Pain after laparoscopic antireflux surgery

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ABSTRACT

INTRODUCTION The benefits of antireflux surgery are well established. Laparoscopic techniques have been shown to be generally safe and effective. The aim of this paper was to review the subject of pain following laparoscopic antireflux surgery.

METHODS A systematic review of the literature was conducted using the PubMed database to identify all studies reporting pain after laparoscopic antireflux surgery. Publications were included for the main analysis if they contained at least 30 patients. Operations in children, Collis gastroplasty procedures, endoluminal fundoplication and surgery for paraesophageal hernias were excluded. The frequency of postoperative pain was calculated and the causes/management were reviewed. An algorithm for the investigation of patients with pain following laparoscopic fundoplication was constructed.

RESULTS A total of 17 studies were included in the main analysis. Abdominal pain and chest pain following laparoscopic fundoplication were reported in 24.0% and 19.5% of patients respectively. Pain was mild or moderate in the majority and severe in 4%. Frequency of pain was not associated with operation type. The authors include their experience in managing patients with persistent, severe epigastric pain following laparoscopic anterior fundoplication.

CONCLUSIONS Pain following laparoscopic antireflux surgery occurs in over 20% of patients. Some have an obvious complication or a diagnosis made through routine investigation. Most have mild to moderate pain with minimal effect on quality of life. In a smaller proportion of patients, pain is severe, persistent and can be disabling. In this group, diagnosis is more difficult but systematic investigation can be rewarding, and can enable appropriate and successful treatment.

The benefits of antireflux surgery are well established. The laparoscopic approach has been proven in a meta-analysis to be an effective and safe alternative to open surgery with faster return to normal activity and fewer complications although it has a greater reoperation rate. Results of laparoscopic fundoplication have been reported extensively with studies comparing symptomatic reflux and medication requirement in patients undergoing different operative techniques. Common adverse outcomes reported are dysphagia, bloating, reoperation and complications. Postoperative pain is measured less frequently and a review is lacking. This paper presents a clinical review of pain after laparoscopic antireflux surgery.

Methods

A literature search was conducted using the PubMed database to identify all studies describing pain after antireflux surgery. Series with at least 30 patients were included. Exclusion criteria included operations in children, Collis gastroplasty, endoluminal fundoplication and surgery for paraesophageal hernias. Reference lists were cross-checked and smaller studies were also identified for discussion. The frequency, sites and duration of pain after antireflux surgery are reported. The causes, investigation and management are discussed.

Results

Overall, 17 studies containing a total of 2,737 patients were selected for analysis (Fig 1 and Table 1). Most studies...
Table 1: Studies included in the main analysis

| Study                | Patients | Frequency of pain | Mean follow-up duration (range) in months | Site of postoperative pain | Fundoplication type | Cause of postoperative pain | Treatment/outcome |
|----------------------|----------|-------------------|------------------------------------------|----------------------------|---------------------|-----------------------------|-------------------|
| Bortie, 2010<sup>4</sup> | 35       | 37%               | 72                                       | Abdominal                  | Nissen              | –                           | –                 |
| Frantzides, 2006<sup>5</sup> | 615      | –                 | 3                                        | Odynophagia                | Nissen              | Symptoms resolved without treatment | 2 reoperated       |
| Beldi, 2002<sup>6</sup>  | 60       | –                 | 43 (12–72)                               | Epigastric                 | Nissen              | 1 intestinal obstruction 1 trocar hernia 2 gas bloat syndrome | 2 reoperated       |
| Negre, 1983<sup>7</sup>  | 60       | –                 | 120                                      | Upper abdomen / left flank | Nissen (Rossetti)   | –                           | 1 reoperated – adhesions |
| Franzen, 2005<sup>8</sup> | 45       | –                 | 57 (33–78)                               | Epigastric                 | Nissen              | 3 herniated fundoplication 2 paraoesophageal hernia | 4 reoperated 1 medical therapy |
| Valiati, 2000<sup>9</sup> | 181      | –                 | 4.9% (24–84)                             | Epigastric                 | Various             | –                           | –                 |
| Wykypiel, 2005<sup>10</sup> | 209      | –                 | 2.4% (retrosternal) 10% (epigastric)      | Retrosternal Epigastric    | Nissen              | –                           | –                 |
| Fein, 2008<sup>11</sup>  | 120      | 59% (epigastric) 23% (chest) | 46% (epigastric) 41% (chest) 120 | Epigastric Chest | Nissen/anterior/ Toupet | –                           | –                 |
| Rosenthal, 2006<sup>12</sup> | 186      | 39%               | 49% (1–121)                              | –                           | Nissen/Toupet       | –                           | –                 |
| Bisgaard, 2004<sup>13</sup> | 60       | 37% (visceral) 0% (incisional) | 58% (visceral) 30% (incisional) 1 | Visceral Incisional | Nissen              | –                           | –                 |
| Patti, 2002<sup>14</sup>  | 165      | 100%              | 15% (same or worse) 13                   | Chest                      | Total and partial (360° and 240°) | –                           | –                 |
| de Beaux, 2001<sup>15</sup> | 312      | 71% (epigastric) 37% (odymphagia) | 40% (epigastric) 5% (odymphagia) 6 | Epigastric Odympagia | Nissen/anterior 180° | –                           | –                 |
| Watson, 1999<sup>16</sup>  | 107      | 68% (epigastric) 19% (odymphagia) | 25% (epigastric) 2% (odymphagia) 6 | Epigastric Odympagia | Nissen/anterior 180° | –                           | –                 |
| So, 1998<sup>17</sup>    | 35       | 34%               | 14% (12–36)                              | Chest/epigastric           | Nissen / Toupet / Hill | –                           | –                 |
| Peters, 1998<sup>18</sup> | 100      | –                 | 1% (8–60)                                | Epigastric                 | Nissen              | –                           | –                 |
| Fuchs, 1997<sup>19</sup>  | 221      | –                 | 1.2% (3–60)                              | Epigastric                 | Various              | –                           | –                 |
| Negre, 1983<sup>20</sup>  | 226      | 0%                | 22% (36–144)                             | Left upper quadrant/epigastric | Nissen (Rossetti) | –                           | None              |
assessed dysphagia and gastro-oesophageal reflux as primary outcomes rather than pain. Therefore, a meta-analysis was not possible.

