Anti-Reflux Surgery III: Endoscopic Fundoplications

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9.1 Introduction

Gastroesophageal reflux disease (GERD) is a common disorder and is associated with a significant decrease in quality of life (QOL) [1]. It is known to affect up to 20% of the Western population [2]. Either symptomatic therapy with proton pump inhibitors (PPI) or more causative treatment by conventional anti-reflux surgery has been shown to be effective. Although data remain contradictory, PPI may be cancer protective [3] but might also lead to eventual long-term adverse events [4]. Additionally, PPI are not addressing the underlying anatomical defect and simultaneously leads to inadequate control of symptoms such as regurgitation. The surgical mainstay to treat GERD has been laparoscopic fundoplication, which, however, is invasive and might lead to adverse events, such as dysphagia, gas bloat syndrome, or recurrent reflux in the long term [5]. Today, only a small proportion of GERD patients are finally treated by conventional anti-reflux surgery. This leads to a group of patients, who are either not willing to be treated by or are not effectively treated with PPI but simultaneously do not want to run the potential risks of conventional surgery [6]. In the last two decades, endoscopic therapies have emerged to bridge this treatment gap between laparoscopic fundoplication and chronic medical management of GERD. Some of which have not withstood clinical tests due to several reasons [7], but with some still or again available and in clinical use. Today, both pharmacological and surgical shortcomings have led medical as well as surgical societies to acknowledge the role of endoscopic GERD therapies for selected patients [8, 9], which have evolved with enormous innovations in endoscopic tools and treatment options. All of them invented to challenge standard anti-reflux

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surgery but foremost might provide a less destructive option to treat GERD simultaneously providing the opportunity of a personalized surgical anti-reflux therapy [10, 11].

9.2 Techniques and Results

The general technical concept of all plication devices to treat GERD is the endolumenal creation of a serosa-to-serosa plication using either tags or staples to reinforce an insufficient "anti-reflux valve."

One of the first commercially available devices for endoscopic plications was the NDO Surgical plicator (NDO Surgical Inc., Mansfield, MA). It was built to deliver a transmural suture for serosal apposition and full thickness plication at the cardia. Patient factors predictive of 24-h pH normalization have been analyzed [12]. Khajanchee and colleagues identified a body mass index below 30, an initial DeMeester score under 30, and a heartburn score smaller than two to be predictive for successful endoscopic fundoplication. This group of patients had a normalized DeMeester score in more than 80% of patients compared to no normalization if patients had higher BMI, higher pre-plication DeMeester score, or more severe heartburn. However, this device is no longer available commercially.

Based on a similar plicator technology, a modified endoscopic full thickness plication device was reintroduced more recently by a different manufacturer (GERD-X, G-SURG GmbH, Seeon-Seebruck, Germany). In early small study evaluation, it was found to improve subjective as well as objective parameters at the 1-year follow-up. Refinements of the device as well as technique are still under investigation. The device uses hydraulic technique for control and is used with a small diameter endoscope, which is introduced into the stomach. Along with the device it can be retroflexed to manipulate and retract the gastric cardia into the two arms of the plication tool and deploying sutures after gathering sufficient tissue (Fig. 9.1a, b). Multiple sutures are used to create an augmented anti-reflux valve [13, 14]. The authors described significant improvement in symptoms, QOL, and DeMeester scores, with six patients requiring anti-reflux surgery within 3 months due to persistent symptoms. Few serious adverse events such as hematoma, pneumonia, intractable pain, and a Mallory-Weiss tear were reported [15]. Although the plicator appears promising to reduce symptoms in the short-term, long-term results and randomized trials are necessary to evaluate its role in the management of GERD.

The majority of data, so far, have been available on the transoral incisionless fundoplication (TIF) procedure using the EsophyX device (EndoGastric Solutions, Redmond, WA, USA). It was originally described in 2005 and has had several modifications until 2009 (TIF 2.0).

