NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE

INTERVENTIONAL PROCEDURES PROGRAMME

Interventional procedure overview of endoluminal gastroplication for gastro-oesophageal reflux disease

Treating reflux by stitching a fold into the gullet above the stomach

In patients with gastro-oesophageal reflux disease, the acidic contents of the stomach are able to travel backwards into the gullet (oesophagus), causing a burning sensation or pain (heartburn) or awareness of an acidy sensation or taste. This happens because the ring of muscle that keeps the stomach contents down isn't working properly.

Endoluminal gastroplication uses a long camera and special instruments inserted through the mouth into the gullet. The surgeon uses the instruments to stitch and fold the lower end of the gullet where it joins the stomach to make the junction between the stomach and the gullet smaller, and so help prevent backwards movement of the stomach contents.

Introduction

The National Institute for Health and Clinical Excellence (NICE) has prepared this overview to help members of the Interventional Procedures Advisory Committee (IPAC) make recommendations about the safety and efficacy of an interventional procedure. It is based on a rapid review of the medical literature and specialist opinion. It should not be regarded as a definitive assessment of the procedure.

Date prepared

This overview was prepared in March 2011.

Procedure name

- Endoluminal gastroplication
- Endoluminal fundoplication
- Endoluminal gastroplasty
- Transoral incisionless fundoplication

Specialty societies

- Association of Upper Gastrointestinal Surgeons for Great Britain and Ireland (AUGIS)
- British Society of Gastroenterology (BSG)

Description

Indications and current treatment

Gastro-oesophageal reflux disease (GORD) is a common condition and is caused by failure of the sphincter mechanism at the lower end of the oesophagus. Symptoms of GORD can be broadly grouped into those directly related to reflux episodes, such as heartburn, regurgitation and waterbrash (sour taste in the mouth), and those symptoms caused by complications of reflux disease, including dysphagia and respiratory symptoms.

Lifestyle modifications and drug therapy are the standard treatments for patients with mild symptomatic GORD. Drug therapy includes antacids/alginates and acid-lowering agents such as H2-receptor antagonists and proton pump inhibitors (PPIs). Patients with reflux symptoms that do not respond to medical treatment may be treated with anti-reflux surgery. Surgical or laparoscopic fundoplication surgery may be used, and minimally invasive treatments such as endoscopic radiofrequency ablation are available.

There are a number of subjective outcome assessment tools for this condition. The gastro-oesophageal health-related quality of life (GERD HRQL) scale assesses patient symptoms and effect on daily living using 10 questions scoring a total of 0 to 50 with lower scores better.

What the procedure involves

Endoluminal gastroplication for GORD aims to reduce the morbidity associated with open or laparoscopic fundoplication.

With patient under sedation, the procedure is carried out using a standard endoscope and an endoscopic suturing or fastening device, with an oesophageal overtube inserted. Multiple plications, or pleats, are made below the gastro-oesophageal junction, with the aim of decreasing the reflux of stomach acid into the oesophagus. Plications are made in either a straight line or circumferentially.

Different devices are available for this procedure.

Literature review

Rapid review of literature

The medical literature was searched to identify studies and reviews relevant to endoluminal gastroplication for gastro-oesophageal reflux disease. Searches were conducted of the following databases, covering the period from their commencement to 9 September 2010 and updated to 28 February 2011: MEDLINE, PREMEDLINE, EMBASE, Cochrane Library and other databases. Trial registries and the Internet were also searched. No language restriction was applied to the searches (see appendix C for details of search strategy). Relevant published studies identified during consultation or resolution that are published after this date may also be considered for inclusion.

The following selection criteria (table 1) were applied to the abstracts identified by the literature search. Where selection criteria could not be determined from the abstracts the full paper was retrieved.

Table 1 Inclusion criteria for identification of relevant studies

Characteristic	Criteria
Publication type	Clinical studies were included. Emphasis was placed on identifying good quality studies. Abstracts were excluded where no clinical outcomes were reported, or where the paper was a review, editorial, or a laboratory or animal study. Conference abstracts were also excluded because of the difficulty of appraising study methodology, unless they reported specific adverse events that were not available in the published literature.
Patient	Patients with gastro-oesophageal reflux disease (GORD / GERD)
Intervention/test	Endoluminal gastroplication
Outcome	Articles were retrieved if the abstract contained information relevant to the safety and/or efficacy.
Language	Non-English-language articles were excluded unless they were thought to add substantively to the English-language evidence base.

List of studies included in the overview

This overview is based on approximately 766 patients from 4 randomised controlled trials[1,2,3,4] 1 non-randomised controlled study[5], 4 case series[6,7,8,9,], and 1 case report[10].

Other studies that were considered to be relevant to the procedure but were not included in the main extraction table (table 2) have been listed in appendix A.

Table 2 Summary of key efficacy and safety findings on endoluminal gastroplication for gastro-oesophageal reflux disease

Abbreviations used: BMI, body mass index, GERD / GORD, gastro-oesophageal reflux disease; GI, gastrointestinal; GSRS, gastrointestinal symptom rating scale; HRQL, health related quality of life; N/S, not significant; PPI, proton pump inhibitor; QOL, quality of life; RF, radiofrequency; SF, short form;

Study details

Rothstein R (2006)[1]

Randomised controlled trial

USA and Europe

Recruitment period: 2005

Study population: patients with history of heartburn or regurgitation requiring daily PPI medication.

n = **159 (78 gastroplication, 81 sham)**

Age: 47 years Sex: 53% male

Patient selection criteria: patients with HRQL score ≥15 off medication and 6+ points higher than when on medication, pathological acid exposure, lower oesophageal resting pressure >5mmHg. Patients without oesophageal dysmotility, persistent dysphagia, weight loss, gas, bloating, oesophageal or gastric varicies, previous antireflux procedure, other oesophageal or gastric surgery.

Technique: patients sedated in accordance with hospital guidelines for upper GI endoscopy. Following gastroscopic inspection 'plicator' device advanced over guidewire. Gastric wall sutured Vs sham procedure (same procedure but with no suturing).. Medication for pain relief as required. PPI medication continued for 2 days, halved to day 5 and then discontinued.

Follow-up: **3 months (median)**

Conflict of interest/source of funding: not reported

Key efficacy findings

Number of patients analysed: **n=132 (63 gastroplication, 69 sham)**

Quality of life

A ≥50% reduction in GORD HRQL score (lower score better) from baseline was considered a treatment response

	Gastroplic.	Sham	p
HRQL improvement ≥ 50%	56%	18.5%	<0.001

Absolute numbers not reported.

Gastroplication group mean	Baseline	3 months	p=
HRQL	25.7	12.7	<0.001

Group mean heartburn score (Visual analogue scale – points lower score better) at 3 months follow up

	Baseline	3 months	p=
Gastroplication	69.5	35.5	<0.001
Sham	69.9	58.3	<0.001

Between group analysis p<0.001

Group mean SF-36 score - mental health (points)

	Baseline	3 months	p=
Gastroplication	49.7	47.1	0.009
Sham	47.7	47.6	0.433

Between group analysis p = not significant

Group mean SF-36 score - physical health (points)

	Baseline	3 months	p=
Gastroplication	49.9	46.2	<0.001
Sham	46.1	44.9	0.110

Between group analysis p = not significant

Key safety findings

Number of patients analysed: **n=159 (78 gastroplication, 81 sham)**

Complications rate per group

Outcome	Gastroplic.	Sham	p=
Any adverse event	50.0% (39/78)	22.2% (18/81)	<0.001
Pharyngeal pain	9.0% (7/78)	9.9% (8/81)	1.000
Chest pain / discomfort	11.5% (9/78)	4.9% (4/81)	0.155
Epigastric pain	11.5% (9/78)	3.7% (3/81)	0.076
Shoulder pain*	11.5% (9/78)	0% (0/81)	0.001
Abdominal pain	9.0% (7/78)	0% (0/81)	0.006
Nausea	7.7% (6/78)	1.2% (1/81)	0.060
Vomiting	5.1% (4/78)	3.7% (3/81)	0.716
Dysphagia	2.6% (2/78)	2.5% (2/81)	1.000
Leukocytosis	2.6% (2/78)	0% (0/81)	0.239
Pneumo-peritoneum	2.6% (2/78)	0% (0/81)	0.239
Eructation	2.6% (2/78)	0% (0/81)	0.239
Hospitalisation	6.4% (5/78)	0% (0/81)	0.027

*1 patient required laparoscopy

The majority of events resolved spontaneously without intervention.

There were no deaths or oesophageal perforations.

Comments

34 of the patients in this study included in original overview

Follow-up issues: 15 patients randomised were excluded as did not meet entry criteria. 9 patients lost to follow up in the gastroplication group, 3 lost in sham group.

Intention to treat analysis for most outcomes.

Study design issues: 15 site multicentre study.

Patients blinded to treatment allocation but not outcome assessors. Blinding effectiveness was not tested on the patients.

No repeat treatments were permitted in the treatment protocol.

Study power calculated assuming a 35% placebo effect.

Study population issues: There were no statistically significant differences between the groups at baseline in terms of clinical or demographic characteristics.

Other issues: Authors surmise that the procedure derives its efficacy by restructuring the gastric cardia to create an improved barrier to gastro-oesophageal reflux.

