INTRODUCTION

High-resolution manometry (HRM) is the gold standard test for diagnosing esophageal motility disorders in patients with unexplained dysphagia and/or chest pain.\(^1\)\(^2\) However, blind positioning of the probe across the EGJ is not always possible due to coiling of the probe in the lower esophagus, compromising an accurate diagnosis.

Herein, we report the failure rate of EGJ probe insertion during HRM in a tertiary care center, and the technique for guidewire-assisted placement of a water-perfused HRM probe in a group of patients with unsuccessful probe positioning.
2 | MATERIALS AND METHODS

2.1 | Study design

This was a single-center, retrospective study conducted at Erasme University Hospital in Brussels after obtaining approval from the local ethical committee (P2020/454) which waived the requirement for patient informed consent.

2.2 | Patients and data collection

Failure rate of EGJ intubation was analyzed for all HRM procedures performed between May, 2014 and November, 2020. Adult patients, in whom the guidewire-assisted HRM probe technique was used during the same time period, were identified from our database. Clinical data, HRM tracing during initial imperfect procedure, barium protocol, and final HRM diagnosis following guidewire insertion were reviewed from the electronic medical record.

2.3 | High resolution manometry

High-resolution manometry was performed by the motility physician in the motility unit located within the endoscopic department. All patients had undergone a previous upper endoscopy to exclude an obstructive lesion and, for most of the patients, a barium esophagram was performed. Manometry was carried out upright with a 45° inclination after an overnight fast, using water-perfused sensors (Solar™, Medical Measurement Systems B.V.) and a 22 channel + 1 channel for guidewire insertion probe (CE4-0062, Dentsleeve International Ltd.). The HRM probe was passed transnasally. Failure to pass the EGJ was defined as the inability to identify the lower esophageal sphincter (LES) and the inability to traverse the crural diaphragm. Data analysis of studies was performed according to Chicago classification (version according to the year of the performed HRM).^3^\\n
2.4 | Guidewire-assisted HRM

When esophageal body analysis and/or EGJ evaluation was not possible due to the inability of placement of the probe across the EGJ, the supplementary non-perfused channel of the water-perfused HRM probe was used to insert it on a guidewire previously placed in the stomach. For this purpose, an ultra-slim 5.4 mm endoscope (GIF-XP190N; Olympus) was used to insert a 0.035-inch guidewire (Boston Scientific) via the nostril into the gastric cavity. Viscous lidocaine (Xylocaine 2%, Astra Zeneca) was applied to the tip of the endoscope for local nasal anesthesia. After removing the endoscope, leaving the guidewire in place, the water-perfused HRM probe was passed over the guidewire.

Key Points
- Blind positioning of a high-resolution manometry (HRM) probe across the esophagogastric junction (EGJ) is not always possible. We report our experience using guidewire-assisted water-perfused HRM probe insertion when the EGJ could not be traversed.
- This study showed that in cases of inability to traverse the EGJ, insertion of a water-perfused HRM probe using an endoscopically-placed nasogastric guidewire allows successful EGJ and esophageal peristalsis assessment leading to accurate diagnosis of underlying motility disorders.

2.5 | Statistical methods

Continuous variables are presented as means with standard deviations (SD) or medians with interquartile ranges (IQR), depending on their distribution. Categorical variables are summarized as frequencies and proportions with their 95% confidence intervals (95% CI).

3 | RESULTS

During the study period, among 2727 HRM procedures, we identified 73 failures of EGJ catheter insertion in 73 patients (failure rate 2.7%). Factors associated with failure of EGJ passage were achalasia (43 patients), previous foregut surgery (11 patients, six patients with fundoplication), hiatal hernia (eight patients), failure of upper esophageal sphincter intubation (eight patients), and esophageal diverticulum (five patients).

Twenty-five patients (17 females [66.7%]; age 71.7 ± 16 years) underwent guidewire-assisted HRM, immediately after failure of EGJ insertion for 17 patients, and on another day for eight patients. The factors associated with failure of EGJ passage were compared in the groups of patients who did and did not undergo a guidewire-assisted probe placement. Achalasia type I (16% vs 43.4%), achalasia type III (20% vs 4.2%), and esophageal diverticula (20% vs 0%) were more frequently observed in the group undergoing guidewire-assisted HRM (p = 0.02; Table S1).

The guidewire-assisted technique extended the procedure by about 20 min compared with standard HRM, was well-tolerated, successful in all patients, and no complications occurred. An example of HRM tracing before and after guidewire-assisted probe insertion in a patient with esophageal diverticulum is shown in Figure 1.