This device also uses a helical retractor and an additional integrated suction apparatus to grasp the distal esophagus, delivering up to 12–23 H-shape polypropylene fasteners to create a 2–3 cm, 270° full thickness esophagogastric fundoplication above the Z-line in the current version (Fig. 9.2a, b). Objective data have shown that the TIF 2.0 device led to better results compared to older versions [16]. A recently

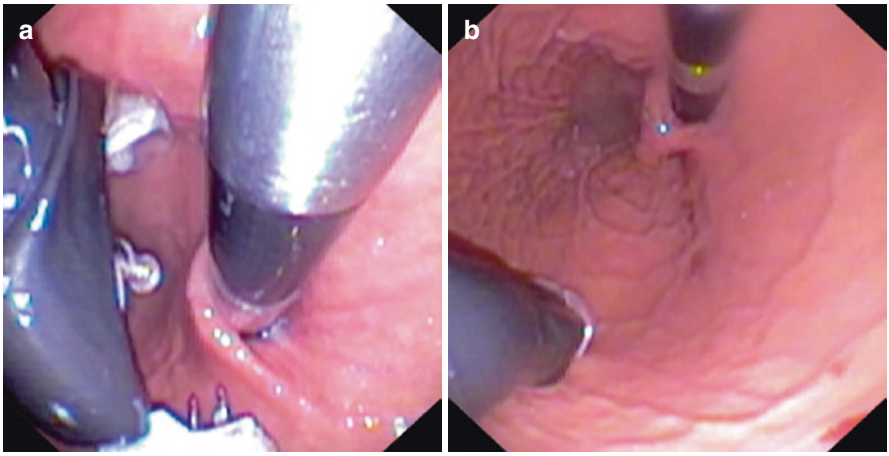

Fig. 9.1 (**a**) The GERD-X device is retroflexed to manipulate and retract the gastric cardia into the two arms of the plication tool. (**b**) Using a small diameter endoscope within the GERD-X device for visualization, the retroflexed view demonstrates the "esophagogastric valve" after the sutures have gathered sufficient tissue

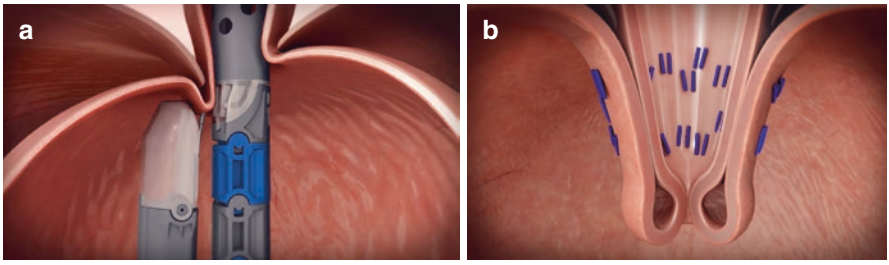

Fig. 9.2 (**a**) The distal esophagus is retracted into the Esophyx® device to deliver the fasteners (schematic drawing). (**b**) Multiple H-shaped fasteners were delivered to create a 270° full thickness esophagogastric fundoplication (schematic drawing)

published systematic review, comparing the TIF procedure with a PPI/sham control group, found a significantly higher response rate to TIF [17]. However, no significant difference in the mean percentage of esophageal acid exposure time was observed. In this meta-analysis, response rate efficacy was found to decrease over time. In contrast, data published more recently could demonstrate more encouraging results with regard to the long-term outcomes of TIF. Two long-term follow-up studies found clinical remission in the majority of patients at a median follow-up of 59 and 97 months. On the other hand, PPI consume did also re-increase over time [18, 19]. Also, the TEMPO trial could confirm the durability of the TIF 2.0 procedure. In their long-term analysis, the resolution of troublesome regurgitation was achieved in 86% after 5 years [20]. The resolution of atypical symptoms was still eliminated 80% after 5 years, with only 34% of patients on daily PPI compared to

100% at initial screening. The incidence of serious adverse events, such as perforations or bleedings appeared to be as low as 2.4% [17]. Although GERD symptoms seem to improve, it appears that objective improvement of distal esophageal acid exposure cannot be achieved and was only normalized in 29% at 12 months, as described by others [21]. Overall, current evidence demonstrates that the TIF procedure is capable to eliminate GERD symptoms in the majority of selected patients with a low incidence of serious adverse events, but objective improvement in distal esophageal acid exposure could not be clearly demonstrated. However, when TIF is used as initial therapy, potentially necessary conventional fundoplication appears not to be impaired [22].