Abbreviations used: BMI, body mass index, GERD / GORD, gastro-oesophageal reflux disease; GI, gastrointestinal; GSRS, gastrointestinal symptom rating scale; HRQL, health related quality of life; N/S, not significant; PPI, proton pump inhibitor; QOL, quality of life; RF, radiofrequency; SF, short form;

Study details	Key efficacy findings	Key safety findings	Comments
Rothstein R (2006) continued	**Medication requirement** Absolute numbers not reported. **Acid reflux** 24 hour pH studies were available for 86.3% (113/131) of patients with 3 months follow-up. % time pH <4.0 Between group analysis p=0.010		

	Gastroplic.	Sham	p=
Complete PPI cessation	50%	24%	0.002

	Baseline	3 months	p=
Gastroplication	10%	7%	<0.001
Sham	9%	10%	0.686

Abbreviations used: BMI, body mass index, GERD / GORD, gastro-oesophageal reflux disease; GI, gastrointestinal; GSRS, gastrointestinal symptom rating scale; HRQL, health related quality of life; N/S, not significant; PPI, proton pump inhibitor; QOL, quality of life; RF, radiofrequency; SF, short form;

Study details	Key efficacy findings	Key safety findings	Comments
Schwartz M P (2007)[2] **Randomised controlled trial** Holland Recruitment period: 2003 to 2005 Study population: patients with persistent GORD partially responsive to PPIs and taking for ≥1 year n = **60 (20 gastroplication, 20 sham, 20 no treatment)** Age: 46 years Sex: 60% male Patient selection criteria: oesophageal pH confirmed GORD. Patients without severe oesophageal motility disorder, hiatus hernia >3cm, history of thoracic or gastric surgery, reflux oesophagitis, Barrett's epithelium, or severe comorbidity. Technique: under endoscopic guidance an oesophageal overtube was placed and the endocinch device inserted, 3 gastroplications made Vs sham treatment (same procedure but with no needle or thread loaded) vs no treatment. **Follow-up: 3 months (median)** Conflict of interest/source of funding: None	Number of patients analysed: **n= 57 (20 gastroplication, 20 sham, 17 no treatment)** **QOL** Group mean change from baseline, points (%). scale 0 to 24 lower scores better Heartburn score: Gastroplic. -8.6 (50%); Sham -0.9 (6%); No treatment -3.1 (18%) p = 0.003 vs sham; p = n/s vs no treatment Regurgitation score: Gastroplic. -5.2 (32%); Sham -1.1 (7%); No treatment -0.4 (2%) p = n/s vs sham; p = n/s vs no treatment Group mean change from baseline, points (%), higher scores better SF-20 Physical function: Gastroplic. 19 (50%); Sham 5 (10%); No treatment 10 (21%) p = n/s v vs sham; p = n/s vs no treatment General health: Gastroplic. 14 (40%); Sham -1 (1%); No treatment -2 (10%) p = 0.04 vs sham; p = n/s vs no treatment **Medication requirement** Group proportions achieving ≥50% reduction in PPI use at 3-month follow-up ≥50% PPI: Gastroplic. 65.0% (13/20); Sham 25.0% (5/20); No treatment 0% (0/17) p = 0.011 vs sham; p = 0.05 vs no treatment	**Complications** Complications rate per group Sore throat: Gastroplic. 40.0% (8/20); Sham 45.0% 9/20) hest pain: Gastroplic. 30/0% (6/20); Sham 0% (0/20) Dysphagia (<7 days): Gastroplic. 50.0% (10/20); Sham 5.0% (1/20) Eructation: Gastroplic. 5.0% (1/20); Sham 0% (0/20) Abdominal pain: Gastroplic. 5.0% (1/20); Sham 5.0% (1/20) Bloating: Gastroplic. 10.0% (2/20); Sham 0% (0/20) Early satiety: Gastroplic. 5.0% (1/20); Sham 0% (0/20) Hiccoughs: Gastroplic. 5.0% (1/20); Sham 0% (0/20) Sedation related: Gastroplic. 0% (0/20); Sham 5.0% (1/20) Length of follow up and measurement of significance not reported. By 12-month follow-up 29% of patients had a second gastroplication procedure. 72% of the sutures were still present but only 19% were judged to be functional.	**Follow-up issues**: 1 patient in the gastroplication group had only 2 stitches inserted due to technical complication but analysed as intention to treat, 3 patients in the no treatment group lost to follow up. **Study design issues**: Single centre study. All procedures and sham conducted by the same endoscopist. Double blinded (for gastroplication vs sham). At 3 months, patients in the sham and no treatment groups were allowed to cross over to gastroplication or other anti-reflux surgery. **Study population issues**: Patients in the sham group had significantly better QOL score at baseline than the other groups. **Other issues**: Additional open label outcomes to 12-month follow-up are not extracted here.

Abbreviations used: BMI, body mass index, GERD / GORD, gastro-oesophageal reflux disease; GI, gastrointestinal; GSRS, gastrointestinal symptom rating scale; HRQL, health related quality of life; N/S, not significant; PPI, proton pump inhibitor; QOL, quality of life; RF, radiofrequency; SF, short form;

Study details	Key efficacy findings	Key safety findings	Comments
Domagk D (2006)[3] **Randomised controlled trial** Germany Recruitment period: 2002 to 2005 Study population: patients with GORD >1 year with PPI treatment for several months (initially responsive) n = **51 (26 gastroplication, Vs 25 bulking agent)** Age: 48 years (mean), Sex: 53% male Patient selection criteria: patients with >5 reflux events per week, dependency on PPIs. Patients without reflux oesophagitis, hiatial hernia >3cm, Barrett' epithelium, oesophageal stricture, or body mass index >35. Technique: local sedation. Gastroplication with Endocinch II device with endoscopic visualisation, overtube and guidewire, 1 to 3 plications inserted. Vs endoscopic injection of polymer into muscle surrounding the oesophagus with fluoroscopic guidance. **Follow-up: 6 months (median)** Conflict of interest/source of funding: Not reported	Number of patients analysed: **49 (26 gastroplication, 23 bulking agent)** **QOL** Group mean (standard deviation) heartburn severity score, points, lower scores better Gastroplic. / Bulking Baseline: 53.7 ± 23.7 / 56.1 ± 18.8 6 months: 20.9 ± 24.2 / 19.9 ± 24.4 Change from baseline: p <0.0001 / p <0.0001 (measurement of significance for between group comparison not reported) Group mean (standard deviation) SF-36 physical score, points, higher scores better Gastroplic. / Bulking Baseline: 45.2 ± 6.0 / 45.3 ± 8.1 6 months: 50.3 ± 8.1 / 49.5 ± 7.9 Change from baseline: p <0.0001 / p = 0.003 (measurement of significance for between group comparison not reported) **Medication requirement** Group proportions achieving ≥50% reduction in PPI use at 6-month follow-up Gastroplic. / Bulking / p= ≥50% PPI: 76.9% (20/26) / 87.0% (20/23) / 0.365 Change from baseline: p <0.0001 / p <0.0001	**Complications** Complication rate per group Outcome / Gastroplic. / Bulking Loss of suture material: 19.2% (5/26) / 0% (0/23) Bleeding: 0% (0/26) / 4.3% (1/2) Fever: 0% (0/26) / 13.0% (3/23) (measurement of significance not reported) Temporary abdominal pain and transient pharingitis recorded in the gastroplication group.	**Follow-up issues**: 2 patients in the bulking agents group refused treatment. Outcomes analysed on a per protocol basis. **Study design issues**: Computer randomisation. Non-blinded study. 7 patients in the gastroplication group and 6 patients in the bulking agents group received repeat treatment. Single centre study, all procedures performed by 2 clinicians **Study population issues**: No statistical comparison of patient groups at baseline **Other issues**: Not all outcomes were compared for difference between groups This study was published since IPAC considered the endoscopic injection of bulking agents procedure.

Abbreviations used: BMI, body mass index, GERD / GORD, gastro-oesophageal reflux disease; GI, gastrointestinal; GSRS, gastrointestinal symptom rating scale; HRQL, health related quality of life; N/S, not significant; PPI, proton pump inhibitor; QOL, quality of life; RF, radiofrequency; SF, short form;

Study details	Key efficacy findings	Key safety findings	Comments
Montgomery M (2006)[4] **Randomised controlled trial** Sweden Recruitment period: not reported Study population: patients with typical symptoms of GORD requiring daily PPI medication. **n = 46 (22 gastroplication, 24 sham)** Age: 41years (mean), Sex: 33% Male Patient selection criteria: endoscopically documented insufficient gastro-oesophageal flap valve, with or without oesophagitis, and gastro-oesophageal reflux. Patients without hiatal hernia >3cm, Barrett's oesophagus, previous antireflux surgery, or severe oesophageal dysmotility. Technique: under general anaesthesia and after insertion of overtube gastroplication with EndoCinch device under endoscopic guidance, 2 to 4 sutures inserted. Vs Sham (same procedure without fastening and under general anaesthesia). During follow up PPIs allowed in case of symptoms. **Follow-up: 12 months (median)** Conflict of interest/source of funding: none	Number of patients analysed: **43 (22 gastroplication, 21 sham)** **QOL** Group median (interquartile range) GSRS score Gastroplic. / Sham / p= Baseline: 14 (10 to 21) / 16 (13 to 19) / N/S 6 weeks: 7 (4 to 13) / 9 (4 to 16) / N/S 3 months: 8 (4 to 14) / 13 (7 to 17) / p<0.05 12 months: 11 (7 to 15) / 12 (7 to 18) / N/S Change from baseline: p<0.05 / p<0.05 (numbers estimated from figure) **Acid exposure** % total time ph<4, median (interquartile range) Gastroplic. / Sham Baseline: 5.95 (3.78 to 6.73) / 5.90 (4.63 to 7.08) 3 months: 6.60 (1.40 to 11.60) / 7.20 (4.00 to 10.90) 12 months: 4.70 (3.19 to 7.13) / 7.40 (4.03 to 12.45) Change from baseline: p = N/S / p = N/S (measurement of significance between groups not reported) **Medication requirement** Group median (interquartile range) doses of PPIs per week Gastroplic. / Sham / p= Baseline: 7 / 7 / N/S 6 weeks: 1 (0 to 7) / 3 (0.35 to 7) / N/S 3 months: 0.5 (0 to 7) / 5 (1 to 7) / p<0.05 12 months: 1 (0 to 7) / 3 (1 to 7) / N/S Change from baseline: p<0.05 / p<0.05	**Compilations** All procedures in both groups were undertaken without complications and with discharge on the 1st day of follow up. Minor side effects of sore throat, mild dysphagia, and epigastric pain all resolved by 3-day follow-up. In gastroplication patients: Remaining sutures in place % (, median; range) Post procedure: 100 % (3; 2–4) 3 months: 71% (2; 1–3) 12 months: 67% (2; 0–3)	**Follow-up issues**: All patients were followed up to 3 months. Between 3 and 12 months, 3 patients were lost to follow up in the sham group. 1 due to pregnancy and 2 underwent laparoscopic antireflux surgery. **Study design issues**: Randomisation method not described, stratification for BMI. 7-day washout of PPIs before pH studies undertaken. All procedures and shams undertaken by 2 experienced clinicians. Persons evaluating postoperative outcomes were blinded to study group. General anaesthesia used to ensure blinding to treatment allocation among patients. **Study population issues**: There were no statistically significant differences between the groups at baseline in terms of demographic or clinical characteristics. **Other issues**: No description provided of the GSRS but appears to be a 35 point scale (lower scores better). General anaesthesia used to ensure blinding to treatment allocation among patients. Authors state that the data raises serious doubts as to the effects after 12 months.

