Surg Endosc
DOI 10.1007/s00464-010-1458-3

Double-guidewire-assisted biliary cannulation: experiences from a single tertiary referral center

Juha M. Grönroos · Hanna Vihervaara · Risto Gullichsen · Simo Laine · Jukka Karvonen · Paulina Salminen

Received: 10 June 2010 / Accepted: 28 September 2010

Abstract
Background Even in experienced hands, a common problem with endoscopic retrograde cholangiopancreatography (ERCP) is difficulty reaching a deep biliary cannulation. The most recent alternative method for difficult biliary cannulation is the double-guidewire technique. The current prospective study aimed to clarify the feasibility and safety of the double-guidewire-assisted biliary cannulation at the authors' institution.
Methods All consecutive patients ($n = 284$) admitted for biliary ERCP during 2009 who had unhindered access to a native papilla were included in the study. The application and success rates of the double-guidewire method for deep biliary cannulation and the complications of ERCP procedures using the double-guidewire technique were determined. The overall success rate for biliary cannulation in these cases also was determined, and the times from the first touch to the papilla to deep biliary cannulation and for the entire ERCP procedure were recorded.
Results The double-guidewire-assisted cannulation technique was applied in 18% (50/284) of ERCPs with a success rate of 66% (33/50). In these 50 cases, the overall success rate for biliary cannulation was 98% (49/50). The median cannulation time was 8 min, and the median duration of the entire ERCP procedure was 20 min. The rate of post-ERCP pancreatitis was 2% (1/50).
Conclusions The double-guidewire technique is a feasible and safe method for difficult biliary cannulation with low rate of post-ERCP pancreatitis. However, it seems important to proceed to alternative cannulation techniques if the double-guidewire technique appears troublesome.

Keywords Bile duct · Cannulation · Double guidewire · ERCP · Pancreatic duct

Despite advances in equipment and expertise, endoscopic retrograde cholangiopancreatography (ERCP) procedures still are occasionally challenging even for an experienced ERCP endoscopist. The most common problem during ERCP is difficulty reaching a selective cannulation of the common bile duct.

For difficult biliary cannulation, a variety of alternative endoscopic techniques have been developed to achieve deep cannulation when standard cannulation maneuvers with guidewire or cannula prove unsuccessful. The precut papillotomy [1] and its modifications such as needleknife fistulotomy are of utmost clinical importance in difficult cases.

The most recent alternative method in difficult biliary cannulation is the double-guidewire technique (i.e., the use of an additional pancreatic guidewire to occupy the pancreatic duct physically and straighten both ducts, facilitating difficult biliary cannulation). Since its first description [2], the adoption of this technique has improved the success rate of biliary cannulation for cases in which the guidewire passes repeatedly into the pancreatic duct. The literature contains some case reports [2, 3], some case series [4–6], and two prospective randomized trials [7, 8] on the role of the double-guidewire technique in difficult biliary cannulation.

Double-guidewire-assisted biliary cannulation was a highlight of the 15th United European Gastroenterology Week in Paris, France, in 2007. After that meeting, we

J. M. Grönroos (✉) · H. Vihervaara · R. Gullichsen · S. Laine · J. Karvonen · P. Salminen
Departments of Surgery and Emergency, University of Turku, PO Box 52, 20521 Turku, Finland
e-mail: juha.gronroos@tyks.fi

Published online: 07 December 2010

adopted this technique into clinical use at our institution. In this report, we describe our experience with double-guidewire-assisted biliary cannulation.

Patients and methods

A total of 452 patients were admitted to Turku University Hospital for ERCP during 2009. Our hospital, an 850-bed tertiary referral teaching hospital serving one-tenth of all Finns, is the only hospital in this area with ERCP facilities. All the ERCP procedures were performed (or supervised; one younger surgeon was receiving ERCP training) by four surgeons with substantial ERCP experience. After an overnight fast, the patients were positioned on their left side for the procedure. Premedication, given 1 h before ERCP, included pethidine (50 mg administered subcutaneously [SC]), atropine (0.6 mg SC), and cefuroxime (1.5 g administered intravenously [IV]).

The ERCP procedures were performed with the patient under conscious sedation using midatzolam (IV) and fentanyl (IV). During the procedure, additional oxygen was given to patients. Heart rate, blood pressure, and oxygen saturation were documented.

