adverse events occurred in 40% as compared with 48% (P=0.02). The probability of survival was slightly higher with the restrictive strategy than with the liberal strategy in the subgroup of patients who had bleeding associated with a peptic ulcer (hazard ratio, 0.70; 95% CI, 0.26 to 1.25) and was significantly higher in the subgroup of patients with cirrhosis and Child-Pugh class A or B disease (hazard ratio, 0.30; 95% CI, 0.11 to 0.85), but not in those with		acute upper gastrointestinal bleeding. However this study did not consider LGIB.

				cirrhosis and Child-Pugh class C disease (hazard ratio, 1.04; 95% CI, 0.45 to 2.37). Within the first 5 days, the portal-pressure gradient increased significantly in patients assigned to the liberal strategy (P=0.03) but not in those assigned to the restrictive strategy.		
Odutayo A, Desborough MJ, Trivella M, Stanley AJ, Dorée C, Collins GS, Hopewell S, Brunskill SJ, Kahan BC, Logan RF, Barkun AN, Murphy MF, Jairath V. Restrictive versus liberal blood transfusion for gastrointestinal bleeding: a systematic review and meta-analysis of randomised controlled trials. Lancet Gastroenterol Hepatol. 2017 May;2(5):354-360. doi: 10.1016/S2468-1253(17)30054-7.	Meta-analysis of randomised controlled trials	Acute upper gastrointestinal bleeding patients from 5 randomised controlled trials totalling 1965 patients.	Mortality, rebleeding, ischaemic events	The number of RBC units transfused was lower in the restrictive transfusion group than in the liberal transfusion group (mean difference -1·73 units, 95% CI -2·36 to -1·11, p<0·0001). Restrictive transfusion was associated with lower risk of all-cause mortality (relative risk [RR] 0·65, 95% CI 0·44-0·97, p=0·03) and rebleeding overall (0·58, 0·40-0·84, p=0·004). We detected no difference in risk of ischaemic events. There were no statistically significant differences in the subgroups	Moderate – meta-analysis but LGIB was not included	These results support more widespread implementation of restrictive transfusion policies for adults with acute upper gastrointestinal bleeding. However, LGIB was not included.

Juan Wang, Yong-Xin Bao, Ming Bai, Yong-Guo Zhang, Wen-Da Xu, Xing-Shun Qi. Restrictive vs liberal transfusion for upper gastrointestinal bleeding: a meta-analysis of randomized controlled trials. World J Gastroenterol . 2013 Oct 28;19(40):6919-27. doi: 10.3748/wjg.v19.i40.6919	Meta-analysis of randomised controlled trials	Patients with acute upper gastrointestinal bleeding from 4 randomized controlled trials	Death, rebleeding, length of hospitalisation, amount of blood transfused, haematocrit and haemoglobin at discharge	The incidence of death was significantly lower in patients receiving restrictive transfusion than those receiving liberal transfusion (OR: 0.52, 95%CI: 0.31-0.87, *P* = 0.01). The incidence of rebleeding was lower in patients receiving restrictive transfusion than those receiving liberal transfusion, but this difference did not reach any statistical significance (OR: 0.26, 95%CI: 0.03-2.10, *P* = 0.21). Compared with those receiving liberal transfusion, patients receiving restrictive transfusion had a significantly shorter length of hospitalization (standard mean difference: -0.17, 95%CI: -0.30--0.04, *P* = 0.009) and a significantly smaller amount of blood transfused (standard mean difference: -0.74, 95%CI: -1.15--0.32, *P* = 0.0005) with a lower hematocrit and hemoglobin level	Moderate – meta-analysis but LGIB was not included	Restrictive transfusion should be used in patients with upper GI bleeding. However, no LGIB patients were included.

				at discharge or after expansion.		
Holst LB, Petersen MW, Haase N, Perner A, Wetterslev J. Restrictive versus liberal transfusion strategy for red blood cell transfusion: systematic review of randomised trials with meta-analysis and trial sequential analysis. BMJ. 2015 Mar 24;350:h1354. doi: 10.1136/bmj.h1354	Systematic review with meta-analysis and trial sequential analysis	9813 Adults or children requiring red blood cell transfusion in 31 trials	Number of red blood cell units transfused, mortality, morbidity, myocardial infarction	The proportion of patients receiving red blood cells (relative risk 0.54, 95% confidence interval 0.47 to 0.63, 8923 patients, 24 trials) and the number of red blood cell units transfused (mean difference -1.43, 95% confidence interval -2.01 to -0.86) were lower with the restrictive compared with liberal transfusion strategies. Restrictive compared with liberal transfusion strategies were not associated with risk of death (0.86, 0.74 to 1.01, 5707 patients, nine lower risk of bias trials), overall morbidity (0.98, 0.85 to 1.12, 4517 patients, six lower risk of bias trials), or fatal or non-fatal myocardial infarction (1.28, 0.66 to 2.49, 4730 patients, seven lower risk of bias trials).	Moderate – meta-analysis, systematic review, trial sequential analysis but LGIB is not exclusively investigated	Compared with liberal strategies, restrictive transfusion strategies were associated with a reduction in the number of red blood cell units transfused and number of patients being transfused, but mortality, overall morbidity, and myocardial infarction seemed to be unaltered. Restrictive transfusion strategies are safe in most clinical settings. Liberal transfusion strategies have not been shown to convey any benefit to patients. This analysis included a heterogeneous group of patients requiring transfusion.
Annemarie B Docherty, Rob O'Donnell, Susan Brunskill , Marialena Trivella, Carolyn Doree, Lars Holst, Martyn Parker, Merete Gregersen, Juliano Pinheiro de Almeida, Timothy S Walsh, Simon J Stanworth · Effect of restrictive versus liberal transfusion strategies on outcomes in	Systematic review and meta-analysis	3033 patients with cardiovascular disease receiving red cell transfusion	Mortality, risk of acute coronary syndrome	In total, 11 trials enrolling patients with cardiovascular disease (n=3033)	Moderate – meta-analysis	The results show that it may not be safe to use a restrictive transfusion threshold of less than 80 g/L in patients with ongoing

patients with cardiovascular disease in a non-cardiac surgery setting: systematic review and meta-analysis. BMJ . 2016 Mar 29;352:i1351. doi: 10.1136/bmj.i1351				were included for meta-analysis (restrictive transfusion, n=1514 patients; liberal transfusion, n=1519). The pooled risk ratio for the association between transfusion thresholds and 30 day mortality was 1.15 (95% confidence interval 0.88 to 1.50, P=0.50), with little heterogeneity (I^2=14%). The risk of acute coronary syndrome in patients managed with restrictive compared with liberal transfusion was increased (nine trials; risk ratio 1.78, 95% confidence interval 1.18 to 2.70, P=0.01, I^2=0%).		acute coronary syndrome or chronic cardiovascular disease. Effects on mortality and other outcomes are uncertain. These data support the use of a more liberal transfusion threshold (>80 g/L) for patients with both acute and chronic cardiovascular disease until adequately powered high quality randomised trials have been undertaken in patients with cardiovascular disease.
Oakland K, Guy R, Uberoi R, Hogg R, Mortensen N, Murphy MF, Jairath V; UK Lower GI Bleeding Collaborative. Acute lower GI bleeding in the UK: patient characteristics, interventions and outcomes in the first nationwide audit. Gut. 2018 Apr;67(4):654-662. doi: 10.1136/gutjnl-2016-313428. Epub 2017 Feb 1	Audit, multicentre study, descriptive	2528 cases of LGIB	Shock, red cell transfusion	Shock was uncommon (58/2528, 2.3%), but 666 (26.3%) received a red cell transfusion.	Very low – cohort study	Red cell transfusion was common but most patients were not shocked and required no endoscopic, radiological or surgical treatment. This suggests over transfusion in this cohort.
Simon GI, Craswell A, Thom O, Fung YL. Outcomes of restrictive versus liberal transfusion strategies in older adults from nine randomised controlled trials: a systematic review and meta-analysis. Lancet Haematol. 2017 Oct;4(10):e465-e474. doi: 10.1016/S2352-3026(17)30141-2. Epub 2017 Sep 11	Systematic review and meta-analysis	5780 patients older than 65 years being investigated in orthopaedic surgery, cardiac surgery and oncology surgery	Mortality	The risk of 30-day mortality was higher in older patients who followed a restrictive transfusion strategy than in those who	Low – LGIB is not investigated	Liberal transfusion strategies might produce better outcomes in geriatric patients than restrictive transfusion strategies. This outcome contradicts current restrictive transfusion

				followed a liberal transfusion strategy (risk ratio [RR] 1·36, 95% CI 1·05-1·74; p=0·017). The risk of 90-day mortality was also higher in those who followed a restrictive transfusion strategy than in those who followed a liberal transfusion strategy (RR 1·45, 95% CI 1·05-1·98; p=0·022).		approaches. However LGIB is not investigated.

Task Force 2

Table 4s. Summary of Evidence for Task Force 2 - Question A									
Author, publication year	**Study Objective**	**Participants/Setting**	**Intervention**	**Comparisons**	**Outcome**	**Study type**	**Results**	**Conclusion**	**Quality assessment**
Oakland 2017	To determine the diagnostic and therapeutic yields of endoscopy, CTA, and angiography for ALGIB.	2 RCT and 13 observational studies. None examined flexible sigmoidoscopy, or compared endotherapy with embolization. 2 observational studies compared colonoscopy vs CTA.	Colonoscopy.	CTA. Angiography.	**Primary:** therapeutic and diagnostic yields. **Secondary:** rebleeding, transfusion requirements, hospital LOS, mortality, and adverse events.	Systematic review.	No difference in diagnostic yields and outcomes between colonoscopy and CTA.	There is a paucity of data of high-quality evidence to recommend one intervention over another	Moderate. Appropriate methodology. Low-quality of included studies.
Van der Star 2020	To evaluate the outcomes of patients with delayed postpolypectomy bleeding.	N = 42, 20 of them initially managed without colonoscopy. Patients with delayed postpolypectomy bleeding after EMR of > 2 cm.	Colonoscopy.	No intervention.	**Primary:** clinical management. **Secondary:** factors associated with active bleeding.	Retrospective multicentric.	Hourly haematochezia was associated with hemostatic therapy. Patients without ongoing bleeding were successfully managed without intervention.	Ongoing hematochezia is associated with a high rate of hemostatic therapy. Patients with self-limited bleeding can be managed without intervention.	NOS score: 4 Selection domain score was downgraded since only patients with delayed postpolypectomy bleeding were included.
Rodríguez de Santiago 2020	To identify factors associated with therapeutic intervention and active bleeding after delayed postpolypectomy bleeding.	N = 548, 140 were initially managed without intervention. Patients with delayed postpolypectomy bleeding	Colonoscopy.	No intervention.	**Primary:** therapeutic intervention and active bleeding. **Secondary:** rebleeding, mortality, transfusion requirements.	Retrospective multicentric.	A need for therapeutic intervention was associated with antithrombotics, haemoglobin drop > 2 g/dL, haemodynamic instability, and comorbidities Rebleeding (<6%) and transfusion requirements were low in those managed without intervention.	Almost half of the patients do not warrant any therapeutic intervention. Colonoscopy is often overused.	NOS score: 6 Selection domain score was downgraded since only patients with delayed postpolypectomy bleeding were included.