**Site of pain**
Pain persisting beyond the usual recovery from surgery can be felt in the abdomen, chest or shoulder.6–8,13,22–25 Chest pain also encompasses retrosternal pain. Pain may be experienced on swallowing (odynophagia) and this is considered separately.

**Frequency/severity**
Abdominal pain following fundoplication occurred in 1–58% of patients (mean: 24.0%) and chest pain was found in 2.4–41% (mean: 19.5%). Odynophagia ranged from 2% to 5% (mean: 3.5%). The variation in frequency reported may reflect heterogeneity of assessment tools and the subjective nature of pain, which may be influenced by many factors. The frequency of severe, intense or disturbing pain was less variable between studies, reported in 3–5% of patients.6,17,24

**Preoperative pain**
When assessing postoperative pain, preoperative pain must also be investigated. The mean proportion of patients suffering pain before operation was 44% (range: 0–100%). Studies have attempted to address the relationship of preoperative chest pain to gastro-oesophageal reflux and its influence on surgical outcome. A study in 165 patients with chest pain undergoing laparoscopic antireflux surgery demonstrated 85% resolution in chest pain.24 In patients who had a high correlation of chest pain with reflux episodes, pain improved in 96% whereas in those with a low correlation, pain improved in 70%. Similar results were found in a study by DeMeester et al.26 Chest pain is therefore more likely to resolve if it correlates with reflux episodes. The variation in frequency of preoperative pain may be explained by differences in selection criteria and assessment techniques.

**Duration**
Follow-up duration ranged from 1 month to 12 years (median: 43 months). While dysphagia and bloating tend to decrease over time,6,13 the data were analysed to see whether the same is true for pain. In one study, visceral and incisional pain decreased over the first 30 postoperative days.17 However, there was no correlation between follow-up length and frequency of pain beyond this period (r=0.25). The cause of pain is likely to influence the duration. For example, pain due to gastro-oesophageal oedema is likely to settle over time whereas pain secondary to gastro-oesophageal reflux may worsen over time. A detailed breakdown required to investigate this is not presented in the literature.

**Discussion**

**Causes**
The most common causes of pain following laparoscopic antireflux surgery are paraoesophageal herniation, slipped fundoplication, tight fundoplication, postoperative gastro-oesophageal junction oedema and gastric/oesophageal perforation.5,12,27–29 Other causes include wound infection/haematoma, port site hernia, intra-abdominal abscess, postoperative haemorrhage, bowel obstruction/perforation, pneumothorax and pleural effusion.12,27,29 There are numerous case reports of rare complications causing pain that include splenic infarction,29 portal thrombosis,31 gastric volvulus32 and pancreatitis.33 Where investigation has not identified a cause for pain (particularly when it is exacerbated by movement/position), stretching of sutures or adhesions may be responsible.7

Odynophagia is less common than chest or abdominal pain. It often resolves with time.5,13 However, in some cases, it can be persistent.10,20,21 The pathogenesis of odynophagia is not well understood but may be related to transmural sutures, oesophagitis, ulceration, oedema, perforation or oesophageal spasm.23

Surgical damage to the vagal nerve has also been blamed for causing a range of postoperative symptoms including pain as a result of postprandial gastric distension.31

Only one paper gave sufficient information to compare the frequency of postoperative pain in patients undergoing different procedure types.15 In 99 patients, there was no difference in the frequency of chest or abdominal pain experienced by patients undergoing either Nissen, anterior or Toupet fundoplication.