A completely different technology is used by the MUSE (Medigus, Omer, Israel) endoscopic stapling device, which consists of built-in video camera, an endostapler, and an ultrasound transducer. The ultrasound-based range finder helps in assessing the tissue thickness before firing the staples (Fig. 9.3a, b). The stapler is then fired at the level above the esophageal Z-line and repeated several times to form a sufficient fundoplication. So far, available evidence is mainly limited with regard to the safety and efficacy of the device. Zacherl and colleagues reported the 6-month results of 66 patients in a prospective multicenter trial and found improvement in the GERD Health-Related Quality of Life score as well 65% of patients off PPI. However, there were eight severe adverse events recorded within the first 24 patients, with two who required re-intervention [23]. This led to technical and protocol changes, with no further cases of leak or pneumo-mediastinum in the next 48 subjects enrolled. Kim et al., found nearly 70% of patients remaining off PPI after 4 years. No residual severe adverse events were observed after the 6-month follow-up [24] but no long-term pH studies were reported.

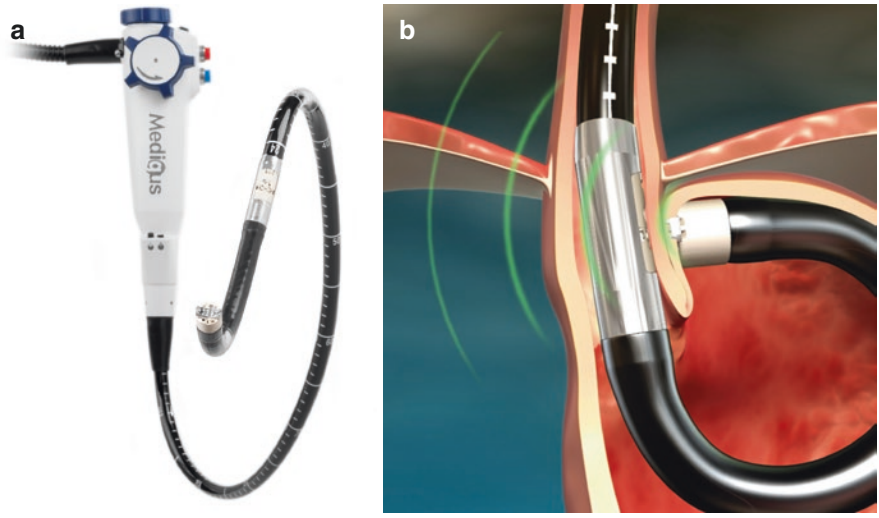

Fig. 9.3 (**a**) The flexible MUSE system uses an endoscopic stapling device, which consists of built-in video camera, an endostapler, and an ultrasound transducer. (**b**) The distal esophagus is retracted into the ultrasonic-guided stapler device (schematic drawing)

9.3 Conclusion

Overall, endoscopic fundoplication could be an alternative therapy for highly selected patients. Hereby, proper patient selection is mandatory to achieve appropriate results from endoscopic fundoplications. As potentially later conventional fundoplication seems not to be impaired with some procedures, it could also nicely serve as initial nonmedical therapy in some patients. Current data on improvement of objective parameters such as esophageal acid exposure are still missing. As long-term reflux symptom control efficacy also appears to decrease with time, the appealing option of an endoscopic fundoplication has certainly to be a matter of continued research.

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