Abbreviations used: BMI, body mass index, GERD / GORD, gastro-oesophageal reflux disease; GI, gastrointestinal; GSRS, gastrointestinal symptom rating scale; HRQL, health related quality of life; N/S, not significant; PPI, proton pump inhibitor; QOL, quality of life; RF, radiofrequency; SF, short form;

Study details	Key efficacy findings	Key safety findings	Comments
Jeansonne L O (2009)[5] **Non-randomised controlled study** USA Recruitment period: 2002 to 2006 Study population: Symptomatic GORD **n = 126 (58 gastroplication, 68 RF ablation)** Age: 45 years (mean), Sex: not reported Patient selection criteria: Patients chosen for endoluminal therapy with obesity, borderline manometric or impedance study, inability to undergo general anaesthesia, or desire to avoid surgery. Patients without large paraoesophageal hernia, oesophagitis, or structure. Technique: Local anaesthesia. Under endoscopic visualisation the Plicator device was introduced over a guidewire and 1 suture inserted Vs endoluminal RF ablation. **Follow-up: 6 months (mean)** Conflict of interest/source of funding: none	Number of patients analysed: **126 (58 gastroplication, 68 RF ablation)** **Medication requirement** Proportion of patients requiring PPIs Gastroplic. / RF ablation Baseline 95% / 84% Follow up 43% / 50% p = 0.01 / 0.01 (absolute figures not reported) **Quality of life** Proportion of patients with 'moderate to severe' heartburn Gastroplic. / RF ablation Baseline 53% / 55% Follow up 43% / 22% p = 0.03 / <0.01 (absolute figures not reported) **Acid exposure** Mean % time pH <4 Gastroplic. / RF ablation Baseline 10.0% / 10.8% Follow up 6.1% / 9.1% p = 0.05 / >0.9 (N/S) (absolute figures not reported)	**Compilations** Proportion of patients requiring additional laparoscopic Nissen fundoplication. Gastroplic. / RF ablation Proportion 5.2% (3/58) / 4.4% (3/68) Mean time to Nissen fundoplication 11.4 months / 11.4 months	**Follow-up issues**: prospective follow up. Only 40% follow up in the Gastroplication group and 60% in the RF ablation group. A subset of patients underwent 24 hour pH monitoring. Median follow up was longer in the gastroplication group (8.1. months) than the RF ablation group (5.1 months) **Study design issues**: For first 2 years of study only RF was available, for remaining period gastroplication or RF chosen on patient preference, surgeons' judgement, and anatomic suitability. No between-group comparisons analysed. **Study population issues**: Patients in this study were those who were chosen for endoluminal therapy over surgery. There were no significant differences between the groups at baseline in terms of demographic characteristics. However the mean BMI was 32.9 in the gastroplication group and 27.8 in the RF ablation group (p=0.05). 9.1% of patients in the gastroplication group had previously undergone fundoplication compared to 14.7% of the RF ablation group. **Other issues**: This study was published since IPAC considered the endoscopic Radiofrequency ablation procedure.

Abbreviations used: BMI, body mass index, GERD / GORD, gastro-oesophageal reflux disease; GI, gastrointestinal; GSRS, gastrointestinal symptom rating scale; HRQL, health related quality of life; N/S, not significant; PPI, proton pump inhibitor; QOL, quality of life; RF, radiofrequency; SF, short form;

Study details	Key efficacy findings	Key safety findings	Comments
Paulssen E J (2008)[6] **Case series** Norway Recruitment period: 2001 to 2004 Study population: symptomatic GORD, mean duration of symptoms 11 years. n = **119** Age: 46 years, Sex: 62% male. Patient selection criteria: Patients with erosive oesophagitis on gastroscopy or positive 24 hours pH measurement, PPI therapy with incomplete response, intolerable side effects, or unwillingness for lifetime treatment. Technique: under local sedation, and endoscopic visualisation, overtube inserted and gastroplication with EndoCinch device with 2 or 3 sutures in horizontal pattern. 20 patients underwent repeat procedure at 3- or 12-month follow-up from index intervention. Follow-up: **41 months (mean)** Conflict of interest/source of funding: not reported.	Number of patients analysed: **116 at 3 months, 83 at 12 months** **Medication requirement** Group mean (standard deviation) doses of PPIs per week | | Gastroplication | p= | |---|---|---| | Baseline | 8.7 (4.60) | N/A | | 3 months | 4.0 (4.36) | <0.01 | | 12 months | 5.0 (5.81) | <0.01 | | 41 months | 6.4 (6.23) | 0.06 | **QOL** Group mean (standard deviation) heartburn severity score | | Gastroplication | p= | |---|---|---| | Baseline | 21.4 (4.72) | N/A | | 3 months | 12.4 (8.69) | <0.01 | | 12 months | 13.4 (8.98) | <0.01 | | 41 months | 8.5 (8.43) | <0.01 | **Acid exposure** Group mean (standard deviation) % time pH<4 | | Gastroplication | p= | |---|---|---| | Baseline | 11.7 (7.37) | N/A | | 3 months | 10.1 (6.64) | 0.01 | | 12 months | 13.5 (11.24) | 0.69 | **Operative characteristics** Mean endoscopic gastroplication procedure time was 25.3 minutes.	**Complications** Minor self-limiting bleeding was 'common'. Prolonged epigastric pain or dysphagia was 'rare'. | Outcome | Rate | |---|---| | Procedure curtailed after 1 suture due to reaction to sedation | 0.8% (1/119) | | Suture removed due to difficulty swallowing | 0.8% (1/119) | | Readmission for liver abscess (several days follow-up) | 0.8% (1/119) | | Readmission for fever – unrelated to the procedure (-day follow-up) | 0.8% (1/119) | | Oesophageal fungal infections | 1.7% (2/119) | (length of follow up not reported unless stated) Group mean (standard deviation) number of sutures remaining | | Gastroplication | p= | |---|---|---| | Baseline | 2.51 (0.57) | N/A | | 3 months | 1.87 (0.70) | <0.01 | | 12 months | 1.81 (0.90) | <0.01 |	**Follow-up issues**: Long-term follow-up by telephone survey. 67.2% (80/119) of patients having index treatment were available for final follow up. **Study design issues**: 20 patients had a repeat gastroplication procedure during follow up. Efficacy outcomes at final follow up reported here exclude patients having a repeat procedure. Not all patients underwent all outcome assessments. No comparison between those who did and those who did not. Two different gastroplication devices were used during the series. **Study population issues**: Patients with long standing GORD symptoms. **Other issues**: Authors state that GORD is a condition where there is inconsistency between symptoms and objective measurement.

Abbreviations used: BMI, body mass index, GERD / GORD, gastro-oesophageal reflux disease; GI, gastrointestinal; GSRS, gastrointestinal symptom rating scale; HRQL, health related quality of life; N/S, not significant; PPI, proton pump inhibitor; QOL, quality of life; RF, radiofrequency; SF, short form;

Study details	Key efficacy findings	Key safety findings	Comments
Cadiere G-B (2008)[7] **Case series** International Recruitment period: 2006 Study population: symptomatic GORD, median duration of symptoms 6 years. **n = 86** Age: 44 years (median), Sex: 66% Male Patient selection criteria: Patients with chronic GORD for >6 months responsive to PPI therapy (GORD HRQL score <12 points on medication). With acid exposure on 48 hr pH monitoring, and a deteriorated gastro-oesophageal junction. Patients without severe reflux oesophagitis, BMI >35kg/m^2, Barrett's oesophagus, motility disorder, stricture, ulcer, delayed gastric emptying, hiatial hernia >2cm, or previous antireflux surgery. Technique: Under general anaesthesia, and endoscopic visualisation gastroplication with the Esophyx device with 'multiple' fasteners delivered circumferentially. At 7-day follow-up patients discontinued PPIs but returned to their baseline dose if symptoms returned then weaned off if possible. Follow-up: **12 months (median)** Conflict of interest/source of funding: Study supported by manufacturer	Number of patients analysed: **n = 82** **Acid exposure** Group median (range) % time pH<4 (off PPIs) Gastroplication p= Baseline n=82 10 (3 to 67) N/A 6 months n=81 7 (1 to 29) <0.001 12 months n=71 7 (0 to 22) 0.02 **QOL** Group median (range) GORD HRQL score (off PPIs) Gastroplication p= Baseline n=82 24 (11 to 38) N/A 6 months n=81 5 (0 to 24) <0.0001 12 months n=79 7 (0 to 30) <0.0001 Group median (range) Heartburn score (off PPIs) Gastroplication p= Baseline n=82 21 (10 to 30) N/A 6 months n=81 4 (0 to 19) <0.0001 12 months n=79 6 (0 to 20) <0.0001 **Medication requirement** Requirement of PPIs Daily / Occasional / None Baseline 100% (86/86) 0% (0/86) 0% (0/86) 12 months 15.2% (12/79) 16.5% (13/79) 68.4% (54/79) **Operative characteristics** Mean procedure time was 77 minutes.	**Complications** Serious adverse events Outcome / Rate Perforation of proximal oesophagus during insertion of device (surgical suture – no sequelae) 1.2% (1/86) Perforation during insertion in a patient with a narrow hypopharynx (surgical repair – discharge 21-day follow-up) 1.2% (1/86) Intraluminal bleeding (blood transfusion – 4 units, endoscopic clipping and injection of fibrin glue) 1.2% (1/86) Other adverse events Outcome / Rate Musculoskeletal shoulder pain 18.6% (16/86) Abdominal pain 15.1% (13/86) Pharangolaryngeal pain 8.1% (7/86) Nausea 8.1% (7/86) Epigastric pain 7.0% (6/86) Bleeding 5.8% (5/86) Fever 3.5% (3/86) Dysphagia 3.5% (3/86) Diarrhoea 2.3% (2/86) Vomiting 2.3% (2/86) Length of follow up varies (mostly to 1 month)	**Follow-up issues**: Prospective follow up. 96% of patients available at 6 months follow up, and 94% at 12 months. **Study design issues**: Multicentre study at 7 sites. QOL outcomes assessed off PPI therapy and other medications. **Study population issues**: None **Other issues**: Patients were grouped by function of gastro-oesophageal junction at baseline using the Hill grade. Grade I valves: prominent tissue fold surrounding the endoscopic shaft. Grade II valves: moderately prominent tissue fold, rarely opens with respiration and closes promptly. Grade III valves: barely present fold, fails to close around endoscope. Grade IV valves: lack of muscular fold, lumen of oesophagus open allowing squamous epithelium to be viewed from below.