Miyakuni 2020	To investigate if angiography should be prioritized as initial treatment for patients with severe ALGIB.	N = 3,220 colonoscopy / 805 angiography. (4:1 propensity score matching). Patients > 16 years old from the Japanese Diagnosis Procedure Combination inpatient database who were admitted and underwent angiography or colonoscopy within 1 day of admission for severe ALGIB.	Colonoscopy. Patients who underwent both colonoscopy and angiography within 1 day of admission were included in this group.	Angiography.	**Primary:** in-hospital mortality. **Secondary:** surgery.	Retrospective nationwide cohort.	In-hospital mortality was similar (RR 1.14; 95 % CI 0.95–1.36). The need for surgery within 1 day was lower in the angiography group (RR 0.44; 95% CI 0.29-0.67). In subgroup analyses, patients that did not require ICU admission nor mechanical ventilation had better outcomes. 75% of patients also underwent CTA in the matched cohorts.	In patients with severe ALGIB, in-hospital mortality did not significantly differ between colonoscopy and angiography. Angiography might be superior in patients with more severe ALGIB.	NOS score: 7
Lee 2020	To determine the diagnostic performance of CTA compared to colonoscopy as an initial test.	N = 112 CTA / 65 colonoscopy / 205 sigmoidoscopy as an initial test. Patients with haematochezia presenting at the emergency department.	Colonoscopy and sigmoidoscopy.	CTA.	Diagnostic accuracy to detect active bleeding and aetiology. Hospital LOS.	Retrospective single centre.	CTA and colonoscopy had similar sensitivity (85.7% vs 76.9%, respectively) and specificity (100% both) for detecting the active bleeding site. Colonoscopy had superior specificity (88.2% vs 40%) for identifying the aetiology. Sigmoidoscopy was less accurate. Hospital LOS was similar between the 3 groups.	CTA was not inferior to lower endoscopy for active bleeding site detection.	NOS score: 6

Clerc 2017	To compare CTA and lower endoscopy.	N = 122 lower endoscopy / 32 CTA / 29 neither of both. Patients consecutively admitted with ALGIB.	Lower endoscopy.	CTA.	Diagnostic accuracy and bleeding control.	Retrospective single center.	Median time to CTA was shorter (3 vs. 22 hours, P < 0.001). Active bleeding was identified more often with CTA (31% vs. 15%. P = 0.031). Surgery was more common in patients who underwent CTA.	CTA may be a suitable first-line modality for patients with ALGIB. Colonoscopy is more convenient for postinterventional ALGIB.	NOS score: 6
Nagata 2015	To evaluate the role of urgent CTA.	N = 126 CTA prior urgent colonoscopy / 97 early colonoscopy alone.	Early colonoscopy (< 24 hours).	Early colonoscopy and CTA.	Rebleeding, detection rate of the bleeding source, need for endoscopic therapy and transfusion.	Retrospective single center.	The detection rate was higher with CTA plus colonoscopy for vascular lesions (35.7 vs. 20.6%, P = 0.01), leading to more endoscopic therapy. No differences in other clinical outcomes.	Urgent CTA before colonoscopy increases the detection rate of vascular lesions and allows to apply endoscopic therapy more often, but did not impact clinically relevant outcomes.	NOS score: 7
Burgess 2014	To analyze outcomes of patients with clinically significant post-EMR bleeding and elaborate a management algorithm.	N = 62, 33 were managed without intervention. Patients with delayed postpolypectomy bleeding after EMR of > 2 cm.	Colonoscopy	Conservative management	Bleeding severity, intervention for hemostatis, perforation and surgery rates	Retrospective multicenter study.	Intervention for hemostasis was associated with hourly hematochezia, American Society of Anesthesiologists grade 2 or higher and transfusion.	Delayed pospolypectomy bleeding solves spontaneously in 55% of patients	NOS score: 6 Selection domain score was downgraded since only patients with delayed postpolypectomy bleeding were included
Strate 2005	To assess factors associated with early colonoscopy vs. radiographic evaluation of patients with severe ALGIB.	N = 118 patients with severe ALGB. A total of 182 procedures were performed: colonoscopy, 83; angiography, 21; scintigraphy, 29; sigmoidoscopy, 24;	Early colonoscopy (< 24 hours).	Scintigraphy and angiography.	Identification of the source of bleeding , therapeutic interventions, recurrent bleeding.	Retrospective single center.	Early colonoscopy compared to early radiographic procedures had a higher diagnostic yield (85% vs 45%, P = 0.005), lower LOS (P = 0.025) and	Early colonoscopy may improve outcomes.	NOS score: 6

		and upper endoscopy, 25.					transfusion requirements (P = 0.024). No differences in other outcomes.		
Green 2005	To evaluate the benefit of urgent colonoscopy compared to a standard protocol including colonoscopy and/or radiology.	N = 50 early / 50 elective Patients >18 years presenting with haematochezia. All patients had upper GI sources of bleeding excluded by nasogastric lavage or endoscopy. Anorectal sources of bleeding were excluded by anoscopy and/or proctoscopy. Terminated early because of low recruitment.	Colonoscopy within 2 h after the clearance of stool and large clots and within 8 h of hospitalization or the diagnosis of haematochezia.	Patients with ongoing bleeding underwent technetium labelled red cell scanning and angiography. Patients without ongoing bleeding or negative scans underwent elective colonoscopy (< 96 h).	**Primary:** Rebleeding. **Secondary:** LOS, blood transfusion requirements, need for surgery, and mortality.	RCT: single center, nonblinded, superiority.	A definite source of bleeding was found more often in urgent colonoscopy group (OR 2.6; 95% CI 1.1-6.2). No difference in mortality, hospital LOS, and rebleeding.	Although early colonoscopy identified a definite source of bleeding more often than a standard care algorithm, the approaches are not different regarding important outcomes.	Overall risk of bias: Some concerns Randomization: Low risk Deviations from intended intervention: Some concerns Missing data: Low risk Measurement of the outcome: Some concerns Selection of the reported result: Some concerns
Richter 1995	To determine the effectiveness of diagnostic and management technologies for ALGIB.	N = 107 Patients with ALGIB	Colonoscopy	Scintigraphy Angiography	Diagnostic yield and therapy.	Retrospective single-center.	Diagnostic and therapeutic yield of colonoscopy was higher compared to angiography and scintigraphy. Barium enema and sigmoidoscopy had lower clinical yields.	Colonoscopy is the most appropriate first-line modality for patients with ALGIB.	NOS score: 6

GI: gastrointestinal; ALGIB: acute lower gastrointestinal bleeding; CTA: computed tomography angiography; EMR: endoscopic mucosal resection; LOS: length of stay; NOS: Newcastle-Ottawa scale; RR: relative risk; CI: confidence interval; ICU: intensive care unit.

Table 5s. Quality assessment of Observation studies by Newcastle-Ottawa scale for Task Force 2 - Question A									
Author and year	**Selection**				**Comparability**	**Exposure**			**Total score**
Cohort studies	Representativeness of the exposed cohort.	Selection of the non-exposed cohort.	Ascertainment of exposure	Outcome of interest was not present at start of study.	Based on the design or analysis.	Assessment of outcome.	Follow-up enough for outcomes to occur (30 days).	Adequacy of follow up of cohorts.	
Case and control studies	Is the case definition adequate?	Representativeness of the cases.	Selection of Controls.	Definition of Controls.		Ascertainment of exposure.	Same method of ascertainment for cases and controls.	Non-Response Rate.	
Lee 2020	1	1	1	1	0	1	1	0	6
Van der Star 2020	0	0	1	1	0	1	1	1	5
Rodríguez de Santiago	0	0	1	1	1	1	1	1	6
Miyakuni 2020	0	1	1	1	1	1	1	1	7
Clerc 2017	1	1	1	1	0	1	1	0	6
Nagata 2015	1	0	1	1	1	1	1	1	7
Burgess 2014	0	0	1	1	1	1	1	1	6
Strate 2005	1	1	1	1	0	1	1	0	6
Richter 1995	1	1	1	1	0	1	1	0	6

Table 6s. GRADE table for the comparison colonoscopy vs radiological procedures - Task Force 2 - Question A										
Nº of studies	**Outcome**	**Risk of bias**	**Indirectness**	**Inconsistency**	**Imprecision**	**Publication bias**	**Summary of the effect**	**Quality of evidence**	**Anticipated effect**	**Importance**
1 Systematic review 1 RCT 6 observational studies	Diagnostic accuracy	Serious	Serious	Serious	Serious	Uncertain	Studies reporting similar accuracy, favouring endoscopy, and favouring CTA.	+ O O O Very low	No significant difference between CTA and colonoscopy	Important
1 Systematic review 1 RCT 4 Observational studies	Treatment	Serious	Not serious	Serious	Serious	Uncertain	Studies reporting similar accuracy, favouring endoscopy, and favouring radiology.	+ O O O Very low	Colonoscopy might be superior as first-line for patients without severe ALGIB.	Important

ALGIB: acute lower gastrointestinal bleeding; CTA: computed tomography angiography

Table 7s. Summary of Evidence for Task Force 2 - Question B									
Author, publication year	**Study Objective**	**Participants/ Setting**	**Intervention**	**Comparisons**	**Outcome**	**Study Type**	**Results**	**Conclusion**	**Quality assessment ***
Kherad 2020 [4]	To determine whether the performance of colonoscopy within 24 hours of admission improves relevant clinical outcomes.	4 RCTs (N = 228 early / 235 elective) and 13 observational studies (N = 1,061,281). Four observational studies were only presented as abstracts.	Early colonoscopy (< 24 hours).	Elective colonoscopy (>24 hours).	**Primary:** Overall rebleeding rate **Secondary:** rates of surgery, mortality, hospital LOS, identification of a definite or a probable cause of lower GI bleeding, adverse events, stigmata of recent haemorrhage, length of ICU stay, blood transfusions rate, total units of blood received, endoscopic therapy, and the need for angiography.	Systematic review with meta-analysis of RCTs and observational studies.	No differences when pooling data from RCTs in any outcome. Among observational studies only, early colonoscopy was associated with lower rates of all-cause mortality, blood transfusion, surgery, and shorter hospital LOS.	Unlike observational studies, data from RCTs do not support early colonoscopy.	High. This meta-analysis did not include 2 observational studies found in our search [15,28] and included an observational study that mixed upper and lower GI bleeding [31].
Anvari 2020 [5]	To evaluate the role of colonoscopy timing.	4 RCTs (N = 228 early / 235 elective) and 9 observational studies (N = 63,105	Urgent colonoscopy (< 8-24 hours).	Standard colonoscopy. (24-96 hours).	**Primary**: Length of hospital stay, blood transfusion, need for additional intervention and mortality	Systematic review with meta-analysis of RCTs and	No differences when pooling data from RCT	Timing of colonoscopy does not affect	High.

		early/ 66,170 standard).			**Secondary:** rebleeding, diagnostic yield, and adverse events.	observational studies.	in any outcome. Among observational studies only, early colonoscopy was associated with lower rates of all-cause mortality, surgery, and shorter hospital LOS.	patient outcomes.	
Tsay 2020 [6]	Determine optimal timing of colonoscopy.	4 RCTs N = 228 early / 235 elective.	Early colonoscopy defined as < 24 h from presentation .	Elective colonoscopy (>24 hours).	**Primary:** further bleeding, defined as persistent or recurrent bleeding after index colonoscopy or other initial diagnostic testing. **Secondary:** diagnostic yield, mortality, stigmata of recent bleeding, transfusions, hospital LOS, endoscopic intervention, any primary hemostatic intervention, surgery or interventional radiology, intervention after initial colonoscopy or other diagnostic test, and adverse events	Systematic review with meta-analysis of RCTs.	Further bleeding was not decreased among patients who received early colonoscopy (RR, 1.57; 95% CI 0.74–3.31). No differences in secondary outcomes	Early colonoscopy does not have an impact on clinically relevant outcomes based on data from RCTs.	High.
Afshar 2018 [10]	To characterize the utility of early colonoscopy.	2 RCTs, 9 observational comparative and 10 single-arm studies N = 25,781	Early colonoscopy (< 24 hours).	Elective colonoscopy (> 24 hours).	**Primary:** overall rebleeding rate and time to rebleeding **Secondary:** mortality, length of hospital and ICU stay, surgery, adverse events, blood transfusion, diagnostic yield, endoscopic therapy, and stigmata of recent bleeding.	Systematic review with meta-analysis of RCTs.	Early colonoscopy detected more definitive sources of bleeding and was associated with shorter hospital LOS.	Early colonoscopy does not decrease rebleeding, mortality or need for surgery, but it may increase the detection of	High.

							No other differences were noted.	definitive sources of bleeding and reduce hospital LOS.	
Kouanda 2017 [7]	To compare outcomes between urgent and elective colonoscopy in hospitalized patients.	2 RCTs and 10 observational studies. N = 10,172 early / 14,224 elective.	Urgent colonoscopy (<8-24 hours).	Elective colonoscopy (> 24 hours).	**Primary:** localization of the bleeding site and use of hemostatic interventions to treat bleeding. **Secondary:** rebleeding, adverse event rates, transfusion rates, mortality, hospital LOS, and costs.	Systematic review with meta-analysis of RCTs and observational studies.	Early colonoscopy was associated with increased use of endoscopic therapeutic intervention. This finding disappeared when only prospective trials were pooled. No differences in other outcomes.	Early colonoscopy may not alter critical clinical outcomes.	High.
Sengupta 2017 [9]	Timing of colonoscopy.	2 RCT and 4 observational studies. N = 422 early / 479 elective.	Early colonoscopy (< 24 hours).	Elective colonoscopy (> 24 hours).	**Primary:** Rate of rebleeding. **Secondary:** localization of bleeding site, surgery, hospital LOS, mortality and endoscopic interventions.	Systematic review with meta-analysis of RCTs and observational studies.	Early colonoscopy was associated with a higher detection of bleeding source and endoscopic intervention. Mortality, rebleeding, and need for surgery did not differ.	Early colonoscopy does not reduce rebleeding, hospital LOS, or need for surgery, but is associated with a higher rate of source localization and endoscopic intervention.	Moderate. Some concerns about search strategy and statistical methods.