After exclusion of the patients whose papilla could not be reached due to duodenal stricture or previous surgery, those with intended pancreatic duct cannulation, and those with previous procedures on the papilla, the study group consisted of 284 consecutive patients (151 females and 133 males) with unhindered access to a native papilla admitted for biliary ERCP. The mean age of the patients was 65 years (range, 13–95 years).

The primary methods for biliary cannulation at our institution are the conventional methods, usually with the guidewire loaded into the cannula and infrequently with the cannula alone. If these conventional cannulation methods fail and the guidewire or the cannula passes into the pancreatic duct more than once, we use the double-guidewire method. If even the double-guidewire-assisted cannulation fails in terms of biliary cannulation, we may try again with the conventional guidewire method or, as usual, proceed to the needleknife-assisted cannulation, which in our hands means a fistula through the neck of the papilla [9].

The main outcome measurements were the application and success rates of the double-guidewire method for deep biliary cannulation and the complications of ERCP procedures in which the double-guidewire technique was used. The overall success rate for biliary cannulation in these difficult cases also was determined, and the time from the first touch to the papilla to successful deep biliary cannulation together with the findings, procedures performed, and the duration of the entire ERCP procedure were recorded prospectively in a database (Microsoft Excel file) created for ERCP procedures in our endoscopy unit. The current study was approved by our hospital's committee on clinical research.

Complications associated to ERCP procedures were defined using standard criteria [10–12]. Briefly, post-ERCP pancreatitis (PEP) was defined as the presence of new or worsened abdominal pain associated with a threefold or greater increase in plasma amylase activity above the upper limit of the reference interval.

The severity of PEP was graded according to the length of the hospital stay as mild (2–3 days of hospitalization), moderate (4–10 days of hospitalization), or severe (>10 days of hospitalization). Bleeding was classified as immediate or delayed, and the need for endoscopic injection therapy and blood transfusions was recorded. Cholangitis was defined by a typical clinical picture including fever, upper abdominal pain, and increased levels of serum bilirubin and C-reactive protein. Early mortality (defined as death within 30 days of ERCP) was recorded, and in case of death, the relationship of the death to the procedure was determined.

Results

The application and success rates of the double-guidewire technique for deep biliary cannulation and the overall success rate for deep biliary cannulation in the aforementioned cases are presented in Table 1. The double-guidewire-assisted method for biliary cannulation was applied for 18% ($n = 50$; 31 females and 19 males) of all biliary ERCP attempts with unhindered access to a native papilla ($n = 284$; 151 females and 133 males).

The double-guidewire technique proved to be successful for 33 (66%) of the 50 patients. As for the 17 patients (34%) with failed double-guidewire cannulation, the conventional guidewire method was attempted once more in four cases, with a successful result for all of them. For the remaining 13 cases, we proceeded to needleknife fistulotomy. For 12 of these 13 patients, the needleknife fistulotomy proved successful. Thus, after alternative techniques, deep biliary cannulation could be achieved for 49 of the 50

Table 1 Application and success rates of the double-guidewire technique for deep biliary cannulation and the overall success rate for deep biliary cannulation in these cases

	% (*n*)
Application rate for the double-guidewire technique	18 (50/284)
Success rate for the double-guidewire technique	66 (33/50)
Overall success rate for these patients	98 (49/50)

patients, giving the overall success rate of 98% for deep biliary cannulation in these difficult cases.

In the case that met failure, needleknife-induced hemorrhage was encountered. Although the bleeding ceased shortly without any endoscopic interventions, a decision was made to discontinue the procedure. In a repeat ERCP later, a conventional guidewire cannulation method was successful. Thus, all the papillas with a double-guidewire cannulation attempt could be eventually cannulated.

The cannulation times and duration of the entire ERCP procedure, the findings, the number of diagnostic and therapeutic procedures, and the complications experienced by patients with an attempted double-guidewire-assisted biliary ERCP are shown in Table 2. In addition to the minor needleknife-induced bleeding and the PEP of moderate severity after successful double-guidewire cannulation, no other complications were encountered.

Discussion

Most often, the success rate for cannulation in ERCP is not satisfactory at the overall national level. For example, the recent large-scale prospective survey of ERCP practice in the United Kingdom showed achievement of overall deep biliary cannulation for only 2,684 (84%) of 3,210 patients undergoing their first ever ERCP [13]. This is not the case in expert centers with high volumes. For example, in the survey by Fukatsu et al. [14], the total success rate for biliary cannulation was as high as 99% (497 of 501 patients).