Abbreviations used: BMI, body mass index, GERD / GORD, gastro-oesophageal reflux disease; GI, gastrointestinal; GSRS, gastrointestinal symptom rating scale; HRQL, health related quality of life; N/S, not significant; PPI, proton pump inhibitor; QOL, quality of life; RF, radiofrequency; SF, short form;

Study details	Key efficacy findings	Key safety findings	Comments
Barnes W E (2011) **Case series** USA Recruitment period: 2008 to 2009 Study population: chronic symptomatic GORD, 75% with symptoms >5 years. **n = 124** Age:60 years (median), Sex: 26% male Patient selection criteria: GORD with persistent symptoms on daily PPIs, with reflux confirmed by endoscopy or barium swallow. Technique: Under general anaesthesia, and endoscopic visualisation; transoral fundoplication with the Esophyx 2 device, 12 to 30 fasteners deployed. PPIs continued for 2 weeks. **Follow-up: 7 months median** Conflict of interest/source of funding: supported by manufacturer.	Number of patients analysed: **n= 110** **QOL** Group median scores (range) GORD - HRQL: Transoral fundoplication; p= Baseline on PPI: 28 (0 to 45) 7 months: 2 (0 to 35); <0.001 Gastro-oesophgeal reflux symptom score: Transoral fundoplication; p= Baseline on PPI: 46 (8 to 60) 7 months of PPI: 0 (0 to 12); <0.001 Reflux symptom index: Transoral fundoplication; p= Baseline on PPI: 29(3 to 45) 7 months of PPI: 4 (0 to 30); <0.001 Absolute numbers not reported **Medication requirement** 92.7% (102/110) of patients had completely discontinued PPIs at final follow-up **Operative characteristics** 99.2% (123/124) of the procedures were completed successfully. Mean operating time 45 minutes. 1 patient had the procedure terminated due to haematoma secondary to long-term anticoagulant use.	**Complications** Perioperative events Outcome: Rate Haematoma: 0.8% (1/124) There were no other perioperative / immediate postoperative complications. Events up to 2 weeks Outcome: Rate Epigastirc pain: 50% Left shoulder pain: 15% Sore throat: 4% Nausea: 1% Absolute figures not reported **Additional surgery** 4.0% (5/124) of patients underwent Nissen revision during follow-up and were excluded from analysis.	**Follow-up issues**: Retrospective study 124 consecutive patients treated. 11.3% (14/124) patients lost to follow up. **Study design issues**: 2 participating sites Patients elected endoluminal gastroplication due to concerns about safety of laparoscopic fundoplication, had previous surgery, or preferred minimally invasive procedure. Clinicians were trained in the procedure Baseline assessment was made on PPIs, but not clear whether follow-up outcomes were also. **Study population issues**: 74% of patients had been on PPIs for > 5 years **Other issues**: No pH measurements outcomes reported.

Outcome	Baseline	7 months	p =
Heartburn	92%	19%	<0.001
Regurgitation	85%	12%	<0.001
Abdominal distention	76%	22%	<0.001
Dysphagia	68%	15%	<0.001
Coughing	77%	25%	<0.001

Abbreviations used: BMI, body mass index, GERD / GORD, gastro-oesophageal reflux disease; GI, gastrointestinal; GSRS, gastrointestinal symptom rating scale; HRQL, health related quality of life; N/S, not significant; PPI, proton pump inhibitor; QOL, quality of life; RF, radiofrequency; SF, short form;

Study details	Key efficacy findings	Key safety findings	Comments
Pleskow D (2008)[9] **Case series** USA Recruitment period: not reported Study population: symptomatic GORD **n = 33** Age: 48 years (mean), Sex: 58% male Patient selection criteria: Patients with heartburn or regurgitation for >6 months requiring daily antisecretory medication, positive oesophageal manometry study, and oesophageal acid exposure. Patients without erosive oesophagitis, Barrett's oesophagus, stricture, hiatial hernia >2cm, dysphagia, weight-loss oesophageal bleeding, vomiting, gas/bloat, or oesophageal / gastric varicies. Technique: under endoscopic visualisation gastroplication with the Plicator device, 1 suture placed. PPI medication withdrawn after 5 days follow up, where symptoms returned a rescue protocol used for medication escalating treatment from antacids to PPIs. No repeat gastroplication treatments allowed. **Follow-up: 59 months (median)** Conflict of interest/source of funding: supported by manufacturer	Number of patients analysed: **n= 33** **QOL** Group median GORD HRQL score (points) Gastroplication p= Baseline on PPIs 11 N/A Baseline off PPIs 19 N/A 36 months 8 N/R 60 months 10 <0.001* * Versus off PPI at baseline (Vs on PPI p=0.341) The proportion of patients achieving ≥50% improvement in GORD HRQL score remained stable between 36-month follow-up (55%) and 60-month follow-up (50%) (measurement of significance not reported). Group median SF-36 physical score (points) Gastroplication p= Baseline on PPIs 53 N/A Baseline off PPIs 50 N/A 36 months 51 N/R 60 months 52 <0.001* * Versus off PPI at baseline **Medication requirement** Patients requiring daily PPI medication Baseline 91% 60 months 40% (absolute figures and measurement of significance not reported) Complete cessation of PPI medication was achieved in 33.3% (10/30) of patients.	**Complications** Post procedure outcomes Outcome Rate Sore throat 45% Abdominal pain 41% Chest pain 24% Transient dysphagia 21% All resolved spontaneously (absolute numbers not reported) Two patients developed dyspnoea and 1 patient had mucosal abrasion in the fundus. Procedure was completed in all 3 with no long-term injury. No complications occurred between 36- and 60-month follow-up.	**Follow-up issues**: Retrospective follow-up of initial 1 year open label study. 51.6% (33/64) of initially treated patients responded. **Study design issues**: Multicentre study at 7 sites. Most outcomes are self-reported subjective assessments. **Study population issues**: No comparison made between patients included in this long-term follow-up analysis and those who did not respond. **Other issues**: None.

Abbreviations used: BMI, body mass index, GERD / GORD, gastro-oesophageal reflux disease; GI, gastrointestinal; GSRS, gastrointestinal symptom rating scale; HRQL, health related quality of life; N/S, not significant; PPI, proton pump inhibitor; QOL, quality of life; RF, radiofrequency; SF, short form;

Study details	Key efficacy findings	Key safety findings	Comments
Agostini M (2010)[10] Case report **n = 1** Gastroplication with EsophyX2 device under endoscopic visualisation.	A 68 year old female with high-grade GORD underwent endoluminal gastroplication under general anaesthesia breathing through a nasotracheal tube. Preoperative assessment revealed no contraindication to the procedure, 30 minutes before the end of the procedure an episode of desaturation occurred (SpO_2 < 90%), which was partially resolved by increasing FiO_2 to 50%. After withdrawal of the device SpO_2 remained low (90 – 95%) and subcutaneous emphysema was evident over the neck and face. Auscultation revealed that respiratory sounds were absent on the right side and reduced on the left. Bilateral pneumothorax was confirmed on X-ray. After bilateral insertion of chest tubes in the fifth intercostals space SpO_2 rapidly improved. Complete lung expansion was confirmed on X-ray. Chest tubes were removed at 1-day follow-up, and the patient discharged after 2 days. At 1-week follow-up there was complete resolution of subcutaneous emphysema and normal chest auscultation was observed.		Clinical experience with the procedure at the centre is not reported. No potential explanation for the event is offered.

Efficacy

Quality of life scores / heartburn symptoms.

A randomised controlled trial of 159 patients reported that a significantly greater proportion of patients had improvement in GORD HRQL score following endoluminal gastroplication (56%) than following sham treatment (18.5%) at 3-month follow-up ($p < 0.001$) (absolute figures not reported)[1]. A randomised controlled trial of 60 patients reported that there was a significantly greater improvement in mean heartburn score off medication (0 to 24 points, lower scores better) from baseline in patients treated with endoluminal gastroplication (50%) than in those treated with sham treatment (6%) at 3-month follow up ($p = 0.003$); however, there was no statistically significant difference in regurgitation scores[2].

A randomised controlled trial of 46 patients reported that the median gastrointestinal symptom rating score was significantly better following gastroplication (8 points) than following sham (13 points) at 3-month follow-up ($p < 0.05$)[4], however by 12-month follow-up the difference between groups was no longer statistically significant (11 and 12 points respectively).

A case series of 119 patients reported that group mean heartburn severity score improved significantly from 21.4 points at baseline to 8.5 points at 41-month follow-up ($p < 0.01$)[6]. A case series of 33 patients reported that group median Short form-36 physical score improved significantly from 50 points (off PPI medication) at baseline to 52 points at 5-year follow-up ($p < 0.001$), by which time 40% of patients in the study still required daily PPI medication[9].