Seth 2017 [8]	Timing of colonoscopy.	2 RCT and 4 observational studies. N = 9,498 early / 13,921 elective.	Urgent colonoscopy (8-24 hours).	Elective colonoscopy (24-96 hours).	**Primary:** Mortality. **Secondary:** rebleeding, hospital LOS, stigmata of recent bleeding, surgery and identification of bleeding source.	Systematic review with meta-analysis of RCTs and observational studies.	Stigmata of recent bleeding was associated with early colonoscopy. No differences in other outcomes.	Early colonoscopy may increase the rate of detection of stigmata of recent bleeding. No differences in other relevant clinical outcomes.	High.
Niikura 2020 [11]	To evaluate whether early colonoscopy improves clinical outcomes compared with elective colonoscopy.	N = 79 early / 80 elective Outpatients > 20 years with moderate to severe hematochezia or melena within 24 hours of arrival with 3 occurrences of hematochezia within 8 hours or hemorrhagic shock or requiring transfusion.	Colonoscopy within 24 h of presentation.	Elective colonoscopy (24-96 hours).	**Primary:** Stigmata of recent bleeding, defined as visualization of active bleeding; nonbleeding visible vessel or adherent clot **Secondary:** 30-day rebleeding, endoscopic treatment success, additional endoscopic examinations, need for interventional radiology/surgery/transfusion, length of stay, 30-day thrombotic events, 30-day mortality, bowel preparation-related adverse events, and colonoscopy-related adverse events.	RCT: multicenter, open-label, superiority design.	Stigmata of recent bleeding in early colonoscopy group 21.5% vs 21.3 in the elective group (difference, 0.3; 95% CI -12.5 to 13.0; P = .967). No differences in secondary outcomes.	Early colonoscopy did not increase the stigmata of recent bleeding detection rate and did not improve any clinically relevant outcome.	Overall risk of bias: Some concerns. Randomization: Low risk. Deviations from intended intervention: Some concerns. Missing data: Low risk. Measurement of the outcome: Some concerns. Selection of the reported result: Some concerns.
Van Rongen 2019 [13]	To evaluate whether early colonoscopy.	N = 63 early / 69 elective.	Colonoscopy within 24 h of	Standard colonosco	**Primary:** hospital LOS. **Secondary:** diagnostic yield, stigmata of recent bleeding,	RCT: single center,	Early colonoscopy reduced the hospitalization	Early colonoscopy reduced hospital LOS	Overall risk of bias: Some concerns.

	reduces hospital LOS.	Outpatients over 20 years with hematochezia <24 h of presentation and in whom upper GI bleeding source was either not suspected or excluded by upper endoscopy. Patients with hemodynamic instability refractory to resuscitation and serious comorbidities were excluded.	presentation.	py (24-72h).	blood transfusion, 30-day recurrent bleeding, adverse events, 30-day mortality.	nonblinded, superiorit.y	LOS (median 2 days vs 3 days; P = .009). No differences in a post-hoc analysis including hospital LOS. The number of recurrent bleedings was higher in the early colonoscopy group: 13% vs 3%. No differences in other outcomes.	when readmission time was not considered. Recurrent bleedings and readmissions were higher in the early colonoscopy group.	Randomization: Low risk. Deviations from intended intervention: Some concerns. Missing data: Low risk. Measurement of the outcome: Some concerns. Selection of the reported result: Some concerns.
Laine 2010 [12]	To determine the proportion of patients with serious hematochezia who have upper GI bleeding and whether urgent colonoscopy improve outcomes.	N = 36 early / 36 delayed. Patients with hematochezia without upper GI bleeding and at least one high-risk feature of severe bleeding. The trial was terminated before reaching the prespecified sample size.	Colonoscopy within 24 h after presentation.	Delayed colonoscopy (36-60 h).	**Primary:** further bleeding. **Secondary:** diagnostic yield, blood transfusion, hospital LOS, subsequent interventions, and hospital charges.	RCT: single center, nonblinded, superiority.	13% of patients had an upper source of GI bleeding. Further bleeding was similar in both groups (22% early group vs 14%). No differences in secondary outcomes.	Patients with severe lower GI bleeding should undergo upper endoscopy. Urgent colonoscopy does not improve clinical outcomes.	Overall risk of bias: Some concerns. Randomization: Low risk Deviations from intended intervention: Some concerns. Missing data: Low risk. Measurement of the outcome:

									Some concerns. Selection of the reported result: Some concerns.
Green 2005 [14]	To evaluate the benefit of urgent colonoscopy compared to a standard protocol including colonoscopy and/or radiology.	N = 50 early / 50 elective Patients >18 years presenting with hematochezia. All patients had upper GI sources of bleeding excluded by nasogastric lavage or endoscopy. Anorectal sources of bleeding were excluded by anoscopy and/or proctoscopy. Terminated early because of low recruitment.	Colonoscopy within 2 h after the clearance of stool and large clots and within 8 h of hospitalization or the diagnosis of hematochezia.	Patients with ongoing bleeding underwent technetium labelled red cell scanning and angiography. Patients without ongoing bleeding or negative scans underwent elective colonoscopy (< 96 h).	**Primary:** Rebleeding. **Secondary:** LOS, blood transfusion requirements, need for surgery, and mortality.	RCT: single center, nonblinded, superiority.	A definite source of bleeding was found more often in urgent colonoscopy group (OR 2.6; 95% CI 1.1-6.2). No difference in mortality, hospital LOS, and rebleeding.	Although early colonoscopy identified a definite source of bleeding more often than a standard care algorithm, the approaches are not different regarding important outcomes.	Overall risk of bias: Some concerns Randomization: Low risk Deviations from intended intervention: Some concerns Missing data: Low risk Measurement of the outcome: Some concerns Selection of the reported result: Some concerns
Mosli 2020 [15]	To examine the success of urgent colonoscopy in identifying the source of bleeding.	N = 83 early/ 100 delayed. Patients > 18 years old that underwent inpatient colonoscopy.	Urgent colonoscopy (<24 hours).	Delayed colonoscopy (> 24 hours)	**Primary:** Identification of a source of bleeding. **Secondary:** need of surgery and mortality.	Retrospective, single center.	Risk Ratios comparing urgent to delayed colonoscopy for identification of bleeding source , colectomy and mortality were 1.01 (P = 0.94), 4.8.	Urgent colonoscopy did not improve the rate of identification of the source of bleeding, colectomy rate or mortality.	NOS score: 7

							P = 0.11) and 1.2 (P =0.89), respectively.		
Nigam 2019 [16]	To assess if early colonoscopy decreases the risk of rebleeding and hospital readmission.	N= 8320 early / 8320 delayed. (propensity score matching) Patients older than 18 years with primary diagnosis of diverticular bleeding who underwent colonoscopy during hospitalization. Patients who had the colonoscopy before hospitalization were excluded.	Early colonoscopy (within 24 h).	Delayed colonoscopy (> 24 h).	**Primary:** 30-day rebleeding and all-cause 30-day re-admission. **Secondary:** identify clinical factors associated with postdischarge adverse outcomes.	Retrospective cohort study using a nationwide administrative database.	Early colonoscopy was associated with increased risk of rebleeding within 30 days (OR, 1.34;P=0.007) and increased re-admission to the hospital within 30 days (OR, 1.37; P =0.03).	Early colonoscopy in patients with diverticular bleeding was associated with increased risk of 30-day rebleeding.and all-cause hospital re-admission. Concerns about the impact of confounders on results.	NOS score: 9
Saraireh 2019 [17]	To assess the impact of timing of colonoscopy in patients with acute diverticular bleeding.	N = 45,020 early / 43,580 delayed Patients from NIS USA database. Discharges with the primary or secondary inpatient discharge diagnosis of diverticular bleeding and underwent colonoscopy.	Early colonoscopy (< 24 h).	Delayed colonoscopy (> 24 h).	**Primary:** hospital LOS and total hospitalization costs. **Secondary:** Mortality.	Retrospective cohort study using a nationwide administrative database.	Hospital LOS (3.7 vs 5.6 days, P<0.001) and hospitalization costs ($9317 vs $11767, P<0.001)were lower in patients with early colonoscopy.	No difference in mortality.	NOS score: 7
Wada 2019 [18]	To evaluate factors associated with hospital LOS in patients	N = 62 early / 161 delayed. Patients hospitalized with colonic diverticular bleeding.	Urgent colonoscopy (< 24 h).	Delayed colonoscopy (> 24 h).	**Primary:** Predictors of hospital LOS. **Secondary:** blood transfusion, endoscopic treatment, cecal intubation, adverse events, rebleeding.	Retrospective single-center cohort study.	Urgent colonoscopy (OR 0.41, P = 0.007) predicted a shorter hospital LOS	Urgent colonoscopy is safe and reduces hospital LOS in patients with	NOS score: 7

	hospitalized with acute diverticular bleeding.						and a higher likelihood of endoscopic treatment (OR 7.8; P < 0.001). No differences in adverse events or rebleeding.	colonic diverticular bleeding.	
Kim 2018 [19]	To determine the benefit of endoscopy in patients with GI bleeding in ICU patients. Secondarily, to compare early vs late endoscopy.	N = 36 early / 33 delayed. Patients with acute upper or lower GI bleeding admitted at the ICU who underwent bedside endoscopy.	Early colonoscopy (< 24 h).	Delayed colonoscopy (> 24 h).	Rate of identification of bleeding source, primary hemostasis rate, rates of second endoscopy angiography, surgery, units of red blood cell transfused, hospital LOS, length of ICU stay, recurrent bleeding rate, and mortality.	Retrospective single center study	Early colonoscopy decreased the rate of identifying the bleeding focus (58% vs. 82%, P = 0.008) and haemostasis (19% vs. 49%, P = 0.011), probably because bowel preparation and blood interference of observation were more frequent (38.9% vs. 6.1%, P =0.035)	Early colonoscopy in ICU patients with lower GI bleeding should only be considered after adequate bowel preparation.	NOS score: 5
Devani 2018 [20]	To investigate trends of early colonoscopy and their out-comes in patients admitted with lower GI bleeding.	N = 1,526,829 (37% early, 24% delayed and 38% no colonoscopy). Patients from the NIS database admitted with lower GI bleeding.	Early colonoscopy (< 24 h).	Delayed colonoscopy (> 24 h).	Hospitalization costs, hospital LOS, mortality	Retrospective cohort study using a nationwide administrative database.	Increasing trend of utilization of early colonoscopy during the study period. Early colonoscopy reduced LOS and hospitalization cost.	The use of early colonoscopy is increasing. It was associated with lower LOS and cost, without a significant impact on mortality	NOS score: 6 Only presented as abstract

Douaihy 2017 [21]	To compare early vs late colonoscopy in patients with lower GI bleeding	N = 67 early / 133 delayed Patients admitted with lower GI bleeding who underwent colonoscopy	Early colonoscopy (< 24 h).	Delayed colonoscopy (> 24 h).	**Primary:** Rebleeding **Secondary:** hospital LOS and mortality	Retrospective single center study.	Inadequate prep was higher in the early arm (38% vs 27%, P < 0.05). No other differences were noted.	No benefit of early colonoscopy in clinical outcomes.	NOS score: 5 Only presented as abstract.
Winn 2016 [22]	To evaluate the effect of endoscopy time for acute upper and lower GI bleeding.	N = 29 early / 370 delayed colonoscopy. All patients with GI bleeding, admitted to a tertiary care, university-based hospital who underwent colonoscopy.	Early colonoscopy (< 24 h).	Delayed colonoscopy (> 24 h).	LOS, mortality, need for repeat endoscopy and transfusion requirements.	Retrospective single center study.	Rebleeding (27% vs 6%, P < 0.001) and mortality were higher in the early colonoscopy group.	Resuscitative measures should be thoroughly carried out prior to urgent colonoscopy.	NOS score: 4 Only presented as abstract.
Hassan 2016 [23]	To evaluate the effect of early colonoscopy in acute diverticular bleeding.	N = 65 early / 232 delayed colonoscopy.	Early colonoscopy (< 24 h).	Delayed colonoscopy (> 24 h).	Risk of rebleeding, LOS, blood transfusion requirements, and inpatient mortality.	Retrospective single center study.	No difference in rebleeding (4.6% in the early group vs 9.9%, P = 0.18) or transfusion requirements. LOS was shorter in the early group (3 vs 4.3 days, P = <0.001).	Early colonoscopy reduced LOS in patients with acute diverticular bleeding.	NOS score: 5 Only presented as abstract.
Nagata 2016 [24]	To investigate the safety and effectiveness of early vs elective colonoscopy in	N= 163 early / 163 elective . (propensity score matching) Consecutive patients admitted for acute overt lower GI bleeding.	Early colonoscopy (< 24 h).	Delayed colonoscopy (> 24 h).	**Primary:** 30-day rebleeding and 30- day mortality rates. **Secondary:** Adverse events during bowel preparation and colonoscopy, diagnostic rate of stigmata of recent hemorrhage, endoscopic therapy rate, blood transfusion requirement, interventional radiology or surgery requirement, and LOS.	Retrospective single center study.	The early colonoscopy group had higher rebleeding (13.5% vs.7.4%,P = 0.07) with no differences in mortality rate. No differences in secondary	Early colonoscopy is safe, allows for endoscopic therapy as it identifies the bleeding source, and reduces hospital LOS. However, it does not	NOS score: 9