The diagnostic yield of the guidewire-assisted procedure in comparison with barium esophagram and imperfect HRM tracing with curled catheter is summarized in Figure 2. In two patients, the probe was unable to pass the upper esophageal sphincter during initial HRM. Initial HRM tracings were not interpretable for analysis in 14 patients. No evidence of a disorder of peristalsis was found in six
patients. Four patients were already diagnosed with achalasia, with persisting dysphagia after previous endoscopic treatment. Achalasia subtype remained unchanged except for one patient with achalasia type III, which was also suspected at radiology. A new motility disorder was diagnosed in 15 patients. In 10 of them, the disorder was also suspected at radiology and/or initial imperfect HRM, while for 5 of them, the use of guidewire-assisted probe placement led to the new diagnosis (Tables S2 and S3).

All patients diagnosed with type III achalasia (among them one patient with a diverticulum), and two patients with hypercontractile esophagus and associated esophageal diverticulum were treated by peroral endoscopic myotomy (POEM) and associated septotomy of the diverticulum (D-POEM), in case of diverticulum, while pneumatic dilation was performed in patients diagnosed with type I or II achalasia.

4 | DISCUSSION

In this study, we report for the first time a series of 25 patients with successful guidewire-assisted insertion of a HRM catheter after failure of EGJ passage. We also confirm that failure to pass the EGJ is uncommon during esophageal manometry in a tertiary center with a rate of 2.7%, comparable with what is reported in the literature, and is mostly observed in patients with achalasia, previous foregut surgery, large hiatal hernia, or esophageal diverticulum.5,6

Interestingly, among patients with an esophageal diverticulum, one patient was diagnosed with type III achalasia and three patients with a hypercontractile esophagus. An association between esophageal diverticula and motor disorders has been reported, although it is unknown if motility disorders occur primary or secondary to the diverticulum.6,7

For the guidewire-assisted technique, a water-perfused probe with a supplementary channel was used to insert the catheter on a guidewire previously inserted into the stomach. Technically, the placement of a guidewire using an ultra-slim endoscope via the nostril is an easy and well-tolerated procedure in non-sedated patients.8 On the contrary, for solid-state manometry, endoscopy-guided placement of the probe can be attempted, but is not always successful and can be facilitated using a retrieval basket.4,9 In our tertiary care hospital, the guidewire-assisted HRM technique was performed with little additional time, on the same day in the majority of the patients; however, it can be speculated that the procedure might be more difficult to carry out in a routine endoscopy program if the motility unit is not located within the endoscopy department.

Guidewire-assisted placement of the HRM probe allowed confirmation of a motility disorder that was suspected at radiology and/or initial imperfect manometry in 40% of patients, and uncovered a motility disorder in 20% of them. In most patients with achalasia, the diagnosis was suspected with barium esophagram and/or imperfect manometry tracing. In cases where the EGJ cannot be evaluated, the absence of peristalsis and the absence or presence of panesophageal pressurization during a rapid drink test are highly predictive of achalasia type I or II, that can be confirmed using other diagnostic modalities, such as radiology of functional lumen imaging probe.4,5

In our series, initial HRM tracings were often uninterpretable in cases of type III achalasia and hypercontractile esophagus, because either the esophageal segment was too short to be evaluated or the
esophageal pressure rise was estimated to be caused by the curled catheter.

Precise subtyping of achalasia may impact the outcome of treatment with pneumatic dilation being less effective than myotomy for patients with type III achalasia. An extended proximal myotomy during POEM, adjusted to the length of the spastic contractions recorded on the HRM tracing, is now the preferred treatment for type III achalasia and for patients with diverticulum-associated motility disorders.

The main limitation of our study is its retrospective nature. Moreover, we acknowledge that the diagnostic yield of guidewire-assisted placement of HRM probe is limited to a selected group of patients as the procedure was proposed only in one-third of all cases of failure of EGJ passage. This was the case when imperfect tracings were difficult to interpret, when radiology had not been performed or was inconclusive, and when the physician performing HRM considered that a precise diagnosis would help to choose the most appropriate treatment.

In summary, in case of inability to traverse the EGJ, gastric insertion of a water-perfused HRM probe using an endoscopically-placed nasogastric guidewire allows successful EGJ and esophageal peristalsis assessment. This technique might be a useful adjunctive tool for water-perfused HRM, when a precise diagnosis is needed in an era of effective and minimally-invasive endoscopic treatment options.

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The authors have no conflicts of interest to declare.
AUTHORS’ CONTRIBUTION
HL conceived the idea, collected the data, drafted, and finally approved the manuscript. CD and PG collected the data, performed the analysis, drafted, and finally approved the manuscript. JD and DB drafted and finally approved the manuscript.

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SUPPORTING INFORMATION
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