Oesophageal pH measurement

The randomised controlled trial of 159 patients reported that mean % time exposed to pH < 4 decreased from 10% at baseline to 7% at 3-month follow-up after endoluminal gastroplication, while it increased from 9% to 10% among patients treated by sham (between group analysis $p = 0.010$)[1]. A non-randomised controlled study of 126 patients reported that mean % time exposed to pH <4 reduced significantly between baseline (10%) and 6-month follow-up (6%) following endoluminal gastroplication ($p = 0.05$), whereas following radiofrequency ablation there was no statistically significant change from baseline (11%) to 6 months follow up (9%) ($p > 0.9$) (measurement of significance between groups not reported)[5].

Medication requirement

The randomised controlled trial of 60 patients reported a significantly greater proportion of patients had a decrease of 50% or more in PPI medication requirement following endoluminal gastroplication (65%; 13/20) than following a

sham procedure (25%; 5/20) at 3-month follow-up (p = 0.011), however the sham procedure was also significantly better than no treatment (0%; 0/17) (p = 0.05)[2].

A randomised controlled trial of 51 patients reported that treatment led to a significant reduction in the proportion of patients able to reduce PPI medication by 50% or more at 6-month follow-up with both endoluminal gastroplication (77%; 20/26) and endoscopic injection of polymer (87%; 20/23) (p = 0.0001 for both procedures), however the difference between groups was not statistically significant (p = 0.365)[3].

Safety

Perforation

A case series of 86 patients reported perforation of the oesophagus in 2 patients (one reportedly with a narrow hypopharynx) during the procedure, both were resolved with surgical suture or repair, with no clinical sequelae[7].

Pneumothorax

A case report of 1 patient undergoing endoluminal gastroplication reported that bilateral pneumothorax occurred following withdrawal of the device. Complete lung expansion was confirmed on X-ray following temporary insertion of chest tubes, and the patient was discharged at 2-day follow-up[10].

Pain

A randomised controlled trial of 159 patients reported that epigastric pain occurred in 12% (9/78) of patients in the endoluminal gastroplication group and in 4% (3/81) of patients in the sham group following the procedure (p = 0.076)[1], abdominal pain was significantly more common following endoluminal gastroplication 9% (7/78) than following sham treatment 0% (0/81) (p = 0.006).

Digestive complications

A randomised controlled trial of 159 patients reported that there was no statistically significant difference between the endoluminal gastroplication and sham groups in the rate of vomiting (5% [4/78] and 4% [3/81] respectively), nausea (8% [6/78] and 1% [1/81]), and dysphagia (3% [2/78] and 2% [2/81]) following the procedure (length of follow-up not reported)[1]. A randomised controlled trial of 60 patients reported that dysphagia (up to 7-day follow-up) occurred in 50% (10/20) of patients following endoluminal gastroplication and 5% (1/20) of patients following the sham procedure (significance not reported)[2].

A case series of 119 patients treated by endoluminal gastroplication reported that 1 out of 119 patients required a suture to be removed due to difficulty swallowing,

and that oesophageal fungal infection occurred in 2% (2/119) of patients (length of follow-up not reported)[6].

Other

A randomised controlled trial of 46 patients reported that all procedures in both treatment groups (endoluminal gastroplication or sham) were undertaken without complications and all patients were discharged within 1-day follow-up[4].

Suture longevity

A randomised controlled trial of 60 patients reported that among 29% of patients who had subsequent endoluminal gastroplication within 12 months of the first procedure, 72% of the original sutures were still present, but only 19% were functional (not otherwise defined) [2].

Validity and generalisability of the studies

- The intervention received (degree of gastroplication) varied between studies. Also different configurations of gastroplication may influence outcome.
- There was a considerable placebo effect with sham treatment.
- Little long term data are available (one small case series to 5-year follow-up). There is some evidence of drop off of treatment effect at 1-year follow-up.
- Concomitant use of PPI medication was not standardised across all studies. Some outcomes were reported as being assessed off PPIs (24 hour pH monitoring).
- Only 2 out of 4 RCTs were double-blinded; 1 was unblinded and 1 blinded to patients only (but blinding effectiveness was not tested)
- Comparators differ across controlled studies; 3 had a sham procedure with no suturing, 1 used injection of bulking agents and 1 used radiofrequency ablation, making the efficacy of the procedure difficult to triangulate.
- Studies varied substantially between them in comparator interventions (controlled studies) and in patient selection and exclusion criteria, specifically in relation to comorbid conditions.

- In some studies repeat gastroplication was allowed per protocol, whereas in other studies, outcomes were assessed after 1 treatment only. This makes comparisons between studies difficult.

Existing assessments of this procedure

aSERNIP

Endoscopic treatments for gastro-oesophageal reflux disease. Accelerated systematic review. Report No. 54. August 2006 (not specific to endoluminal gastroplication).

CONCLUSION

'Due to the relatively recent genesis of endoscopic anti-reflux therapies for the treatment of GORD, their scope, applicability, efficacy and cost effectiveness have not been established. Results from the included studies suggested that endoscopic procedures may improve symptoms and quality of life and reduce the need for drug therapy in select patients with GORD. However, in some sham controlled trials the outcomes between groups were similar, and endoscopic results were generally inferior when compared with laparoscopic fundoplication. Doubts about the durability of improvements in outcomes cannot be allayed by the current evidence.'

Blue Cross / Blue Shield medical policy

Transesophageal Endoscopic Therapies for Gastroesophageal Reflux Disease: policy 110. Approved Oct. 2009.

POLICY / CRITERIA

'Transesophageal endoscopic therapies are considered investigational for the treatment of gastroesophageal reflux disease (GERD).'

POSITION STATEMENT

'Current published evidence is insufficient to establish the long-term safety and effectiveness of transesophageal endoscopic antireflux procedures for the treatment of gastroesophageal reflux disease (GERD).

It is uncertain whether transesophageal endoscopic antireflux procedures can reliably decrease the need for medications to manage symptoms, decrease acid exposure to the esophagus, improve the extent of esophagitis, or improve overall health outcomes in the long-term in patients with GERD.

It is unknown whether transesophageal endoscopic antireflux procedures are at least as effective as medical management or standard open or laparoscopic Nissen fundoplication.

Published clinical practice guidelines concluded that current clinical trial data has neither established the safety, effectiveness and durability of these procedures, nor identified clear indications and patient selection criteria.'

Related NICE guidance

Below is a list of NICE guidance related to this procedure. Appendix B gives details of the recommendations made in each piece of guidance listed.

Interventional procedures

- Endoscopic injection of bulking agents for gastro-oesophageal reflux disease. NICE interventional procedures guidance 055 (2004). Available from www.nice.org.uk/guidance/IPG55

- Endoscopic radiofrequency ablation for gastro-oesophageal reflux disease. NICE interventional procedures guidance 292 (2009). Available from www.nice.org.uk/guidance/IPG292

- Endoscopic augmentation of the lower oesophageal sphincter using hydrogel implants for the treatment of gastro-oesophageal reflux disease. NICE interventional procedures guidance 222 (2007). Available from www.nice.org.uk/guidance/IPG222

Clinical guidelines

- Dyspepsia: Managing dyspepsia in adults in primary care. NICE clinical guideline 17 (2004). Available from www.nice.org.uk/guidance/CG17

Specialist Advisers' opinions

Specialist advice was sought from consultants who have been nominated or ratified by their Specialist Society or Royal College. The advice received is their individual opinion and does not represent the view of the society.

Mr J Anderson (British Society of Gastroenterology), Mr S Paterson-Brown (Association of Upper Gastro Intestinal Surgeons of Great Britain and Ireland), Mr M Thompson (British Society of Gastroenterology) .

- Two Specialist Advisers categorised this procedure as novel and of uncertain safety and efficacy, and one considered it to be established and no longer new.
- The main comparators to the procedure include long-term PPIs, or laparoscopic or Nissen fundoplication.
- Theoretical adverse effects include perforation of the oesophagus and proximal stomach, stenosis of oesophageal junction, early failure to control reflux, injury to surrounding tissues/organs, dysphagia and foreign body sensation
- A Specialist Adviser considered the key efficacy outcomes to include control of acid reflux without further surgery.
- There are uncertainties about long-term efficacy and patient selection.
- Training involves visiting centres, mainly across Europe, who carry out this procedure, followed by mentoring by experts. The manufacturer offers didactic sessions and hands-on animal training under supervision of specialized clinical training staff. Optional training modalities include clinical case observation and didactic with a physician host.
- Maastricht Hospital has carried out the most of these procedures in Europe and are currently analysing their longer-term results.
- There is currently some uncertainty about the value of this procedure in the long term, and its advantage over laparoscopic fundoplication.
- Likely to be suitable for a very limited number of patients.
- According to the U.S. Medical Device Reporting database, a total of 19 serious adverse events related to the use of EsophyX have occurred for a total of 3,170 cases performed worldwide as of 1 August 2010.
- A number of trials (registries and prospective RCTs) are ongoing (see details below).
- One Specialist Adviser noted that the relatively non-invasive nature, cost-efficacy, and short hospitilisation time, along with the lack of scar and cosmesis benefits are strong arguments in favour of pursuing this technology.

If efficacy and safety data are accepted and continue to be monitored then this is certainly a step forward by all means of assessment.

Patient Commentators' opinions

NICE's Patient and Public Involvement Programme was unable to gather patient commentary for this procedure.

Issues for consideration by IPAC

- This procedure was due for review as part of the usual 3-year IP review process; however an additional / separate notification to the programme has also been received.
- Among UK adults, gastro-oesophageal reflux symptoms are more common among the socially disadvantaged.
- A considerable number of studies are included in Appendix A.
- A number of studies are ongoing with this procedure.

1) Transoral Incisionless Fundoplication (TIF) Registry Study for Treatment of Gastroesophageal Reflux Disease (GERD) - NCT01118585 - USA multicenter registry, follow up 12 months, target completion September 2012.