	hospitalized patients.						outcomes.	reduce mortality and may increase the risk for rebleeding.	
Niikura 2015 [25]	To identify predictors for the identification of stigmata of recent bleeding on colonic diverticula.	N = 158 early / 238 elective Patients with acute lower GI bleeding. The population with colonic diverticular bleeding was subanalyzed.	Early colonoscopy (< 24 h).	Delayed colonoscopy (> 24 h).	**Primary:** Stigmata of recent bleeding in patients with diverticular bleeding. **Secondary:** blood transfusion requirements, LOS, need for interventional radiology and surgery, and rebleeding.	Retrospective single center study.	Stigmata of recent bleeding identification rate was higher in the urgent (22%) than in the 24 to 48 hours (2.9%, P<0.01) and >48 hours groups (1.0%, P<0.01).	Urgent colonoscopy increases the detection rate of stigmata of recent bleeding in acute diverticular bleeding.	NOS score: 7
Albeldawi 2014 [26]	To assess the utility and outcome of urgent vs elective colonoscopy in patients admitted to the ICU.	N = 24 urgent / 33 elective Consecutive patients admitted to the ICU who underwent colonoscopy for the initial evaluation of acute lower GI bleeding.	Urgent colonoscopy (within 24 h of admission to the ICU).	Elective colonoscopy (> 24 h after admission to the ICU).	**Primary:** rebleeding rate. **Secondary:** blood transfusion requirement, duration of ICU stay, need for angiography or surgery, and 30-day mortality.	Retrospective single center cohort study.	Rebleeding rate did not differ between urgent and elective colonoscopy groups (21% vs. 28%, P=0.53). Patients who underwent urgent colonoscopy received more blood transfusions (P=0.003).	Urgent colonoscopy as the initial investigation of acute lower GI bleeding did not result in significant differences in rebleeding rate or any other relevant outcomes.	NOS score: 6
Navaneethan 2014 [27]	To investigate the impact of the timing of colonoscopy on outcomes.	N = 9156 early / 13,564 delayed Patients between 18-90 years with a primary diagnosis discharge code of lower GI bleeding in the 2010 NIS dataset.	Early colonoscopy (within 24 h of hospital admission).	Delayed colonoscopy (after 24 h).	**Primary:** in-hospital mortality. **Secondary:** LOS, need for blood transfusions, and total hospital costs.	Retrospective study from a nationwide population-based study	There was no difference in hospital mortality. Delayed colonoscopy was associated with an increased	Early colonoscopy decreased LOS and hospitalization costs. However, it did not appear to affect mortality.	NOS score: 7

							need of blood transfusion, hospital LOS by 1.6 days and hospitalization costs of $7187.		
Rodríguez-Moranta 2007 [30]	To determine whether delay in performing colonoscopy influences diagnostic accuracy, endoscopic therapy, and the hospital LOS.	N = 212. 84.4% underwent colonoscopy. Consecutive patients admitted with lower GI bleeding	Early colonoscopy (within 24 h of hospital admission).	Delayed colonoscopy (after 24 h).	Hospital LOS, source of bleeding, endoscopic therapy.	Prospective Observational cohort study	Early colonoscopy was associated with a better chance of identifying a definitive source of bleeding and receive endoscopic therapy, and with shorter LOS in Cox regression	Early colonoscopy can improve clinical outcomes.	NOS score: Only presented as abstract.
Schmulewitz 2003 [28]	To evaluate predictor of hospital LOS.	N = 125 early / 290 delayed Patients > 18 years admitted with a diagnosis of hematochezia or lower GI bleeding.	Early colonoscopy (within 24 h of hospital admission).	Delayed colonoscopy (after 24 h).	**Primary:** hospital LOS. **Secondary:** hemostatic therapy, surgery, rebleeding.	Retrospective single center study.	The mean LOS for patients having colonoscopy within 24 hours of hospitalization was shorter (5.4 vs. 7.2 days; P < 0.008).	Early colonoscopy reduced LOS.	NOS score: 8
Strate 2003 [29]	To determine whether time to colonoscopy impacts hospital LOS in patients admitted with all sources and severities of	N = 69 early / 75 delayed Patients admitted to a tertiary care hospital with acute lower GI bleeding..	Early colonoscopy (<12 h and 12-24 h from admission).	Delayed colonoscopy (after 24 h).	**Primary:** hospital LOS.	Retrospective single center study.	Earlier colonoscopy was associated with a shorter hospital LOS.	Time to colonoscopy is an independent predictor of hospital LOS.	NOS score: 8

	acute lower GI bleeding.								

RCTs: Randomized controlled trials; LOS: Length of hospital stay; GI: Gastrointestinal; NOS: Newcastle-Ottawa scale; ICU: Intensive Care Unit; CI: Confidence intervals; OR: Odds ratio; NIS: Nationwide Inpatient Sample. * The risk of bias 2 (RoB 2) revised tool from the Cochrane organization was used to assess the risk of bias of randomized controlled trial.

Table 8s. Quality assessment of Observation studies by Newcastle-Ottawa scale for Task Force 2 - Question B

Author and year	**Selection**				**Comparability**	**Exposure**			**Total score**
Cohort studies	Representativeness of the exposed cohort	Selection of the non-exposed cohort	Ascertainment of exposure	Outcome of interest was not present at start of study	Based on the design or analysis	Assessment of outcome	Follow-up enough for outcomes to occur (30 days)	Adequacy of follow up of cohorts	
Case and control studies	Is the case definition adequate?	Representativeness of the cases	Selection of Controls	Definition of Controls		Ascertainment of exposure	Same method of ascertainment for cases and controls	Non-Response Rate	
Mosli 2020	1	1	1	1	1	1	1	0	7
Nigam 2019	1	1	1	1	2	1	1	1	9
Saraireh 2019	1	1	1	1	1	1	1	0	7
Wada 2019	1	1	1	1	1	1	1	0	7
Kim 2018	0	0	1	1	1	1	1	0	5
Devani 2018	1	1	1	1	1	1	0	0	6
Douahy 2017	1	1	1	1	0	1	0	0	5
Winn 2016	1	0	1	0	1	1	0	0	4
Hassan 2016	1	1	1	1	0	1	0	0	5
Nagata 2016	1	1	1	1	2	1	1	1	9
Niikura 2015	1	1	1	1	1	1	1	0	7
Albeldawi 2014	0	1	1	1	1	1	1	0	6
Navaneethan 2014	1	1	1	1	1	1	1	0	7
Rodríguez-Moranta 2007	1	1	1	1	1	1	0	0	6
Schmulewitz 2003	1	1	1	1	1	1	1	1	8
Stratte 2003	1	1	1	1	1	1	1	1	8

Table 9s. Summary of Evidence for Task Force 2 - Question D									
First author, publication year	**Study objective**	**Participants/setting**	**Intervention**	**Comparisons**	**Outcomes**	**Study Type**	**Results**	**Conclusion**	**Level of evidence**
Gül Utku 2020	To show the efficacy, safety and outcomes of unprepped PEG-flush in acute LGIB	Elderly (>65 y) with severe LGIB, n=33	Sodium phosphate enema before colonoscopy and water jet cleaning with 2L PEG solution during colonoscopy. Within 8 hours after admission.	None	Adequate bowel cleaning, detection of lesions, endoscopic treatment.	Single center, prospective, single arm study	BBPS 7.18 ±0.88, Endoscopic treatment in 87%.	Immediate PEG-flush is safe and effective in acute LGIB in elderly patients	Low
Repaka 2012	Evaluate feasability, safety and outcome of immediate unprepped hydroflush colonoscopy for LGIB	In patients, 12 patients, n=13 procedures	Three 1 liter enemas and direct colonoscopy with "hydroflush" technique (water-jet pump irrigation and a mechanical endoscope suction device)	None	Percentage of colonoscopies with preparation permitting satisfactory evaluation of bleeding source	Prospective, single center, single arm study	Complete colonoscopy in 9/13. Definite bleeding source identified in 5/13	The method is feasible	Low
Ohyama 2000	Evaluate the effectiveness and problems of urgent colonoscopy in acute LGIB	206 patients,	Unprepped colonoscopy	None			Colonoscopy to ileocecum in 35%, prevented in 5,8% judged unnessecary to reach cecum in the rest.		Low
Oakland 2019	BSG guideline						If inpatient colonoscopy is to be performed, then patients should receive bowel preparation to enable adequate mucosal visualisation.		Low

State 2016	ACG guideline						Unprepped sigmoidoscopy/colonoscopy in the setting of LGIB is not recommended.		Low

Table 10s. Summary of Evidence for Task Force 2 - Question C									
First author, publication year	**Study objective**	**Participants/setting**	**Intervention**	**Comparisons**	**Outcomes**	**Study Type**	**Results**	**Conclusion**	**Level of evidence**
Ahktar 2002	Study frequency and aetiology of LGIB in African-American and Hispanic elderly	236 patients	Upper endoscopy, colonoscopy, radiology	None	Bleeding source	Retrospective	9% had an upper bleeding source	9% had an upper bleeding source	Low
Jensen 1988	Evaluate diagnosis and treatment in severe ongoing haematochezia	80 patients	Upper endoscopy, colonoscopy, radiology	None	Bleeding source	Prospective	11% had an upper bleeding source	11% had an upper bleeding source	low
Lain 2010	Determine proportion of patients with severe haematochezia with an upper bleeding source	85 patients	Upper endoscopy within 6h	None	Bleeding source	Prospective	15% had an upper bleeding source	15% had an upper bleeding source	Low
Oakland 2018	Describe patient characteristics, interventions and outcome in LGIB	2528 Patients	Upper endoscopy, colonoscopy, radiology, surgery	None	Bleeding source	Nationwide audit	212/2781=8% had proven/probable/suspected upper bleeding source	8% had upper bleeding source	Low
Strygley 2012	Identify historical features, symptoms, signs, bedside maneuvers and basic laboratory tests results that distinguish UGIB and LGIB,	Structured review				Structured review	serum urea nitrogen/creatinine ration > 30 indicates UGIB	Serum urea nitrogen/creatinine ration > 30 indicates UGIB	Low

Oakland 2019	BSG guideline							An upper endoscopy should be performed immediately if no source is identified by initial CT angiography and if the patient stabilizes after initial resuscitation, gastroscopy may be the first investigation	Low
State 2016	ACG guideline							An upper endoscopy should be performed in patients with haematochezia associated with hemodynamic instability	Low

Table 11s. Summary of Evidence for Task Force 2 - Question E								
Author, publication year, journal	**Country**	**Study Type**	**Study Objective**	**Participants/ Setting**	**Intervention**	**Outcome**	**Results**	**Conclusion - Level of evidence**
Utku et al, 2020, Geriatric gerontology int	Turkey	Single centre prospective case series	Efficacy, safety and outcomes of unprepared PEG-flush retrograde colon cleansing in elderly with LGIB	Elderly patients presenting with haematochezia between 2014-2018	Unprepared retrograde bowel cleansing colonoscopy within 8 hours of presentation, 2L PEG solution was added to the water jet tank, water injection was started from left colon to right up to the cecum.	Adequate colon cleansing, detection of lesions and endoscopic treatment in the colonoscopy	BBPS on insertion was 2.6 and won withdrawal was 7.18. Around 90% has localized source of bleeding, endoscopic intervention was done in 87% of patients.	Immediate uprepped PEG-flush colonoscopy is an effective practice in localizing bleeding sites and conducting endoscopic therapy. 2C. Weak recommendation, low quality evidence.
Niikura et al, 2015, PLOS One	Japan	Retrospective review of 623 patients	To assess the various adverse events and hemodynamic instability during bowel preparation and colonoscopy in emergently hospitalized patients	Hospitalized patients between 2009-2013 who underwent colonoscopy and completed a questionnaire in a prospectively collected database.	PEG solution was given for bower prep in adjunct to enema in case patient did not completely consume the PEG solution	Bowel prep and colonoscopy related AE	Preparation related AE: hypotension (7%) and vomiting (2%). Colonoscopy related AE: hypotension (14%), CVA (1%)	AE in LGIB patients were low and non-significant difference compared to age- and gender-matched control groups. 2C. Weak recommendation, low quality evidence
Soriani et al, 2020, Vid GIE	Italy	Case report	Efficacy of rapid bowel prep on colon cleansing	70 yo male presented with acute LGIB	1 liter hyperosmolar PEG+asc followed by 1L of water, followed by urgent colonoscopy 2 hours after the end of the solution intake	Colon cleansing and endoscopic diagnosis and interventiion	Excellent bowel prep (BBPS 9), Dieulfoy lesion in the cecum was diagnosed and treated	The new 1-L PEG+Asc solution can be considered for rapid BP in acute LGIB patients allowing substantial time reduction in BP