Table 2 Cannulation time and duration of the entire endoscopic retrograde cholangiopancreatography (ERCP) procedure as well as the findings, number of diagnostic and therapeutic procedures, and complications in 50 patients with an attempt at double-guidewire-assisted biliary ERCP

Median cannulation time: min (range)	8 (1–31)
Median duration of the entire procedure: min (range)	23 (11–60)
Findings: *n* (%)	
Bile duct stones	17 (34)
Bile duct stricture	11 (22)
Bile duct dilation only	5 (10)
Others	16 (32)
Failure	1 (2)
Nature: *n* (%)	
Diagnostic	5 (10)
Therapeutic	44 (90)
Complications: *n* (%)	
Bleeding	1 (2)
Post-ERCP pancreatitis	1 (2)
Others	0
Mortality	0

Recently, we described our indications, techniques, and results for 1,703 consecutive first-time ERCPs [9]. The overall success rate for bile duct cannulation was 97% in our records. The aforementioned figures emphasize that although every cannulation may be challenging and the results are not satisfactory at the national level, high rates of success for biliary cannulation can be reached in high-volume centers due to routine practice of alternative cannulation methods in difficult cases.

Thus, when selective biliary cannulation cannot be achieved using standard cannulation methods, alternative methods such as double-guidewire and various precutting techniques should be used. In expert hands, deep access to the bile ducts usually can be achieved. Furthermore, if all the endoscopic cannulation techniques prove unsuccessful with patients for whom endoscopic diagnosis and therapy are crucial, a rendezvous procedure definitely should be considered [15].

The current series of 50 patients treated with the double-guidewire technique is one of the largest presented to date in the literature [2–8]. The original reports describing the method were case reports by Dumonceau et al. [2] and Gotoh et al. [3] based on 1 patient only. Next, followed case series by Gyökeres et al. [4] (24 patients), Draganov et al. [5] (12 patients), and Ito et al. [6] (113 patients). In these case series, the success rates for biliary cannulation were relatively high (83% [5] and 73% [6]; no rates are reported in Ref. [4]).

These high success rates, most obviously involving multiple cannulation attempts, may be associated with a relatively high rate of PEP reported in two of these studies (8% [4] and 12% [6]). No PEPs were encountered in the small study (12 patients) of Draganov et al. [5].

In the current series, with its success rate of 66% for the double-guidewire technique for biliary cannulation, the rate for PEP remained as low as 2%. The overall success rate for difficult biliary cannulation was, however, eventually as high as 98% in the current series. Therefore, we find that to keep the PEP rate as low as possible and the overall cannulation rate still as high as possible, it is important to proceed to alternative cannulation techniques if the double-guidewire technique appears troublesome. Prophylactic pancreatic stenting is reported to decrease the risk for PEP after double-guidewire cannulation [6]. No pancreatic stents were inserted in our series.

As for the two published prospective randomized trials on the role of the double-guidewire cannulation [7, 8], both were designed to compare the performance of the double-guidewire technique with standard cannulation techniques. In the single-center pilot trial of Maeda et al. [7], the success rate for the double-guidewire technique (27

patients) was significantly higher than that for the conventional technique (93% vs 58%), and no PEP occurred in this pilot study.

In contrast, de Tejada et al. [8] concluded in their multicenter trial (97 patients) that the double-guidewire technique was not superior to standard cannulation technique (success rates of 47% and 56%, respectively) and might be associated with a higher risk for PEP (17% and 8%, respectively). In their multicenter study from six centers, with a mean of only 16 patients in each during the 2-year study period, the success rate for the double-guidewire-assisted cannulation was rather low (47%), but the rate for PEP still was surprisingly high (17%).

The former results suggest that too many low-volume centers were participating because a high success rate for biliary cannulation with a low complication rate can be reached only in high-volume centers that use alternative cannulation methods routinely in difficult cases. Also, the median cannulation time was 16 min in the former multicenter study [8], clearly longer than in the current study (8 min). All these results support the policy of centralizing ERCP procedures in high-volume centers.

The limitation of the current study is that it was not a randomized study comparing the double-guidewire-assisted cannulation method with the other cannulation techniques. Instead, it was a thorough and accurate prospective data collection of consecutive biliary ERCP procedures at our experienced tertiary referral center during 1 year.