2) Endoscopic Fundoplication vs Proton Pump Inhibitors for GERD Treatment NCT00857597 - USA randomised open label controlled trial (vs PPIs), follow up 12 months, target completion March 2011.

3) Randomized EsophyX vs Sham/Placebo Controlled TIF Trial: The RESPECT Study - NCT01136980 - USA randomised single blind controlled trial (vs sham), follow up 12 months, target completion December 2011.

4) Transoral Incisionless Fundoplication (TIF) vs Sham for Treatment of Gastroesophageal Reflux Disease (GERD) - NCT01110811 - European randomised single blind controlled trial (vs sham), follow up 6 months, target completion June 2011.

- Non-English language studies have not been selected for the overview as considerable data are available in English.

References

1 Rothstein R, Filipi C, Caca K et al. (2006) Endoscopic full-thickness plication for the treatment of gastroesophageal reflux disease: A randomized, sham-controlled trial. Gastroenterology 131:704-712.

2 Schwartz MP, Wellink H, Gooszen HG et al. (2007) Endoscopic gastroplication for the treatment of gastro-oesophageal reflux disease: a randomised, sham-controlled trial. Gut 56:20-28.

3 Domagk D, Menzel J, Seidel M et al. (2006) Endoluminal gastroplasty (EndoCinch) versus endoscopic polymer implantation (Enteryx) for treatment of gastroesophageal reflux disease: 6-month results of a prospective, randomized trial. American Journal of Gastroenterology 101:422-430.

4 Montgomery M, Hakanson B, Ljungqvist O et al. (2006) Twelve months' follow-up after treatment with the EndoCinch endoscopic technique for gastro-oesophageal reflux disease: a randomized, placebo-controlled study. Scandinavian Journal of Gastroenterology 41:1382-1389.

5 Jeansonne LO, White BC, Nguyen V et al. (2009) Endoluminal full-thickness plication and radiofrequency treatments for GERD: an outcomes comparison. Archives of Surgery 144:19-24.

6 Paulssen EJ and Lindsetmo RO (2008) Long-term outcome of endoluminal gastroplication in the treatment of gastro-oesophageal reflux disease: effect of a second procedure. Scandinavian Journal of Gastroenterology 43:5-12.

7 Cadiere GB, Buset M, Muls V et al. (2008) Antireflux transoral incisionless fundoplication using EsophyX: 12-month results of a prospective multicenter study. World Journal of Surgery 32:1676-1688.

8 Chen YK, Raijman I, Ben-Menachem T et al. (2005) Long-term outcomes of endoluminal gastroplication: a U.S. multicenter trial. Gastrointestinal Endoscopy 61:659-667.

9 Pleskow D, Rothstein R, Kozarek R et al. (2008) Endoscopic full-thickness plication for the treatment of GERD: Five-year long-term multicenter results. Surgical Endoscopy 22:326-332.

10 Agostoni M and Boemo C (2010) Bilateral pneumothorax during transoral incisionless fundoplication. European Journal of Anaesthesiology 27:216-217.

Appendix A: Additional papers on endoluminal gastroplication for gastro-oesophageal reflux disease

The following table outlines the studies that are considered potentially relevant to the overview but were not included in the main data extraction table (table 2). It is by no means an exhaustive list of potentially relevant studies.

Article	Number of patients/follow-up	Direction of conclusions	Reasons for non-inclusion in table 2
Abou-Rebyeh, H., Hoepffner, N., Rosch, T. et al (2005) Long-term failure of endoscopic suturing in the treatment of gastroesophageal reflux: a prospective follow-up study. Endoscopy 37 (3) 213-216	n = 38 FU = 1 year	Endoluminal Gastroplication has some short-term beneficial effects on clinical symptoms and pH-metry. However, mainly due to the loss of the endoscopically placed sutures, these effects were not maintained at the 1-year follow-up. EGP cannot therefore be recommended for routine clinical use.	Larger studies are included in table 2
Arts, J., Lerut, T., Rutgeerts, P et al (2005) A one-year follow-up study of endoluminal gastroplication (Endocinch) in GERD patients refractory to proton pump inhibitor therapy. Digestive Diseases & Sciences 50 (2) 351-356	n = 20 FU = 12 months	We conclude that endoluminal gastroplication provides short- and medium-term symptomatic and objective relief to a subset of GERD patients refractory to high-dose PP	Larger studies are included in table 2
Bell RCW, Freeman K. (2010) Clinical and pH-metric outcomes of transoral esophago-gastric fundoplication for the treatment of gastroesophageal reflux disease (GERD). Surgical Endoscopy. Dec 2010 Epub ahead of print	n = 37 FU = 6 months	Rotational/longitudinal esophagogastric fundoplication using the EsophyX device significantly improved symptomatic and objective outcomes in over 70% of patients at median 6-month follow-up. Post-fundoplication side effects were not reported after transoral incisionless fundocplication	Appendix A Larger studies are included in Table 2
Bergman, S., Mikami, D. J., Hazey, J. W et al (2008) Endoluminal fundoplication with EsophyX: the initial North American experience. Surgical Innovation 15 (3) 166-170	n = 8 FU = 2 months	It appears to be safe and provides moderate effectiveness in treating the symptoms of GERD. Further studies comparing this technique with conventional medical and surgical therapies are necessary	Larger studies are included in table 2
Birk, J., Pruitt, R., Haber, G et al (2009) The	n = 81	The Plicator procedure effectively improved GERD	Larger studies are included in table 2

Plicator procedure for the treatment of gastroesophageal reflux disease: a registry study. Surgical Endoscopy 23 (2) 423-431	FU = 1 year	quality-of-life scores, reduced GERD symptoms and medication use, and yielded higher treatment satisfaction than with the use of chronic antisecretory therapy	
Cadiere, G. B., Rajan, A., Rqibate, M. et al (2008) Endoluminal fundoplication (ELF)--evolution of EsophyX, a new surgical device for transoral surgery. Minimally Invasive Therapy & Allied Technologies: Mitat 15 (6) 348-355	n = 19 FU = 1 year	The endoluminal gastroplication procedure provides an anatomical approach similar to that of laparoscopic anti-reflux surgery for the treatment of GERD	Larger studies are included in table 2 Probably the same patients as reported in Cadiere (2008) in table 2
Cadiere, G. B., Van, Sante N., Graves, J et al (2009) Two-year results of a feasibility study on antireflux transoral incisionless fundoplication using EsophyX. Surgical Endoscopy 23 (5) 957-964	n = 19 FU = 2 years	The results at 2 years supported the long-term safety and durability of transoral incisionless fundoplication (endoscopic gastroplication) and its sustained effect on the elimination of heartburn, esophagitis, <or=2 cm hiatal hernia, and daily dependence on PPIs	Larger studies are included in table 2 Probably the same patients as reported in Cadiere (2008) in table 2
Chadalavada R, Lin E, Swafford V, Sedghi S, et al. (2004) Comparative results of endoluminal gastroplasty and laparoscopic antireflux surgery for the treatment of GERD. Surgical Endoscopy; 18(2).261–5	n = 87 FU = 8 months	Laparoscopic antireflux surgery offers greater reduction in medication use than endoluminal gastroplication, as well as more durable patient satisfaction. Benefits of endoluminal gastroplication may include short-term symptomatic improvement while considering definitive surgical management	Larger studies are included in table 2
Chen, Y. K., Raijman, I., Ben-Menachem, T et al (2005) Long-term outcomes of endoluminal gastroplication: a U.S. multicenter trial. Gastrointestinal Endoscopy 61 (6) 659-667	n = 85 FU = 12 months	Endoscopic gastroplication is safe and effective, and is associated with symptom reductions in patients with GERD for at least 24 months	Larger studies are included in table 2
Chen, D., Barber, C., McLoughlin, P et al (2008) Systematic review of endoscopic treatments for gastro-oesophageal reflux disease. [Review] [45 refs]. British Journal of Surgery 96 (2) 128-136	n = 740 FU = 1.5 to 24 months	At present there is insufficient evidence to determine the safety and efficacy of endoscopic procedures for gastro-oesophageal reflux disease, particularly in the long term	Systematic review with no meta-analysis. Same studies as included elsewhere in this overview. Newer RCTs included in table 2

Chuttani, R., Sud, R., Sachdev, G et al (2003) A novel endoscopic full-thickness plicator for the treatment of GERD: A pilot study. Gastrointestinal Endoscopy 58 (5) 770-776	n = 7 FU = 1 year	Endoscopic full-thickness plication is feasible, safe and, in this pilot study, appeared to reduce symptoms and medication use associated with GERD	Larger studies are included in table 2
Conchillo, J. M., Schwartz, M. P., Selimah, M et al (2007) Role of intra-oesophageal impedance monitoring in the evaluation of endoscopic gastroplication for gastro-oesophageal reflux disease. Alimentary Pharmacology & Therapeutics 26 (1) 61-68	n = 18 FU = 3 months	Impedance monitoring can identify the specific effect of endoscopic gastroplication on the different types of reflux episodes with regard to gas-liquid composition and pH, as well as on volume clearance and the proximal extent of the refluxate	Larger studies are included in table 2
Davis, R. E., Iqbal, A., Gerhardt, J. D et al (2005) A long-term comparison of plication configurations for endoluminal gastroplication: circumferential versus helical. Journal of Clinical Gastroenterology 39 (10) 869-876	n = 20 FU = 18 months	Endoluminal gastroplication improves heartburn and regurgitation scores at 18 months. Our study suggests that there is no benefit to additional plications when using the helical pattern	Larger studies are included in table 2 Comparison of two different endoluminal gastroplication techniques
DeMarco, D. C. and Anderson, R. D. (2003) Outcomes of endoluminal gastric plication for the treatment of gastroesophageal reflux disease. Baylor University Medical Center Proceedings 16 (4) 392-393	n = 43 FU = 1 year	Larger studies will need to be done to aid the physician in evidence based decision making for treatment of GORD.	Larger studies are included in table 2
Demyttenaere, S. V., Bergman, S., Pham, T., et al (2010) Transoral incisionless fundoplication for gastroesophageal reflux disease in an unselected patient population. Surgical Endoscopy 24 (4) 854-858.	n = 26 FU = 10 months	Both symptoms and health-related quality-of-life (HRQL) scores significantly improved after treatment. Further follow-up evaluation and objective testing are required	Larger studies are included in table 2

