

Low-cost disposable endoscope: pros and cons



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Bibliography

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Keith Obstein and collaborators from the Vanderbilt University, United States, have designed and developed a low-cost \$35 disposable endoscope [1]. This endoscope uses a joystick-like driving mechanism which controls the endoscope tip. Their team proved its feasibility in examining the esophagus and the stomach of an ex-vivo phantom model. Unexperienced users had similar performance using a conventional scope and the new disposable scope and favor the later.

Conventional endoscopes have high acquisition costs – 20,000 to \$40,000 for an upper endoscopy or colonoscopy tube and around \$80,000 to \$120,000 for a complete two-tube working system to explore both the upper and the lower gastrointestinal tract. Costs for an additional endoscopic ultrasound system are in the range of \$200,000.

Use of conventional scopes requires higher levels of continuous training and skills, both for physicians and endoscopy nurses, especially for therapeutic procedures. The American Society of Gastrointestinal Endoscopy (ASGE) training recommendations and competence evaluation include both quantitative and detailed qualitative examination criteria [2].

The workload, costs, and staff hazards associated with reprocessing conventional endoscopes are significant, and costs range between \$140 and \$280 per endoscope [3, 4]. Non-adherence to endoscope reprocessing guidelines together with failure to perform periodic maintenance and auditing may lead to cross-contamination [3]. In light of these disadvantages, there are potential advantages of using disposable endoscopes (► **Table 1**). Available single-use disposable scopes are listed presented in ► **Table 2** [5, 6].

The PrimeSight TNE-500 esophagoscope was discontinued in April 2018, the day that the Cogentix company was acquired by Laborie company [7]. This was not a disposable scope, but was only covered by a single-use plastic sheet (EndoSheath). A sheet version with a working channel for biopsy capability was also available. Several clinical studies were published using this

esophagoscope, mainly for Barrett esophagus screening and surveillance. The cost of one EndoSheath was around \$40.

E.G. II is a South Korean disposable \$100 scope with the capability of examining the esophagus and partly the stomach and duodenum. There is no working channel with biopsy capability. The device is commercially available.

Ambu company, the Danish manufacturer of disposable ear, nose and throat scopes and bronchoscopes, projected the launch of disposable upper and lower gastrointestinal scopes by 2020 [8]. The current price for one disposable bronchoscope is \$350. Disposable robotics colonoscopy systems are listed in ► **Table 3**.

Available human studies were done on approximately 100 patients before the year 2013 and no other data have become available since [9–11]. There are no published data on their use outside their initial development centers.

Cecal intubation rates for Aer-O-Scope, Endotics System and Invendoscope were 98.2%, 93.1% and 98.4%, respectively, and mean time to reach the cecum was 14 minutes, 51 minutes, and 15 minutes, respectively.

► **Table 1** Comparative analysis of reusable and single-use endoscopes.

Reusable endoscopes	Single-use endoscopes
High acquisition costs	Lower acquisition costs
Higher level of training and skills	Lower level of training and skills
High reprocessing costs (disinfection, surveillance, maintenance, repair)	No reprocessing costs
Risk of cross-contamination	No risk of cross-contamination
Impact on the environment?	Impact on the environment?

► **Table 2** Currently available disposable endoscopes.

Disposable scope name	PrimeSight TNE-500 esophago-scope (with EndoSheath)	E.G. II	aScope
Manufacturer	Laborie, Canada (acquired Cogentix, United States, in 2018)	IntroMedic, South Korea	Ambu, Denmark (acquired Invendo Medical, Germany, in 2017)
Availability	Discontinued [5]	Available	Projected in 2020 [6]
Outer diameter	4.7 mm and 5.4 mm (with working channel)	4 mm	6.2 mm, 5.4 mm, 4.2 mm ¹
Bending	2-way	2 way	2 way ¹
Bending angle	215° up and 140° down	210° up and down	180° up and 180° down ¹
Length	650 mm	1022 mm	600 mm ¹
Air inflation	Yes	Yes	Probably
Suction channel	Yes	No	Yes ¹
Biopsy capability	Yes	No	Yes ¹
Explores	Esophagus	Esophagus and partially the stomach and duodenum	Upper and lower gastrointestinal tract; an ERCP solution is also developed.
Cost of the disposable part	Sheath \$ 40	Endoscope \$ 100	\$ 350 ¹
Cost of the non-disposable part	System with endoscope \$ 11,650	System \$ 15,000	aView monitor \$ 2600
Feasibility studies	[5]	[6]	Over 50 studies for bronchoscopy and ENT

¹ Listed characteristics for aScope Broncho

► **Table 3** Currently available robotic disposable colonoscopes.

Robotic disposable colonoscopy name	Aer-O-Scope	Endotics System	Invendoscope SC210
Manufacturer	GI View, Israel	Endotics, Italy	Ambu, Denmark (acquired Invendo Medical, Germany, in 2017)
Availability	Current version unavailable. New version projected for 2020.	Unknown, possibly available	Available
Features	Two working channels	One working channel	One working channel
Cost of the disposable part	Target projected price \$ 250	Unknown	\$ 350
Cost of the non-disposable part	Target projected price \$ 15,000	Unknown	Invendo SPU E210, quote on demand.

The Invendoscope SC210 version is available for purchase for \$ 350 together with the Invendo E210 guiding system. A new version of Aer-O-Scope has been tested and is projected to be marketed in 2020.

Returning to ► **Table 1**, one of the concerns with low-cost disposable scopes may be plastic pollution. This may be an issue for the future as it recently has been shown that plastic microparticles may be traced in stools of humans around the globe [12]. EU has recently tackled this issue and banned single-use plastics [13].

A disruptive technology could change the face of endoscopy as we know it. Low-cost video-capsules or nanorobots with possibility of biopsy, tagging, and therapy may appear sometime. In the meantime, our core business is endoscopy and we should

strive to improve it, maybe by transitioning to single-use instruments. For the moment, there is no way to predict the future of endoscopy, but it certainly is exciting.

Competing interests

None

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