								and earlier endoscopic intervention 2C. Weak recommendation, low quality evidence
Lim et al, 2013, JGH	Korea	Retrospective analysis	diagnostic rates and clinical courses of patients with haematochezia who underwent emergent colonoscopy after either bowel preparation or a simple enema	Medical records of 194 patients who were admitted between 2004-2011 due to haematochezia were retrieved.	Patients were assigned to either enema group or PEG solution group	diagnostic rate, cecal intubation rate, the cause of failure of cecal intubation or repeat CFS, and the rate of colonoscopic haemostasis	Source of bleeding was identified in 88.7% of patients. 64.4% had enema while 35.6% had PEG. Localization of bleeding: PEG group 97.1% (67/69) and 84% (105/125) in the enema group; (P = 0.008). the cecal intubation rates were 45.6% (57 patients) in the enema group and 84.1% (58 patients) in the PEG group; (P < 0.001)	emergent colonoscopy with bowel preparation using PEG is effective in haematochezia patients. Also, emergent colonoscopy after an enema may facilitate identification of the bleeding focus and performance of endoscopic haemostasis in patients with severe haematochezia 2C. Weak recommendation, low quality evidence
Laine et al, 2010, AJG	USA	RCT of urgent vs elective colonoscopy	In patients with acute LGIB, Urgent colonoscopy would improve clinical outcomes, such as further bleeding, when compared with routinely scheduled elective colonoscopy. Pts in urgent arm receive 4L PEG solution	Between 2002-2008, 85 patients admitted with acute LGIB while 72 pts were randomly assigned to urgent vs elective	following negative upper endoscopy, patients were randomly assigned to either urgent (12h) or elective (36-60h) colonoscopy	further bleeding, defined as haematochezia persisting for > 24 h, recurrent haematochezia after initial resolution of haematochezia, heart rate > 100 or systolic BP < 100 mm Hg after	Eighty-five eligible patients had urgent upper endoscopy; 13 (15 %) had an upper source. The remaining 72 were randomized to urgent (N = 36) or elective (N = 36) colonoscopy. Further bleeding occurred in 8 (22 %) vs. 5 (14 %) of the urgent vs. elective groups (difference = 8 % , 95 % confidence interval (CI) = − 9 to 26 %). Units of blood (1.5 vs. 0.7), hospital days (5.2 vs. 4.8), subsequent diagnostic or	Use of urgent colonoscopy in a population hospitalized with serious lower GI bleeding showed no evidence of improving clinical outcomes or lowering costs

						hemodynamic stability for ≥ 1 h, or haemoglobin drop > 2 g/ dl after stable haemoglobin values >3h apart	therapeutic interventions for bleeding (36 % vs. 33 %), Poor colon preparation leading to a second colonoscopy was noted in two (6 %) patients in the urgent group (one additional diagnosis made at second colonoscopy) and three (8 %) patients in the elective group .	as compared with routine elective colonoscopy. No sufficient data from this study about bowel prep.
Green et al, 2005, AJG	USA	RCT of haematochezia pts to urgent vs elective colonoscopy – in the urgent arm pts were given purge BP	urgent colonoscopy would improve early rebleeding	Between 1993-1995, 112 patients were admitted with haematochezia	Patients randomized to urgent colonoscopy underwent colonic preparation with a polyethelyne glycol based purgative (Golytely, Braintree Laboratories, Braintree, MA) administered either orally (25 patients) (one cup every 15 min) or by nasogastric tube (25 patients) (250 mL every 15 min).	primary end point was rebleeding, secondary: duration of hospital and intensive care unit stay, blood transfusion requirements, need for surgery, and mortality	The endoscopic view during urgent and elective colonoscopy was rated (by the previously stated scale) as “excellent” in 36% and 38%, “fair” in 56% and 52%, and “poor” in 8% and 10% of patients (respectively) There was no comparison between the oral vs ng tube instillation of PEG	No significant difference in BP between the two arms

Table 12s. Summary of Evidence for Task Force 2 - Question F									
Author, publication year	**Study Objective**	**Participants/ Setting**	**Intervention**	**Comparisons**	**Outcome**	**Study Type**	**Results**	**Conclusion**	**Quality assessment (for RCTS)***
Setoyama, 2011	Clinical outcomes of endoscopic band ligation vs clips in treatment of colonic diverticular hemorrhage	66 patients from Tokyo 48 – endoclips 18 – EBL	Endoscopic band ligation n=18	Endoscopic clips N=48	Rate of early rebleeding initial success rate for hemostasis, complete eversion or not, complication rate	Retrospective cohort study	Although the initial success rate for hemostasis was 100% without any complications, the rate of early rebleeding was 33% (16 patients), which was significantly higher than the rate for the EBL-treated group (P = 0.018).	EBL is safer, more effective and superior to endoclips	Low
Okamoto, 2019	Compare endoscopic band ligation to endoscopic clipping of the same colonic diverticular haemorrhagic lesion	n=135	n=67 patients treated with EBL	n=68 patients treated with EC	Rebleeding rate a year later	Historical control study	Rebleeding rate was lower in the EBL group (7 of 67, 10%) than in the EC group (21 of 68, 31%; p<0.01)	Low rebleeding rate in the EBL group was attributed to the low degree of rebleeding from the same diverticulum, indicated that EBL was superior to EC in preventing rebleeding	Low-moderate
Ishii, 2018	Evaluate the effectiveness of endoscopic treatment for colonic diverticular bleeding	Sixteen studied (n=384 with CDB)	EBL vs. clipping vs. coagulation		Initial hemostasis, early recurrent bleeding and need for transcatheter arterial embolization or surgery	Systematic review and meta-analysis	Pooled estimates of initial hemostasis were coagulation, 1.00 (95% CI, .91-1.00) (I^2 = .0%); clipping, .99 (95% CI, .97-1.00) (I^2 = .0%); and ligation, .99 (95% CI, .95-1.00) (I^2 = .0%). Pooled estimates of early recurrent bleeding were coagulation, .21(95% CI, .01-.51) (I^2 = 61.2%); clipping, .19 (95% CI, .07-.35) (I^2 = 77.3%); and ligation, .09 (95%	Ligation therapy was more effective compared to clipping to avoid TAE or surgery. Coagulation, clipping and ligation were equivocal in terms of effectiveness for initial hemostasis and preventing early recurrent bleeding	High

							CI, .04-.15) (I^2 = .0%). Pooled estimates of need for TAE or surgery were coagulation, .18 (95% CI, .00-.61) (I^2 = 68.9%); clipping, .08 (95% CI, .03-.16) (I^2 = 36.8%); and ligation, .00 (95% CI, .00-.01) (I^2 = .0%). The proportion of need for TAE or surgery in the ligation group was significantly lower than that in the clipping group (P = .003) and marginally lower than in the coagulation group (P = .086). No significant difference was found between coagulation and clipping groups (P = .44).		
Nakano, 2015	EBL vs. EC in treatment of colonic diverticular hemorrhage	n=100	EBL group n=61	EC group n=39	Cumalative incidence of rebleeding at 1, 12, 24 and 36 months after treatment. Scar formation and late rebleeding. Time-to-event analysis.	Retrospective case series	Rebleeding occurred in 21/61 EBl patient and 26/39 EC patients. Time-to-event analysis revealed statistically significant data (log-rank test, P=.0036).	EBL was superior to EC in the treatment of colonic diverticular hemorrhage but risk of bleeding wasn't avoided even after the diverticula had been resolved using EBL	Low-moderate
Witte, 2000	Describe methods of modifiying multiband ligating devices and application in treatment of colonic bleeding	n=5	5 patients with colorectal hemorrhage treated endoscopically		Successful band ligation	Case series	Band ligation was successful in all 5 patients with follow-up ranging from 2-5 months	EBL seems safe and effective treatment for various types of colorectal hemorrhage	Low

Farrell, 2003	Evaluate the utility of colonoscopic band ligation for control of diverticular bleeding in vivo and ex vivo	In vivo study; n=4			Hospital stays, acute complications, rebleeding, need for surgery	In-vivo and ex-vivo pilot study	No acute complications, no rebleeding and no need for surgery in the 1 year follow up period	Both in-vivo and ex-vivo data suggest that endoscopic band ligation may be safe and effective therapy for actively bleeding colonic diverticula	Low
Marques, 2016	Establish EBL as a safe and effective tresatment for active diverticular bleeding	n=1			Re-bleeding in follow up and complications	Case report	In 3 month follow-up no rebleeding or complications reported	Multiple diverticula in descending and sigmoid colon were treated with EB with no re-bleeding or complcations. EBL is a safe and effective treatment.	Low-moderate
Daisuke, 2015	Explore endoscopic detachable snare ligation as a treatment of diverticular hemorrhage	n=8	8 patients with colonic diverticular hemorrhage		Mean procedure time required for hemostasis, sustained hemostasis, early rebleeding and complications	Retrospective case study	Mean procedure time after diverticulum identification was 5 +/- 2 minutes, sustained hemostasis in 88% of the patients and early rebleeding occurred in 1 patient	EDSL may be a safe and effective treatment for colonic diverticular hemorrhage	Low-moderate
Takahashi, 2016	Report case of delayed perforation after endoscopic band ligation for treatment of colonic diverticular bleeding	n=1				Case report	Case of delayed perforation after EBL treatment in the sigmoid colon	EBL poses a risk of delayed perforation	Low
Sato, 2020	Case report of delayed perforation after endoscopic band ligation for colonic diverticular hemorrhage	n=1				Case report	Patient developed severe abdominal pain which CT revealed intraabdominal free air suggesting delayed perforation after EBL performed in the sigmoid colon	EBL is useful in achieving hemostasis for diverticular hemorrhage in the colon but it carries risk of complications that require surgery	Low
Ikeya, 2015	Clarify the risk factors for early rebleeding after EBL in treatment of colonic diverticular hemorrhage	n=101	Rebleeding n=15	Non-rebleeding group n=86	Early rebleeding	Retrospective cohort study	Early rebleeding happened in 15 cases	Younger age, active bleeding of stigmata of recent hemorrhage and leftsided lesions	Moderate

								were identified as risk factors	
Nagata, 2018	Clarify the recurrent bleeding risk of endoscopic band ligation vs. EC for definitive CBD based on stigmata of recent hemorrhage	n=108	EBL n=61	EC n=47	Probability of 1-year recurrent bleeding, need for surgery or experienced perforation	Prospective study combined and with analysis of previous cohort study	Probability of 1-year recurrent bleeding was 11.5% in EBL vs. 37.0% in EC (p=.018). None needed surgery or experienced perforation	Band ligation for definitive CDB has better outcomes than clipping during long-term follow up after endoscopic therapy.	Low-moderate
Jensen, 2000	Establish role of urgent colonoscopy in diagnosis and treatment of patients with severe hematochezia and diverticulosis	121 inpatient with evidence of diverticulosis on colonoscopy	Patient treated medically and colonoscopic treatment n= 48 (study 2)	Patients treated medically and surgically (hemicolectomy) N=73 (Study 1)	Endoscopic hemostasis, additional bleeding, severe bleeding, complications	2 sequential Prospective studies	Study 1, 17/73 had signs of diverticular hemorrhage Study 2: 10/48 has definitive diverticular hemorrhage Study 2 pt → 100% endoscopic hemostasis (vs. 0%), 0% additional bleed (vs. 53%) and 0% severe bleeding (vs. 35%)	Treat patients presenting with severe hematochatochezia and diverticulosis with colonoscopic treatment such as epinephrine, bipolar coagulation or both which may dec. the need for surgery	Low-moderate
Grassia, 2016	Demonstrate the use of hemostatic powder	n-1	One case of diverticular bleeding		Endoscopic hemostasis	Case report	Hemostasis achieved rapidly with no re-bleeding in 30-day follow-up even with anti-platelet therapy	Hemostatic powder should be considered as a therapy option when clip deployment or band ligation is difficult	Low
Prei, 2016	Evaluate the indication profiles ahd short-term outcome of Endoclot	N=70			Hemostasis achievement and rebleeding	Multi-center prospective observational study	Lower GI bleeding hemostasis occurred in 83% of the cases. Rebleeding occurred in 11%. In 10%, Endoclot served as a bridge to surgery	Endoclot can be used as a monotherapy, or in combination with other techniques from oozing bleeding type or lower.. most effective in diffuse or extensive bleeding activity..	Low
Holster, 2014	Evaluate the outcomes of LGIB patients that are treated with Hemospray	N=9			Initial hemostasis and rebleeding	Retrospective study	All patients achieved initial hemostasis but 2 experienced	Hemospray can be effective in the management of LGIB but suggest	Low

							rebleeding (on anti-thrombotic therapy)	cautious use for patients on antithrombotic therapy and spurting bleeding	
Kaltenbach, 2012	Investigating colonoscopy as a first-line modality to diagnose and manage patients with LGIB. Assess primary hemostasis using endoscopic clipping for diverticular bleeding	n = 64 inpatient			Early and late rebleeding, blood transfusion requirements, hospital stay and complications	Retrospective case series	21% of the patients that had stigmata of recent hemorrhage were successfully treated with endoscopic clips without complication or early rebleeding	Colonoscopy can be a safe first-line diagnostic and therapeutic approach for patients with severe LGIB. Endoscopic clipping provides hemostasis of active diverticular bleeding.	Moderate
Olmos, 2006	Assess long-term outcomes of bleeding patients with colonic angiodysplasia treated by argon plasma coagulation	N=100 patients with GIT bleeding caused by colonic angiodysplasia			Over bleeding, hemoglobin concentration	Cohort study	85% of the patients – resolved overt bleeding and hemoglobin levels were stabilized without transfusions or iorn therapy. Transfusion requirements creased in 90% of the patients.	Endoscopic argon plasma ablation therapy is useful in the management of bleeding from colonic angiodysplasia	Low-moderate
Kwan, 2006	Evaluate the long-term efficacy of APC	n = 100	APC (20-40 W power) and 1.0 L/min gas flow	N/A	Long-term complications, perforation, post-procedure bleeding	Review (series of 100 patients)	No immediate or long-term complications were encountered. In particular, no cases of perforation or clinical postprocedure bleeding occurred. Median hemoglobin levels increase significantly following treatment and transfusion requirements are abolished.	The technique is safe and can be used without undue risk, even in patients with substantial comorbidities. APC should therefore be considered as the first-line endoscopic therapy in the management of gastrointestinal vascular lesions.	Moderate