Filipi, C. J., Lehman, G. A., Rothstein, R. I et al (2001) Transoral, flexible endoscopic suturing for treatment of GERD: a multicenter trial. Gastrointestinal Endoscopy 53 (4) 416-422	n = 64 FU = 6 months	Endoscopic gastroplasty is safe. It is associated with reduced symptoms and medication use at 6 month follow-up in patients with uncomplicated GERD	Larger studies are included in table 2
Fry, L. C., Monkemuller, K., and Malfertheiner, P. (2007) Systematic review: endoluminal therapy for gastro-oesophageal reflux disease: evidence from clinical trials. European Journal of Gastroenterology & Hepatology 19 (12) 1125-1139	n = 641(gastroplication) FU = 3 to 24 months	Currently, however, there are not enough scientific and clinical data on safety, efficacy and durability to support the use of endoluminal therapies for GORD in routine clinical practice	Systematic review with no meta-analysis. Same studies as included elsewhere in this overview. Newer RCTs included in table 2
Higuchi, K., Shiba, M., Okazaki, H et al (2007) Four-year follow-up of the first case of gastroesophageal reflux disease treated with endoluminal gastroplication in Japan. Journal of Gastroenterology 42 (4) 325-326	n = 1 FU = 4 years	The patient has not taken oral antacids for 4 years.	Larger studies are included in table 2
Hoppo, T., Immanuel, A., Schuchert, M (2010) Transoral incisionless fundoplication 2.0 procedure using EsophyX for gastroesophageal reflux disease. Journal of Gastrointestinal Surgery 14 (12) 1895-1901	n = 19 FU = 11 months	At short-term follow-up, the TIF procedure is associated with an excessive early symptomatic failure rate, and a high surgical re-intervention rate. This procedure should not be performed outside of a clinical trial	Larger studies are included in Table 2
Idani, H., Ishikawa, T., Iwamoto, T etr al (2007) Endoluminal gastroplication for gastroesophageal reflux appearing after gastric surgery. Digestive Endoscopy 19 (2) 93-96	n = 2 FU = up to 18 months	Endoluminal gastroplication is safe and effective for GERD that develops after surgery although this needs to be confirmed in long-term follow-up studies	Larger studies are included in table 2
Liao, C. C., Lee, C. L., Lin, B. R. et al (2007) Endoluminal gastroplication for the treatment of gastroesophageal reflux	n = 21 FU = 2 years	Endoluminal gastroplication is a safe and modestly effective endotherapy for patients with GERD	Larger studies are included in table 2

disease: a 2-year prospective pilot study from Taiwan. Journal of Gastroenterology & Hepatology 23 (3) 398-405			
Liu, J. J., Carr-Locke, D. L., Osterman, M. T. et al (2006) Endoscopic treatment for atypical manifestations of gastroesophageal reflux disease. American Journal of Gastroenterology 101 (3) 440-445	n = 39 FU = 18 months	Endoscopic suturing of the gastroesophageal junction appears to be a possible treatment option for atypical manifestations of GERD and future studies are needed to determine its role in management	Larger studies are included in table 2
Liu, J. J., Carr-Locke, D. L., Lee, L. S et al (2004) Endoluminal gastroplication for treatment of patients with classic gastroesophageal reflux symptoms and borderline 24-h pH studies. Scandinavian Journal of Gastroenterology 39 (7) 615-620	n = 25 FU = 1 year	Endoluminal gastroplication provides symptomatic relief for patients with classic GERD symptoms despite medical therapy and borderline 24-h pH studies	Larger studies are included in table 2
Mahmood, Z., Byrne, P. J., McMahon, B. P et al (2006) Comparison of transesophageal endoscopic plication (TEP) with laparoscopic Nissen fundoplication (LNF) in the treatment of uncomplicated reflux disease. American Journal of Gastroenterology 101 (3) 431-436	n = 51 FU = 1 year	A safe and effective method of management of symptomatic GERD but further developments are necessary to ensure control of esophageal acid reflux	Larger studies are included in table 2
Mahmood, Z., McMahon, B. P., Arfin, Q., et al (2003) Endocinch therapy for gastro-oesophageal reflux disease: a one year prospective follow up. Gut 52 (1) 34-39	n = 26 FU = 1 year	The Endocinch procedure is an effective and safe outpatient procedure that offers GORD patients significant improvement in symptomatology, QOL, and reduced requirements for PPIs over at least a one year period	Larger studies are included in table 2
Marinis, A., Stefanidis, G., Tsaroucha, A et al (2008) Endoluminal fundoplication for the treatment of GERD: A preliminary report of a new transoral approach. Annals of Gastroenterology 21 (2)	n = 2 FU = 1 week	According to recent studies, reduction of invasiveness, procedural time, adverse effects, hospital stay and need for medical treatment seems to be cost-saving in combination with clinical effectiveness and improved	Larger studies are included in table 2

109-113		quality of life	
Mosler, P., Aziz, A. M., Hieston, K et al (2008) Evaluation of supplemental cautery during endoluminal gastroplication for the treatment of gastroesophageal reflux disease. Surgical Endoscopy 22 (10) 2158-2163	n = 18 FU = 2 years	Little or no long-term efficacy of endoluminal gastroplication with or without cautery was observed after 2 years of follow-up evaluation	Atypical intervention with combined gastroplication and ablation. Larger studies are included in table 2
Ozawa, S., Kumai, K., Higuchi, K et al (2009) Short-term and long-term outcome of endoluminal gastroplication for the treatment of GERD: the first multicenter trial in Japan. Journal of Gastroenterology 44 (7) 675-684	n = 48 FU = 2 years	In this 24-month follow-up study conducted in Japanese subjects, endoluminal gastroplication was found to be effective in about 60% of patients with GERD, and the procedure was safe	Larger studies are included in table 2
Pleskow, D., Rothstein, R., Lo, S et al (2004) Endoscopic full-thickness plication for the treatment of GERD: a multicenter trial. Gastrointestinal Endoscopy 59 (2) 163-171	n = 64 FU = 6 months	In this study, a single full-thickness plication placed at the gastroesophageal junction reduced symptoms, medication use, and esophageal acid exposure associated with GERD	Larger studies are included in table 2 Studies with longer follow up are included in table 2
Pleskow, D., Rothstein, R., Lo, S. et al (2005) Endoscopic full-thickness plication for the treatment of GERD: 12-month follow-up for the North American open-label trial. Gastrointestinal Endoscopy 61 (6) 643-649	n = 64 FU = 1 year	Full-thickness plication at the gastroesophageal junction is an effective endoscopic procedure for treatment of patients with symptoms caused by GERD. It reduces reflux symptoms and antisecretory medication use over at least a 1-year period	Larger studies are included in table 2
Repici, A., Fumagalli, U., Malesci, A et al (2010) Endoluminal fundoplication (ELF) for GERD using EsophyX: a 12-month follow-up in a single-center experience. Journal of Gastrointestinal Surgery 14 (1) 1-6	n = 20 FU = 1year	Endoscopic gastroplication induced improvement of GERD symptoms and patients quality of life in a subgroup of patients with a reduced need for medication. However, it did not significantly change esophageal acid exposure in these patients. The need for revisional standard laparoscopic fundoplication was high	Larger studies are included in table 2
Schiefke, I., Neumann, S., Zabel-Langhennig, A et al (2005) Use of an	n = 20	Endoluminal gastroplication using the ESD is an easy and safe, but unfortunately	Larger studies are included in table 2

endoscopic suturing device (the "ESD") to treat patients with gastroesophageal reflux disease, after unsuccessful EndoCinch endoluminal gastroplication: another failure. Endoscopy 37 (8) 700-705	FU = 6 months	ineffective procedure for endoscopic GERD treatment. Endoluminal gastroplication techniques clearly need refinements before these therapies can evolve as a treatment option for GERD patients	Possibly same patients as Schiefke (2005)
Schiefke, I., Zabel-Langhennig, A., Neumann, S et al (2005) Long term failure of endoscopic gastroplication (EndoCinch). Gut 54 (6) 752-758	n = 70 FU = 18 months	Endoscopic gastroplication (EndoCinch) is a safe and minimally invasive endoscopic treatment for GORD with reasonable short term results. In contrast, long term outcome is disappointing, probably due to suture loss in the majority of patients	Larger studies are included in table 2
Schilling, D., Kiesslich, R., Galle, P et al (2005) Endoluminal therapy of GERD with a new endoscopic suturing device. Gastrointestinal Endoscopy 62 (1) 37-43	n = 20 FU = 3 months	The new endoscopic suturing device allows a feasible and safe technique for application of endoscopic sutures. The procedure could be performed on an outpatient basis by using sedation with propofol. However, the clinical outcome was very limited because of the high number of lost or failed plications	Larger studies are included in table 2
Tam, W. C., Holloway, R. H., Dent, J., et al (2004) Impact of endoscopic suturing of the gastroesophageal junction on lower esophageal sphincter function and gastroesophageal reflux in patients with reflux disease. American Journal of Gastroenterology 99 (2) 195-202	n = 15 FU = 1 year	These changes in lower oesophageal sphincter function result in only a modest reduction in gastroesophageal reflux	Larger studies are included in table 2
Testoni, P. A., Corsetti, M., Di, Pietro S., et al (2010) Effect of transoral incisionless fundoplication on symptoms, PPI use, and ph-impedance refluxes of GERD patients. World Journal of Surgery 34 (4) 750-757	n = 20 FU = 6 months	Endoluminal gastroplication performed using the EsophyX device reduces symptoms and pH-impedance refluxes, allowing interruption or reduction of PPI use in 78% of patients with GERD	Larger studies are included in table 2
Thomson, M., Antao, B., Hall, S et al (2008) Medium-term outcome	n = 17	Endoluminal gastroplication is an effective and safe procedure in children. It is a	Larger studies are included in table 2