The strong element of the current study was the relatively large number of double-guidewire cannulations performed by very experienced ERCP endoscopists in a single relatively high-volume tertiary referral center, minimizing the impact of variable expertise and case volumes that can play a role in multicenter studies. We conclude that in expert hands, the double-guidewire technique is a feasible and safe method in difficult biliary cannulation with a low rate of PEP. To increase the success rate of biliary ERCP procedures, ERCP endoscopists, particularly those who prefer noninvasive cannulation methods to precutting techniques, should be aware of the double-guidewire-assisted cannulation method.

Disclosures Juha M. Grönroos, Hanna Vihervaara, Risto Gullichsen, Simo Laine, Jukka Karvonen, and Paulina Salminen have no conflicts of interest or financial ties to disclose.

References

1. Siegel JH (1980) Precut papillotomy: a method to improve success of ERCP and papillotomy. Endoscopy 12:130–133
2. Dumonceau JM, Deviere J, Cremer M (1998) A new method of achieving deep cannulation of the common bile duct during endoscopic retrograde cholangiopancreatography. Endoscopy 30(Suppl):S80
3. Gotoh Y, Tamada K, Tomiyama T, Wada S, Ohashi A, Satoh Y, Higashizawa T, Miyata T, Ido K, Sugano K (2001) A new method for deep cannulation of the bile duct by straightening the pancreatic duct. Gastrointest Endosc 53:820–822
4. Gyökeres T, Duhl J, Varsanyi M, Schwab R, Burai M, Pap A (2003) Double-guidewire placement for endoscopic pancreatobiliary procedures. Endoscopy 35:95–96
5. Draganov P, Devonshire DA, Cunningham JT (2005) A new technique to assist in difficult bile duct cannulation at the time of endoscopic retrograde cholangiopancreatography. JSLS 9:218–221
6. Ito K, Fujita N, Noda Y, Kobayashi G, Obana T, Horaguchi J, Takasawa O, Koshita S, Kanno Y (2008) Pancreatic guidewire placement for achieving selective biliary cannulation during endoscopic retrograde cholangiopancreatography. World J Gastroenterol 14:5595–5600
7. Maeda S, Hayashi H, Hosokawa O, Dohden K, Hattori M, Morita M, Kidani E, Ibe N, Tatsumi S (2003) Prospective randomized pilot trial of selective biliary cannulation using pancreatic guidewire placement. Endoscopy 35:721–724
8. de Tejada AH, Calleja JL, Diaz G, Pertejo V, Espinel J, Cacho G, Jimenez J, Millan I, Garcia F, Abreu L, UDOGUIA-O4 Group (2009) Double-guidewire technique for difficult bile duct cannulation: a multicenter randomized, controlled trial. Gastrointest Endosc 70:700–709
9. Gullichsen R, Lavonius M, Laine S, Grönroos J (2005) Needle-knife-assisted ERCP. Surg Endosc 19:1243–1245
10. Cotton PB, Lehman G, Vennes J, Geenen JE, Russell RCG, Meyers WC, Liguory C, Nickl N (1991) Endoscopic sphincterotomy complications and their management: an attempt at consensus. Gastrointest Endosc 37:383–393
11. Cotton PB (1994) Outcomes of endoscopy procedures: struggling towards definition. Gastrointest Endosc 40:514–518
12. Freeman ML (1997) Complications of endoscopic biliary sphincterotomy: a review. Endoscopy 29:288–297
13. Williams EJ, Taylor S, Fairclough P, Hamlyn A, Logan RF, Martin D, Riley SA, Veitch P, Wilkinson MN, Williamson PJ, Lombard M, BSG Audit of ERCP (2007) Are we meeting the standards set for endoscopy? Results of a large-scale prospective survey of endoscopic retrograde cholangiopancreatograph practice. Gut 56:821–829
14. Fukatsu H, Kawamoto H, Kato H, Hirao K, Kurihara N, Nakanishi T, Mizuno O, Okamoto Y, Ogawa T, Ishida E, Okada H, Sakaguchi K (2008) Evaluation of needleknife precut papillotomy after unsuccessful biliary cannulation, especially with regard to postoperative anatomic factors. Surg Endosc 22:717–723
15. Grönroos JM (2008) Endoscopic management of postcholecystectomy bile duct strictures. J Am Coll Surg 207:786–787