							(p<.01)		
Suzuki, 2006	Testing new injection-APC method for treatment of colonic angiodysplasia	N = 3 patients with a total of 10 colonic angiodysplasias	Saline adrenaline solution (1:200,000) 2 to 3 mL was injected beneath the angiodysplasia before application of APC. APC 50 W and gas flow 2 L were applied onto the vascular lesion until the sufficient thermal effect was observed.	N/A	Bleeding or perforation during or 14 days after APC application	Case series	No procedure-related complications	New injection-APC method was safe for the treatment of colonic angiodysplasia. This may be useful in treating right-sided colonic lesions where the risks of perforation are greater than for the rest of the colon.	Low-moderate
Ramadani 2018	APC vs. injection therapy with adrenalin and Polidocanol	N=50 patients outpatients with bleeding angiodysplasia of the upper GIT	APC (with a power of 30W and a flow rate of 1-2 L/min) n = 35	Adrenaline solution and a 1.5% solution of polidocanol applied in and around the angiodysplasia lesion n =15	Degree of complications, adverse events	Prospective study	Statistical analysis of the recurrent bleeding after the first treatment disclosed significant differences between the treatment with APC and injection treatment (mann-whitney test p<.01).	APC is more effective treatment option with lower degree of compllications and adverse events in comparison to injection therapy in patients with bleeding AD	Low-moderate
Hookey, 2019	Evaluate the safety and performance of a hemostatic powder (TC-325/hemospray) in the treatment of lower GI bleeding	n=50 patients			Hemostasis and recurrent bleeding within 30 days	Multicenter prospective single-arm study	98% of the patients achieved hemostasis with 5 patients (10%) developed recurrent bleeding within 30 days	Hemostatic powder is effective as monotherapy, part of combination therapy or as rescue therapeutic option for the treatment of nonvariceal lower GI bleeding	Low-moderate

Hrvoje, 2015	Report case of post-polypectomy bleeding controlled by hemospray	n=1			Perforation, symptomatic systemic embolism, or bowel obstruction	Case report	No complications found in the 30-day follow up	Hemospray can be applied as rescue therapy after failue of the primary hemostatic modality	Low
Parra-Blanco, 2000	Evaluate the endoscopic hemoclip in postprocedural colonic bleeding	*n=72*			Endoscopic hemostasis, recurrent bleeding, deaths or need for surgery related to bleeding	Retrospective study	Endoscopic hemostasis was achieved in all the cases of immediate postpolypectomy and postbiopsy bleeding and in all but one with delayed postpolypectomy bleeding.	Early endoscopic management of postprocedural bleeding by hemoclipping provides hemostasis in the majority of cases	Low
J. L. Ng, 2018	Evaluate the efficacy of hemospray in the setting of severe diverticular bleeding	n=10			Achieving hemostasis, reducing re-bleeding and need for re-intervention	Retrospective study	All 10 patients achieved immediate hemostasis without further hemodynamic instability or re-bleeding. No endoscopic, radiological or surgical re-intervention was required	Topical hemostatic powder can offer a safe and effective therapeutic endoscopic option in severe diverticular bleeding with high hemostatic rate	Low
Guo, 2009	Investivate acute nonvariceal bleeding in the upper GI tract and evaluate the effects of endoscopic hjemoclipping	n=68			Permanent hemostasis	Retrospective study	Permanent hemostasis we achieved in 59 cases	Endoscopic hemoclip application is an effective and safe method for acute nonvariceal bleeding in upper GI tract	Very-low
Binmoeller, 1993	Evaluate hemoclip for endoscopic treatment of nonvariceal gastrointestinal bleeding	N=88 (total patients, 24 with colon pstpolypectom y bleeding)			Recurrent bleeding, complications	Uncontrolled study	No sub-group analysis done Recurrent bleeding happened in 5 patients total. No complications	Endoscopic hemoclip placement is highly effective and safe method for treating nonvariceal gastrointestinal bleeding	Low

Bloomfeld, 2001	Evaluate whether urgent colonscopic therapy is effective as acute and long term treatment for diverticular bleeding with stigmata of hemorrhage	n=13 patients that underwent colonoscopic hemostatic management			Rebleeding, surgery needed, complications	Retrospective	5 out of 13 patients experienced early rebleeding within 30 days of the index bleed, 4 needed surgery and 3 patients had late rebleeding, no complications	Endoscopic therapy can provide early hemostasis in some cases of acute diverticular hemorrhage	Low
Green, 2005	Compare urgent colonoscopy to standard care	n=100	N=50 urgent care colonoscopy	N=50 standard care	Mortality, transfusion requirements, early rebleeding, surgery, late rebleeding	RCT	Early rebleeding (22 vs. 30%), surgery (14 vs. 12%) and late rebleeding (16% vs. 14%).	Outcomes not significantly different with regard to important outcome	High

Task Force 3

Table 13s. Summary of Evidence for Task Force 3 - Question A									
Author, publication year	**Study Objective**	**Participants/ Setting**	**Intervention**	**Comparisons**	**Outcome**	**Study Type**	**Results**	**Conclusion**	**Recommendation and Quality**
Kennedy DW, J Vascol Interv Radiol 2010	Diagnostic value of CTA in active GI bleeding.	4 ½ year retrospective series	86 CTA in 74 patients with acuter GI bleeding	Surgery, endoscopy, or pathology	Accuracy of CTA diagnosis	Retrospective case series	22 (26%) positive CTA. Confirmation in 19/22 (86%). Sensitivity 79% Specificity 95% PPV 91% NPV 92%	CT angiography provides valuable information that can be used to determine the appropriateness of catheter angiography if a bleeding source is localized.	Moderate recommendation, low quality evidence
Jacovides CL, JAMA Surg 2015	Role of CTA and scintigraphy prior to arteriography in diagnosing and localizing LGIB	7 year retrospective series	161 patients with LGBI undergoing angiography preceded either by CTA or scintigraphy	CTA vs scintigraphy	Accuracy of CTA and scintigraphy diagnosis	Retrospective case series	Scintigraphy and CTA had similar sensitivity and specificity. Localization of haemorrhage site by CTA was more precise and consistent with angiography findings. CTA reduced the number of imaging studies. Administration of contrast did not worsen renal function	Preceding angiography with a diagnostic study improves localization of the site of LGIB. Increasing the use of CTA may reduce overall imaging studies and increases yield at angiography.	Moderate recommendation, low quality evidence
Ren JZ, World J Gastroenterol 2015	Role of CTA in diagnosing and planning intervention in LGIB	4 year retrospective series	63 patients with LGIB undergoing CTA and then treated by embolization, surgery or conservatively	Angiography or surgery regarded as the gold standard	Accuracy of CTA diagnosis	Retrospective case series	Active bleeding detected in 57/63 (90.5%) Recurrent bleeding in 3/6 patients. The location-based accuracy, sensitivity, specificity, PPV and NPV were 98.8%, 95.0%, 100%, 100%, and 98.5%.	CTA is safe and effective in making decisions regarding treatment in the majority of patients with LGIB.	Moderate recommendation, low quality evidence

Foley PT, J Med Imaging Radiat Oncol 2010	Role of CTA in diagnosing LGIB	30 month retrospective series	20 patients with LGBI undergoing CTA. 10 (9 haemodynamically unstable) were positive at CTA. Of the 10 patients with negative CTA 4 were unstable	Angiography or clinic regarded as the gold standard	Accuracy of CTA diagnosis	Retrospective case series	In the absence of haemodynamic instability CTA has low diagnostic yield and bleeding likely stops spontaneously. In unstable patients, a positive CTA allowed patients to be triaged to surgery or angiography, whereas there was a strong association between a negative CTA and spontaneous cessation of bleeding	CTA is safe and effective in making decisions regarding treatment in the majority of patients with LGIB.	Moderate recommendation, low quality evidence
Nagata N, J Gastroenterol 2015	Role of CT prior to colonoscopy in diagnosing LGIB	Retrospective series	223 patients with LGIB undergoing early colonoscopy. 126 underwent CT within 3 hr from admission.	Patients undergoing CT prior to colonoscopy vs those undergoing directly colonoscopy	Additional value of CT in detecting bleeding lesions	Retrospective case series	Higher detection rate with colonoscopy following (35.7 vs. 20.6 %, p = 0.01), with more endoscopic therapies (34.9 vs. 13.4 %, p=0.01).	Urgent CT before colonoscopy had 15 % additional value for detecting vascular lesion compared to colonoscopy alone and enabled endoscopic therapies.	Moderate recommendation, low quality evidence
Nakatsu S, Intern Med Tokyo Jpn. 2015	Role of CT prior to colonoscopy in diagnosing LGIB	8 year retrospective case series	1604 patients with LGIB undergoing colonoscopy. 55% underwent CT. In 640 cases urgent colonoscopy was performed after CT.	Patients undergoing CT prior to colonoscopy vs those undergoing directly colonoscopy	Additional value of CT in detecting bleeding lesions	Retrospective case series	The rate of detection of bleeding on colonoscopy was higher in case of extravasation on CT than in those without (68% vs. 20%; p<0.001).	Urgent CT is useful for determining timing of colonoscopy as well as the presence and location of active haemorrhage especially in	Moderate recommendation, low quality evidence

								diverticular bleeding.	
Zink SI, Am J Roentgenol. 2008	Role of CTA and scintigraphy prior to arteriography in diagnosing and localizing LGIB	17 month prospective case series	55 patients with LGIB undergoing CT. 41 stable patients received also scintigraphy; 5 unstable went direct to angiography. 18 patients underwent angiography because of bleeding at CT or scintigraphy	Diagnostic accuracy of CT and scintigraphy in detecting active bleeding	Accuracy of CT and scintigraphy diagnosis	Prospective case series	Statistics showed significant disagreement between the two procedures, with simple agreement = 68.3%, κ = 0.341, and p = 0.014. 26.7% CT were positive with all accurately localizing the site of bleeding and identification of the underlying lesion in 8. 46.3% scintigraphy were positive. 18 went on to angiography and only in 4 (22.2%) the site of bleeding was confirmed by angiography.	CT and scintigraphy show significant disagreement for LGIB. CT is effective for detection and localization LGIB in which haemorrhage is active at the time of CT.	Moderate recommendation, high quality evidence
Speir EJ, J Vasc Interv Radiol 2019	Role of CTA and scintigraphy prior to arteriography in diagnosing and localizing LGIB	5 year retrospective case series	223 patients with LGIB undergoing angiography, 38 with previous CTA, 173 with scintigraphy and 12 with both.	Diagnostic accuracy of CT and scintigraphy in detecting active bleeding	Accuracy of CT and scintigraphy diagnosis	Retrospective case series	CTA had a positive correlation of 67.7% (95% CI: 57.0, 76.7) and sensitivity of 85.2% (95% CI: 66.3, 95.8), whereas scintigraphy had a positive correlation of 29.3% (95% CI: 27.7, 31.0) and sensitivity of	CTA has greater positive correlation to angiography than scintigraphy for assessing LGIB in active stable as well as hemodynamically unstable LGIB.	Moderate recommendation, low quality evidence

							94.4% (95% CI: 84.6, 98.8).		
Feuerstein JD, Am J Roentgenol. 2016	Role of CTA and scintigraphy in diagnosing and localizing LGIB	2 year retrospective case series	125 patients with LGIB considered. 45 CTA and 90 scintigraphy were performed.	Diagnostic accuracy of CT and scintigraphy in detecting active bleeding	Accuracy of CT and scintigraphy diagnosis	Retrospective case series	17 (38%) CTA showed active bleeding compared with 34 (38%) scintigraphy (p = 1.000). However, the site of bleeding was accurately localized on 24 (53%) CTA scans and 27 [30%] scintigraphy (p = 0.008).	Both CTA and scintigraphy can be used to identify active bleeding, but the site of bleeding is localized with CTA in a significantly higher proportion of studies.	Moderate recommendation, low quality evidence