of endoluminal gastroplication with the EndoCinch device in children. Journal of Pediatric Gastroenterology & Nutrition 46 (2) 172-177	FU = 3 years	viable option for the treatment of GERD refractory to or dependent on antireflux medications	
Tierney, B., Iqbal, A., Haider, M et al (2007) Effects of prior endoluminal gastroplication on subsequent laparoscopic Nissen fundoplication. Surgical Endoscopy 21 (2) 321-323	n = 6 FU = Not reported	Endoluminal gastroplication does not alter the surgical dissection or results of a subsequent laparoscopic Nissen fundoplication.	Larger studies are included in table 2
Tuebergen, D., Rijcken, E., and Senninger, N. (2004) Esophageal perforation as a complication of EndoCinch endoluminal gastroplication. Endoscopy 36 (7) 663-665	n = 1 FU = 6 months	This experience emphasises the importance of appropriate management of complications as part of the evaluation of new endoscopic methods	Larger studies are included in table 2 Safety outcome reported elsewhere in the literature.
Velanovich, V., Ben-Menachem, T., and Goel, S (2002) Case-control comparison of endoscopic gastroplication with laparoscopic fundoplication in the management of gastroesophageal reflux disease: early symptomatic outcomes. Surgical Laparoscopy, Endoscopy & Percutaneous Techniques 12 (4) 219-223	n = 54 FU = 6 weeks	Endoscopic gastroplication is a viable alternative to laparoscopic fundoplication in selected patients. Nevertheless, approximately one quarter of patients will have no improvement, which is much more than those undergoing laparoscopic fundoplication	Larger studies are included in table 2
Velanovich, V. (2010) Endoscopic, endoluminal fundoplication for gastroesophageal reflux disease: Initial experience and lessons learned. Surgery 148 (4) 646-653	n = 26 FU = N/R	Endoscopic fundoplication with the Esophyx device is feasible with satisfactory initial results. Endoscopic fundoplication seems to be best suited for patients with small hiatal hernias and mild-to-moderate typical symptoms; however, subsequent trials are needed to assess the long-term effectiveness of the technique	Larger studies are included in Table 2
von, Renteln D., Schmidt, A., Riecken, B. et al (2010) Evaluating outcomes of endoscopic full-thickness plication for gastroesophageal	n = 12 FU = 6 months	Endoscopic full-thickness plication significantly reduced total reflux episodes, acid reflux episodes, and total reflux exposure time	Larger studies are included in table 2

reflux disease (GERD) with impedance monitoring. Surgical Endoscopy 24 (5) 1040-1048			
von, Renteln D., Schiefke, I., Fuchs, K et al (2009) Endoscopic full-thickness plication for the treatment of gastroesophageal reflux disease using multiple Plicator implants: 12-month multicenter study results. Surgical Endoscopy 23 (8) 1866-1875	n = 41 FU = 1 year	Endoscopic full-thickness plication using multiple Plicator implants can be used safely and effectively to improve GERD symptoms and reduce medication use	Larger studies are included in table 2
Wenzel, G., Kuhlbusch, R., Heise, J. et al (2005) Relief of reflux symptoms after endoscopic gastroplication may be associated with reduced esophageal acid sensitivity: a pilot study. Endoscopy 37 (3) 236-239	n = 6 FU = 1 month	These preliminary data suggest that the decrease of esophageal sensitivity to acid after endoscopic gastroplication is part of the mechanism responsible for the reduction of reflux symptoms	Larger studies are included in table 2
White, B., Jeansonne, L. O., Cook, M et al (2009) Use of endoluminal antireflux therapies for obese patients with GERD. Obesity Surgery 19 (6) 783-787	n = 22 (10 plic.) FU = 1.5 year	Endoluminal treatment can provide a safe means of improving GERD symptoms for some obese patients, though many will continue to require medication therapy also. Further work aimed at understanding optimal candidates for endoluminal therapy in this patient population is warranted	Larger studies are included in Table 2

Appendix B: Related NICE guidance for endoluminal gastroplication for gastro-oesophageal reflux disease

Guidance	Recommendations
Interventional procedures	**Endoscopic injection of bulking agents for gastro-oesophageal reflux disease. NICE interventional procedures guidance 055 (2004)** 1.1 Current evidence on the safety and efficacy of endoscopic injection of bulking agents for gastro-oesophageal reflux disease does not appear adequate for this procedure to be used without special arrangements for consent and for audit or research 1.2 Clinicians wishing to undertake endoscopic injection of bulking agents for gastrooesophageal reflux disease should take the following action. • Inform the clinical governance leads in their Trusts. • Ensure that patients understand the uncertainty about the procedure's safety and efficacy and provide them with clear written information. Use of the Institute's Information for the Public is recommended. • Audit and review clinical outcomes of all patients having endoscopic injection of bulking agents for gastro-oesophageal reflux disease. 1.3 Publication of safety and efficacy outcomes will be useful in reducing the current uncertainty. The Institute may review the procedure upon publication of further evidence **Endoscopic radiofrequency ablation for gastro-oesophageal reflux disease. NICE interventional procedures guidance 293 (2009)** 1.1 The evidence on safety and efficacy of endoscopic radiofrequency (RF) ablation for gastro-oesophageal reflux disease (GORD) is inadequate and there are inconsistencies in the evidence on efficacy (see section 2.5.1). Therefore, this procedure should only be used with special arrangements for clinical governance, consent and audit or research 1.2 Clinicians wishing to undertake endoscopic RF ablation for GORD should take the following actions. • Inform the clinical governance leads in their Trusts. • Ensure that patients understand the uncertainty about the procedure's efficacy and provide them with clear written information. In addition, the use of NICE's information for patients ('Understanding NICE guidance') is recommended • Audit and review clinical outcomes of all patients having endoscopic RF ablation for GORD (see section 3.1). 1.3 NICE may review the procedure on publication of further evidence

	Endoscopic augmentation of the lower oesophageal sphincter using hydrogel implants for the treatment of gastro-oesophageal reflux disease. NICE interventional procedures guidance 222 (2007) 1.1 There is limited evidence of short-term efficacy on endoscopic augmentation of the lower oesophageal sphincter using hydrogel implants for the treatment of gastro-oesophageal reflux disease (GORD). This evidence also raises concerns about the procedure's safety. Therefore, this procedure should not be used without special arrangements for consent and for audit 1.2 Clinicians wishing to undertake endoscopic augmentation of the lower oesophageal sphincter using hydrogel implants for the treatment of GORD should take the following actions. • Inform the clinical governance leads in their Trusts. • Ensure that patients understand the uncertainty about the procedure's safety and efficacy and provide them with clear written information. In addition, use of the Institute's information for patients ('Understanding NICE guidance') is recommended • Audit and review clinical outcomes of all patients having endoscopic augmentation of the lower oesophageal sphincter using hydrogel implants for the treatment of GORD (see section 3.1). 1.3 Any adverse events resulting from the procedure should be reported to the Medicines and Healthcare products Regulatory Agency (MHRA).
Clinical guidelines	**Dyspepsia: Managing dyspepsia in adults in primary care NICE clinical guideline CG17 (2004)** 1.6.6 Surgery cannot be recommended for the routine management of persistent GORD although individual patients whose quality of life remains significantly impaired may value this form of treatment. • Open surgery is no better than long-term medical therapy at achieving remission from symptoms. • Laparoscopic surgery is no better than open surgery at achieving remission from symptoms. • There is a small (0.1−0.5%) but important post-operative mortality associated with anti-reflux surgery.

Appendix C: Literature search for endoluminal gastroplication for gastro-oesophageal reflux disease

Database	Date searched	Version/files	
Cochrane Database of Systematic Reviews – CDSR (Cochrane Library)	09/09/2010	Sept 2010	8
Database of Abstracts of Reviews of Effects – DARE (CRD website)	09/09/2010	Sept 2010	4
HTA database (CRD website)	09/09/2010	Sept 2010	8
Cochrane Central Database of Controlled Trials – CENTRAL (Cochrane Library)	09/09/2010	Sept 2010	23
MEDLINE (Ovid)	09/09/2010	1950 to August Week 5 2010	209
MEDLINE In-Process (Ovid)	09/09/2010	September 08, 2010	7
EMBASE (Ovid)	09/09/2010	1980 to 2010 Week 35	274
CINAHL (NLH Search 2.0 or EBSCOhost)	09/09/2010	Sept 2010	20
BLIC (Dialog DataStar)	09/09/2010	Sept 2010	1

The following search strategy was used to identify papers in MEDLINE. A similar strategy was used to identify papers in other databases.

1	Endoscopy/
2	Suture Techniques/
3	1 and 2
4	(Endoscop* adj3 (Plicat* or Sew* or Sutur*)).tw.
5	(Endoluminal* or Endo-luminal*).tw.
6	(Gastroplicat* or Gastro-plicat*).tw.
7	ELGP*.tw.
8	Endocinch*.tw.
9	(Endoscopic* adj3 Submucosal* adj3 Dissection*).tw.
10	ESD*.tw.
11	(Suture* adj3 (surg* or technic* or procedure* or method*)).tw.

12	Fundoplication/
13	fundoplicat*.tw.
14	12 or 13
15	(incisionless* or incision-less*).tw.
16	14 and 15
17	TIF*.tw.
18	EsophyX.tw.
19	or/3-11,16-18
20	Esophageal Motility Disorders/
21	Gastroesophageal Reflux/
22	Heartburn/
23	(Esophageal* adj3 Motility* adj3 Disorder*).tw.
24	(Esophageal* adj3 Dysmotility*).tw.
25	((Gastroesophag* or Gastro-oesophag* or Gastro oesophag* or Gastro-esophag* or Gastro esophag*) adj3 Reflux*).tw.
26	GORD*.tw.
27	GERD*.tw.
28	(acid* adj3 heartburn*).tw.
29	20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28
30	19 and 29
31	Animals/ not Humans/
32	30 not 31