Table 14s. Summary of Evidence for Task Force 3 - Question B									
Author, publication year	**Study Objective**	**Participants/ Setting**	**Intervention**	**Comparisons**	**Outcome**	**Study Type**	**Results**	**Conclusion**	**Recommendation and Quality**
Strate 2016 AM J GASTROENTEROL	Management of patients with acute lower gastrointestinal bleeding	Systematic review from 1/1/1968 to 2/3/2015 in Pubmed, Embase and Cochrane library	*Main goals of management of patients with acute overt LGIB*	Few studies compared radiographic interventions to colonoscopy.		Systematic review	1)Retrospective studies suggest the superior diagnostic and therapeutic yield of colonoscopy over radiographic algorithms. 2) super-selective angiographic embolization achieves immediate haemostasis in 40-100% of cases with diverticular bleeding with a rebleeding rate from 0-50%. Bowel ischemia is reported as many as one third of patients, although in recent studies dropped to 1-4%. 3)because angiography relies on active bleeding and has the potential for serious complications it should be reserved for brisk ongoing bleeders.	Radiographic interventions should be considered in patients with high risk clinical features and ongoing bleeding who have a negative upper endoscopy and do not respond adequately to haemodynamic resuscitation efforts, and are therefore unlikely to tolerate bowel preparation and urgent colonoscopy	Strong recommendation, very low quality evidence
Oakland 2019 GUT	British Society of Gastroenterology guidelines for the management of acute LGIB	Systematic review of Medline, Embase, CDSR, Central, Dare, HTA, NHS EED, ClinicalTrials.gov and WHO trial registrey for articels published	In hospital management of adult patients presenting with acute LGIB.			Systematic review		1)Where indicated, catheter angiography with a view to embolization should be performed as soon as possible after a positive CTA to maximize chances of success.	Strong recommendation, low quality evidence

		between 1997 and 2017.						2) in centres with a 24/7 interventional radiology service, this should be available within 60 min for haemodynamically unstable patients.	
Tomonori Aoki 2019 WORLD JOURNAL of GASTROENTEROLOGY	Initial management for acute lower GI bleeding	Literature review	Summary of evidence for initial management of LGIB, and risk stratification of severe LGIB.			review	1)Super selective angiographic embolization achieves immediate haemostasis on 40-100% of diverticular bleeding with occasional rebleeding (15%) 2) disadvantages of angiography and embolization include active bleeding and risk of bowel ischemia (1-4%) and contrast induced nephropathic complications. 3) angiography localizes LGIB source in 24-70% of cases.	This intervention should be reserved for patients with very brisk, ongoing bleeding who do not respond adequately to haemodynamic resuscitation efforts and are unlikely to tolerate bowel preparation and early colonoscopy.	Moderate recommendation, low quality evidence
Werner 2017 UNITED EUROPEAN GASTROENTEROLOGY JOURNAL	Endoscopic and angiographic management of lower GI bleeding	Literature review through Pubmed	*Review of relevant studies focused on the endoscopic and radiological management of lower GI bleeding*			Systematic review	1)TAE is associated with a lower 30 day mortality rate than surgical intervention in high risk group. 2)clinical success rate (cessation of patients symptoms) is 90%, while technical success rate is as high as 100%	1)TAE should be the 1st step in cases of primarily unsuccessful endoscopic treatment (prior to the surgical option). 2)Coils or PVA particles larger than 250 microns are especially suitable in LGIB.	Moderate recommendation, low quality evidence

							3) endoscopic treated patients had a 30-day re-bleeding rate of 11-50%.		
Ray 2017 WORLD Journal of RADIOLOGY	GI haemorrhage with respect to management, endoscopy and interventional radiology	English literature review	*Complementary roles of interventional radiology and therapeutic endoscopy*			English literature review		1)Treatment modality of choice is often based on availability of the services, clinical stability of patients and their presentation. 2) complex patients often require close collaboration between gastroenterologists, radiologists and surgeons.	Moderate recommendation, low quality evidence
Oakland 2017 ENDOSCOPY INTERNATIONAL Open	Determine the diagnostic and therapeutic yields of endoscopy, CTA and angiography for managing LGIB, and their influence on rebleeding, transfusion and hospital stay.	Systematic review of Medline, Pubmed, Embase and central of RCTs and NRSIs between 2000 and end of 2015 in patients hospitalized with LGIB.				Two RCTs and 13 NRSIs were included. None of them included a comparison between endotherapy and embolization, or investigated the timing of CTA or angiography.	1)Two NRSIs showed no difference in diagnostic yields between colonoscopy and CTA. 2)Meta-analysis of NRSIs demonstrated higher diagnostic and therapeutic yields with early colonoscopy. 3)no studies were found that included mesenteric angiography as a first line intervention	1)Limited studies available suggest increase rates of diagnosis and therapy with early colonoscopy. 2)research needs to be done on the clinical outcomes of endoscopic haemostasis compared particularly with mesenteric embolization.	Paucity of high quality evidence
Gralnek 2017 NEJM	Review of formal guidelines (U.S professional societies of gastroenterologists and radiologists), followed by	Recommendations in this article are in general concordant with the US					1)randomized trials are needed to delineate the most effective time of endoscopy, role	If the patient has ongoing bleeding or an inadequate haemodynamic response to fluid	Strong recommendation, low quality evidence

	the reviewers clinical recommendations	professional societies guidelines					of colonoscopy vs radiology as the initial diagnostic method, and the choice among radiographic imaging studies. 2) randomized trials are needed to delineate the efficacy of endoscopic haemostasis1 treatments. 3) efficacy of cone beam CT as an adjunct to selective angiography and embolic agent of choice in endovascular therapy are unclear.	resuscitation and cannot undergo colonoscopy, a recommendation to perform radiographic evaluation, using a multi detector CT angiography and embolization if indicated.	

Table 15s. Summary of Evidence for Task Force 3 - Questions C-D									
Author, publication year	**Study Objective**	**Participants/ Setting**	**Intervention**	**Comparisons**	**Outcome**	**Study Type**	**Results**	**Conclusion**	**Quality assessment (for RCTS)***
Oakland 2017	describe the characteristics of patients with LGIB, the diagnostic and therapeutic interventions used and clinical outcomes	2528 patients admitted with LGIB to 143 hospitals in the UK between 1st September and 30th November 2015, followed up for 28 days prospective observational cohort	none	None - descriptive	Interventions, complications, mortality, hospital re-admission	Prospective cohort study	Six patients received emergency laparotomy for haemorrhage, 1/6 had no pre-operative investigations.	Surgery is rarely the first line investigation and has been superseded by endoscopy and imaging.	Moderate recommendation, low quality evidence
Czymek 2009	outcome for patients with acute bleeding from the lower gastrointestinal tract requiring transfusion and acute surgical care as a function of various risk factors	59 patients who received surgical intervention for LGIB between 1999 and 2007	surgery	None - descriptive	Mortality, post-operative complications	Case series	Mortality in this group was 15.3%, predicted by massive RBC transfusion, Hb <80, pre-operative ventilation and post-operative complications needing re-operation	Mortality is significant in this group	Moderate recommendation, low quality evidence
Jensen 2000	Evaluate the use of colonoscopy performed on an urgent basis for the diagnosis and treatment of patients with severe diverticular haemorrhage.	17 patients with haematochezia and diverticulosis who between 1986 and 1992 received diagnostic colonoscopy, RBC transfusion and if developed severe bleeding (>= 3 units RBC, plus further resuscitation needed) underwent hemicolectomy 10 patients with haematochezia and diverticulosis who between 1994 and 1998 received therapeutic colonoscopy two centres in the US.	Therapeutic colonoscopy	'medical and surgical' treatment	Re-bleeding (required no more than 2 units RBC), severe bleeding (>=3 units RBC), surgery, LOS, complications	Prospective cohort	Significantly more patients experienced re-bleeding, severe bleeding and required hemicolectomy in the 'medical and surgical' group. Patients in the therapeutic colonoscopy group had a shorter LOS (2 days versus 5).	Significant limitations: historical control and old study (several treatments now superseded), provides uncommon prospective data on this comparison, suggesting that endoscopic haemostasis is superior	Moderate recommendation, intermediate quality evidence
Parvanescu 2018	to investigate the clinical features of complicated Meckel's in	Retrospective review of 37 adults who underwent surgical resection of a complicated Meckel's diverticulum in two	surgery	none	Diagnostic yield of CT, death, post-operative complications	Retrospective case series	11 presented with LGI bleeding and were significantly younger than those who presented with Meckel's diverticulitis or obstruction (< 40 years).	Small case series Meckel's may represent a distinct subgroup of LGIB which may not be	Moderate recommendation, low quality evidence

	adults to guide general surgeons and improve early diagnosis	centres in France between 2001 and 2017.					The preoperative diagnosis of MD was determined in 15 of 37 patients (40%). However, none of the patients in the “GI bleeding” group were correctly diagnosed by CT. All patients underwent surgery successfully. A remission of the symptoms was achieved in all cases. Postoperative complications were as follows: 1 death by cardiac failure in a 92-year-old patient; and 2 postoperative wound infections.	optimally diagnosed using CT or colonoscopy Surgery is an effective treatment, but some patients will experience complications.	
Pannatier 2019	to evaluate which criteria determine or influence the initial management of patients with active LGIB detected by CTA	Single centre, retrospective identified from an administrative database between Jan 2004 and June 2017 88 cases in total Only patients with active LGIB that were initially treated with IR or surgery, were included. Patients with different emergency management of their LGIB, such as endoscopy or conservative treatment, were excluded	surgery	IR	RBC transfusion, re-bleeding, final diagnosis, death, LOS	Retrospective cohort	The length of hospital stay was not different between the two groups ($p = 0.136$), 18 days (range 6–45) for surgical cases and 11 days (range 6–102) for cases managed with IR.	Not powered and inadequate methodology to accurate compare infrequent outcomes (re-bleeding and morality)	Moderate recommendation, low quality evidence

Task Force 4

Table 16s. Summary of Evidence for Task Force 4 - Question A-I						
Risk of thromboembolism, recurrent GI bleeding and death after anticoagulation therapy interruption for GIB						
Author (year).	**Study type**	**Study population** **Intervention**	**Key outcomes**	**Key results**	**Limitations**	**Conclusions**
Witt D (2012)	Retrospective, cohort study	442 patients with warfarin-associated GI bleeding *Intervention* 182 (41.2%) withhold warfarin (no-warfarin group) 260 (58.8%) resumed warfarin (warfarin group)	Thromboembolic events Recurrent GI bleeding Death	*90-day thromboembolic event rate*: 0.4% (1/260) in warfarin group 5.5% (10/182) in no-warfarin group HR (95% CI): 0.05 (0.001-0.58) No thromboembolic events in patients who resumed therapy within 14 days *90-day recurrent GI bleeding rate*: 10% (26/260) in warfarin group 5.5% (10/182) in no-warfarin group HR (95% CI): 1.32 (0.50-3.57) Higher risk of recurrent GI bleeding in patients who resumed warfarin within 7 days from index bleeding as compared with those who resumed warfarin later (12.4%vs. 6.2%, p=0.03) *90-day mortality rate*: 5.8% (15/260) in warfarin group 20.3% (37/182) in no-warfarin group HR (95% CI): 0.31 (0.15-0.62)	Retrospective study Data from administrative databases Selection bias (greater co-morbidity burdens in no-warfarin group, which may have contributed to their worse outcomes) Detection and survivorship biases	The decision to not resume warfarin therapy in the 90 days following a GI bleeding event is associated with increased risk for thrombosis and death. Resuming warfarin within 7 days is associated with a two-fold higher risk of rebleeding
Quereshi W, (2014)	Retrospective, cohort study	1329 atrial fibrillation patients with warfarin associated major GI bleeding *Intervention* 676 (50.9%) withhold warfarin (no-warfarin group) 653 (49.1%) resumed warfarin (warfarin group) Time duration of interruption: 62 patients < 7 days 162 patients between 7-30 days 429 patients > 30 days	Thromboembolic events Recurrent GI bleeding Death	*Adjusted HR (95% CI) for warfarin group vs. no-warfarin group:* Thromboembolism: 0.71 (0,54-0.93) Recurrent GI bleeding; 1.20 (0.78-1.86) Mortality: 0.72 (0.60-0.86) Incidence of adverse outcomes per 100 person-years in the warfarin group, stratified by the time of duration of warfarin interruption: < 7 days (n=62): -thromboembolism 11.6 (8.3-16.2) -recurrent GI bleeding 19.3 (14.6-25.5) 7-15 days (n=51): -thromboembolism 12.0 (8.2-17.5) -recurrent GI bleeding 10.8 (7.2-16.3) 15-21 days (n=58) : -thromboembolism 18.1 (13.4-24.5)	Retrospective study Data from administrative database Selection bias (greater co-morbidity burdens in no-warfarin group) Detection and survivorship biases	The decision not to resume warfarin therapy after a GI bleeding event is associated with increased risk for thrombosis and death. There is a trend toward reduced incidence of thromboembolic events the earlier the warfarin is introduced; this trend is more evident within the first 15 days Resuming warfarin within 7 days is associated with a two-fold higher risk of rebleeding

				-recurrent GI bleeding 10.9 (7.2-16.4) 21-30 days (n=53): -thromboembolism 20.7 (15.5-27.7) -recurrent GI bleeding 9.9 (6.3-15.5) >30 days (N=429): -thromboembolism 20.4 (17.8-23.5) -recurrent GI bleeding 9.9 (8.0-12.3)		Decision to restart warfarin within 7 and 30 days of interruption is associated with improved survival and decreased thromboembolism without increased risk of recurrent GI bleeding
Sengupta N (2015)	Prospective, observational cohort study	197 patients who developed GI bleeding on systemic anticoagulation [warfarin (n=145), DOAC (n=33), enoxaparin (n=15), unfractioned heparin (n=12)]	Thromboembolic events and recurrent GI bleeding at 90-day follow-up	Patients with thromboembolic event during the 90-day follow-up: 7 (4%) Patients with readmission fo recurrent bleeding during the 90-day follow-up: 77 (14%) At multivariate regression analysis, anticoagulation continuation was independently associated with a lower risk of thromboembolic events within 90 daus (HR 0.12, 95%CI 0.006-0.81) an an higher, but not significantly, risk of rebleeding (HR 2.17, 95%CI 0.96-6.67)	Residual confounders by indication cannot be excluded (more fragile patients more likely had anticoagulation withheld)	It is recommended to resume anticoagulation within 20 days from the cessation to prevent thromboembolic events.
StaerK L, (2015)	Retrospective analysis of medical claims data	Danish cohort study of AF patients (n=4602) discharged from hospital after GI bleeding while receiving antithrombotic treatment	Thromboembolic events Recurrent GI bleeding Death	Outcomes within two years: 3678 (82.9%) restarted anticoagulation - 725 oral anticoagulant - 1314 APA - 384 oral anticoagulant + APA - 51 DAPT - 11 oral anticoagulant + DAPT 1745 (39.9%) patients died 526 (12.0%) thromboembolism 546(12.1%) recurrent GI bleeding. Compared with non-resumption of treatment: reduced risk of all cause mortality for restaring oral anticoagulation (HR 0.39, 95% CI 0.34- 0.46), an APA (0.76, 0.68 -0.86), and oral anticoagulation plus APA (0.41, 0.32 -0.52) reduced risk of thromboembolism for restarting oral anticoagulation (HR 0.41, 95% CI 0.31-0.54), APA (0.76, 0.61-	Patient compliance to treatment not assessed (potential overestimation of the events in patients restarting antithrombotics)	Among patients with atrial fibrillation who experience gastrointestinal bleeding while receiving antithrombotic treatment; subsequent restart of oral anticoagulation alone was associated with better outcomes for all-cause mortality and thromboembolism compared with patients who did not resume treatment. This was despite an increased longitudinal associated risk of bleeding.

				0.95), and oral anticoagulation plus APA (0.54, 0.36 to 0.82). not significant difference in risk of recurrent GI bleeding for restarting oral anticoagulation (HR 1.26, 95%CI 0.85-1.87), APA (1.09, 0.73-1.64), and oral anticoagulation plus APA (1.30, 0.74-2.29),		
Chai Adisakasopha C, (2017)	Meta-analysis	3 observational studies 1859 patients with warfarin-associated GI bleeding		Thromboembolic events: - warfarin resumption group: 96/970 (9.9%) - warfarin interruption group: 146/889 (16.4%) Resumption of warfarin associated with: risk of thromboembolism: HR 0.68, 95%CI 0.52- 0.88 risk of rebleeding: HR 1.20, 95%CI 0.97- 1.48 mortality; HR 0.76, 95%CI 0.66- 0.88	Only 3 observational studies with potential biases regarding the selection of patients that did and did not Definitions of GI bleeding differed among the studies	Resumption of warfarin following interruption due to GI bleeding is associated with a reduction in thromboembolic events and mortality without a statistically significant increase in recurrent GI bleeding.
Sengupta N (2018)	Retrospective analysis of medical claims data	Data from the 1338 treated with DOACs and hospitalized for GIB (Jan 2010-Dec 2014; Truven Health Marketscan Commercial Claims and Encounters Database)	Thromboembolic events Recurrent GI bleeding (within 90 days)	247 (18%) and 586 (44%) restarted DOAC within 30 days and within 6 months, respectively (mean time resumption 40days, IQR 17-88) Restarting DOAC therapy within 30 days: Risk of thromboembolis: HR, 0.98; 95% CI, 0.37–2.21 Risk of rebleeding: HR, 1.44; 95% CI 0.72–2.68 At multivariate analysis: Prior venous thromboembolism associated with thromboembolism (HR 3.30. 95%CI 1.29-7.38) Thyenopiridine use associetaed with recurrent bleeding (HR 3.12, 95%CI 1.55-5.81)		Resuming DOAC therapy within 30 days was not associated with thromboembolism within 90 days or rebleedign A history of venous thromboembolism and thienopyridine use were associated with a risk of subsequent thromboembolism and GIB, respectively.
Little D, (2019)	Meta-analysis	12 observational studies (3 prospective, 9 retrospective) 3098 patients (VKA=2962; DOACs =72) with anticoagulation-associated GI	Thromboembolic events Recurrent GI bleeding Death	Thromboembolic events: - AC resumption group: 103/1387 (7.6%) - AC interruption group: 178/1157 (15.4%)	Eleven studies were judged to be at serious risk of bias due to confounding	Net clinical benefit favours resuming OAC with a reduced risk of thromboembolism and death, despite an increase in GI bleeding

		bleeding (*updating of previous metanalysis-Chai Adisakasopha*)		Resumption of AC associated with: risk of thromboembolism: HR 0.30, 95%CI 0.13- 0.68 (10 studies)risk of rebleeding: RR 1.91, 95%CI 1.47-2.48, (11 studies) risk of mortality: RR 0.51, 95% CI 0.38-0.70 (8 studies)	Heterogeneity in the pooled estimates for thromboembolism and mortality	
Tapaskar N, (2020)	Meta-analysis	12 studies 4376 patients	Thromboembolic events Recurrent GI bleeding Death	2080 patients resumed 2296 patients discontinued anticoagulation post-index GIB In patients who restarted anticoagulation: Risk of thromboembolism: OR 0.34, 95%CI 0.18-0.65 Risk of rebleeding: OR 1.64, 95%CI 1.03-2.61 Risk of death: OR 0.49, 95% CI 0.41-0.59	Studies with serious risk of bias due to confounding	Resumption of anticoagulation following index GIB is associated with a significant increase in recurrent GIB, but is also associated with a significant decrease in thromboembolic events and all-cause mortality.

HR, hazard ratio; CI, Confidence Interval; MI, myocardial infarction: DOAC, direct oral anticoagulants; VKA, vitamin K antagonist; AC, anticoagulation; APA antiplatelet agent; DAPT, dual antiplatelet agent

Table 17s. Summary of Evidence for Task Force 4 - Question P-X						
Risk of recurrent GIB, cardiovascular and thromboembolic events and death associated with the management of antithrombotic therapy						
Author (year).	**Study type**	**Study population/ Intervention**	**Key outcomes**	**Key results**	**Limitations**	**Conclusions**
Chan FKL (2016)	Retrospective, Single centre cohort study	295 patients hospitalized for GIB on aspirin Outcomes assessed over a 5-year follow-up in according to the cumulative duration of aspirin use: - 21 *non users* (aspirin use in less 20% observation period) -174 *users* (aspirin use in >50% observation period)	Recurrent GI bleeding Serious cardiovascular event Death from other causes	*Cumulative incidence within 5-year follow up of LGIB:* 18.9% in aspirin users 6.9% in non-aspirin users (p=0.07) *Cumulative incidence within 5-year follow up of serious cardiovascular events:* 22.8% in aspirin users 36.5% in non-aspirin users (p=0.017) *Cumulative incidence within 5-year follow up of death from other causes:* 8.2% in aspirin users 26.7% in non-aspirin users (p<0.001) Multivariate analysis: *Independent predictors of recurrent bleeding:* Aspirin: HR (95% CI): 2.76 (1.26-6.07) *Independent predictors of cardiovascular events:* Aspirin: HR (95% CI): 0.59 (0.37-0.91) Comorbidity > *2:* HR (95% CI): 1.99 (1.23-3.23) *Independent predictors of cardiovascular events:* Aspirin: HR (95% CI): 0.33 (0.17-0.63) Old age: HR (95% CI): 1.06 (1.02-1.10)	Retrospective study Channelling bias (clinicians tend to discontinue aspirin in patients who are older and sicker) Drug exposure assessed on prescription pattern rather than compliance Concomitant use of other antiplatelet agent or anticoagulants not assessed	Patients who continued aspirin had an almost 3-fold increased risk of recurrent LGIB requiring hospitalization compared with patients who discontinued aspirin However, continuing n of aspirin was associated with 1.6 fold reduced risk of serious cardiovascular events and >3-fold reduced risk of dying from other conditions
Oakland K, (2019)	Retrospective analysis of prospective data of a multicentre cohort study	2528 patients hospitalized with LGIB: - 1128 unexposed *(reference group)* - 504 single APA users (74.6% withheld during admission - 36.4% for < 5 days) - 79 DAPT users (73.4% at least one agent withheld) - 102 DOAC users (90.2% stopped during admission) - 232 warfarin users (90.5% stopped during admission)	In-hospital rebleeding In-hospital death	I*n-hospital rebleeding/mortality rates:* - Unexposed: 12.8%; 2.1% - Single APA users: 20.1%; 2.4% - DAPT users: 30.3%; 7.7% - DOAC users: 14.1%; 2.9% - Warfarin users: 15.1%; 3.6% *Independent predictors of in-hospital rebleeding:* - Dual antplatelet: HR (95% CI): 5.38 (1.56-18.54) - Single antiplatet : HR (95% CI): 3.57 (1.13-11.28) *Independent predictors of mortality or re-admission for recurrent bleeding:* none *Rebleeding rate in patients on single antiplatelet agent:*	Channelling bias (clinicians tend to discontinue aspirin in patients who are older and frailer) Many missing data as concerns the analysis of outcomes of patients receiving single antiplatelet agent according of length of interruption Lack of statistical power to evaluate explore the association between	In patients with LGIB, patients taking a single antiplatelet agent and DAPT had a 3-fold and 5-fold increased risk of in-hospital rebleeding. However, this did not translate in higher mortality. Anticoagulants increased neither in-hospital rebleeding nor mortality. When rebleeding did occur, most events occurred within 5 days of the index event. No difference was found if

				Continued (n=111): 10.2% Stopped <5 days (n=140): 10.5% Stopped ≥5 days (n=134): 29.0%	a short interruption and cardiovascular adverse events	the antiplatelet withheld for < 5 days, versus continuing it
Sostres C, (2019)	Retrospective observational Two-centres cohort study	871patients using antiplatelet or anticoagulant agent who were admitted for GI bleeding (407 with LGIB): - 38.9% anticoagulant -52.5% antiplatelet agent -8.6 anticoagulant+ antiplatelet agent At the time of admission, 93.% interrupted treatment and 80.5% of them restarted therapy within a median of 7.6 ±6.2 days (median 6 days)	Recurrent bleeding, ischemic events, death Mean follow-up = 24.9 months	*In the overall cohort of bleeding patients (n=416) on antiplatelet therapy*: Ischemic event: aHR (95%CI): 0.793 (0.462-1.363) Recurrent GI bleeding aHR (95%CI): 1.449 (0.816-2.572) Death: aHR (95%CI): 0.636 (0.422-0.959) *In patients with LGIB (n=192) and antiplatelet therapy:* Ischemic event: aHR (95%CI): 0.454 (0.197-1.046) Recurrent GI bleeding aHR (95%CI): 1.593 (0.625-4.056) Death: aHR (95%CI): 0.439 (0.227-0.849) *HR for resuming therapy <7 days vs. >7 days in the total cohort (n=653):* Rebleeding: aHR (95%CI): 1.383 (1.001-1.910) Ischemic events: aHR (95%CI): 0.718 (0.487-1.910) Death: aHR (95%CI): 0.998 (0.719-1.384)	Retrospective data Missing data on timing on resumption	When the analysis is restricted to LGIB in patients on antiplatelet agent, resumption of antiplatelet therapy was associated with a lower risk of death without increasing the risk of recurrent bleeding Resumption of therapy ≤ 7 days after bleeding slightly increased the risk of bleeding
Patel P, (2015)	Retrospective observational Single centre cohort study	716 hospitalized patients with LGIB and associated coronary artery disease (CAD): - 472 aspirin - 179 DAPT - 65 DAPT plus anticoagulant	90-day and 6-month mortality	*Independent predictors of 90-day mortality:* DAPT + anticoagulation: HR (95% CI): 3.23 (1.56-6.16) Charlson Comorbidity Index: HR (95% CI): 1.17 (1.06-1.28) ICU requirement: HR (95% CI): 1.88 (1.05-3.34) *Independent predictors of 6-month mortality:* DAPT + anticoagulation: HR (95% CI): 2.57 (1.33-4.62) Charlson Comorbidity Index: HR (95% CI): 1.14 (1.04-1.25)	The association between triple therapy and mortality may be confounded by indication, as population may be sicker and thus at higher risk for adverse events	The use of triple therapy is associated with increased 90-day and 6-month increased mortality risk for patients hospitalized for LGIB and CAD. This mortality effect may be driven by discontinuation of anticoagulation on discharge

HR, hazard ratio; CI, Confidence Interval; DOAC, direct oral anticoagulants; VKA, APA antiplatelet agent; DAPT, dual antiplatelet agent; CAD, coronary artery disease