Patients experiencing pain beyond that expected in the acute postoperative period can be divided into two categories. Those who suffer a clear complication usually present dramatically with typical clinical features. They are investigated promptly and often require reoperation. Such problems include herniated fundoplications/hiatal closure failure,6 gastric/oesophageal perforation,12,28 intestinal obstruction6 and portal thrombosis.9,25 Alternatively, patients may complain of pain at follow-up visits or through surveys. The cause in these patients is harder to elicit and discussion of further investigation or treatment is rare.

**Clinical assessment**
A detailed history and clinical examination is necessary to identify the presence of complications such as port site hernia and to direct investigations.

**Plain film and contrast radiography**
Chest radiography may identify a pleural effusion, pneumothorax or recurrent hiatus hernia. Single/double contrast swallows can be used to define a recurrent hiatus hernia, confirm the anatomy of the fundoplication and estimate oesophageal shortening/dysmotility.25,26 The appearance of a distended oesophagus may indicate partial obstruction due to an over-tight hiatal closure or a restrictive fundoplication.

**Ultrasonography**
Postoperative ultrasonography is of limited benefit. Nevertheless, free fluid, a collection (subphrenic) or intraperito-
neal gas can be identified. It is beneficial when pain may be unrelated to surgery and caused by undiagnosed pathology such as gallstones.24

**Computed tomography**
Computed tomography (CT) is most useful in the acute postoperative setting where it can identify most complications including abscess formation, perforation, splenic infarction, portal thrombosis and early paraoesophageal hernia.27,36,37 Anatomical position of the stomach and fundoplication with respect to the diaphragm can identify cases of crus failure, paraoesophageal hernia, slipped fundoplication and disrupted fundoplication.

**Magnetic resonance imaging**
Magnetic resonance imaging (MRI) rarely outperforms CT but is useful in the diagnosis of unrelated biliary or spinal pathology.

**Endoscopy**
Endoscopy has been used to show oesophageal widening (tight fundoplication), oesophagitis and peptic stricture.2 Gastric folds above the wrap may signify a slipped fundoplication. A herniated fundoplication can be identified by the relationship of the fundoplication to the diaphragmatic closure.6,20 The depth of anterior and posterior fundoplication tucks can be used to determine the presence or absence of fundoplication disruption.38 Endoscopy is also important to exclude a new cancer and identify any Barrett’s change.39 Food residue in the stomach after fasting may indicate delayed gastric emptying and the need for vagal function testing.

**Manometry/pH studies**
Manometry and pH studies are often performed together. Manometry can demonstrate oesophageal dysmotility, which may be more marked following fundoplication. In some cases, a missed diagnosis of achalasia may be made.39 pH studies may confirm recurrent gastro-oesophageal reflux in cases of a loose or herniated fundoplication.

**Vagal function testing**
When there is gastric food residue after fasting or a history of recurrent vomiting, gastric emptying studies/vagal testing should be considered. Discomfort associated with confirmed delayed gastric emptying can be a result of vagal injury and may indicate the need for pyloroplasty.27,56

**Laparoscopy**
A repeat laparoscopy with division of adhesions and fundoplication revision as necessary may be indicated on the basis of the investigations above.4,5 In cases of persisting pain without a known cause, even without evidence of a clear complication such as paraoesophageal hernia or slipped fundoplication, reoperation may be indicated.7,36

**Summary of investigations**
A summary of the investigations used is shown in Table 2. The choice and sequence of investigations will be determined by individual patient factors, previous investigations and availability of services. Unrelated pathology must also be considered and investigated appropriately. Ultrasonography and MRI may be useful additions in this setting to rule out problems such as gallstones or spinal pathology.

**Management**
Difficult cases should be managed by experienced surgeons. Reoperation can be complex but should not be delayed when investigations have failed to reach a diagnosis.29 Surgical technique should not only involve division of adhesions with full mobilisation and dismantling of the previous fundoplication,29 but biopsy and histological analysis of any doubt or localised scar tissue. The laparoscopic approach is often suitable although a laparotomy may be required, particularly in late reoperation.20,36 Discussion on the choice of revision fundoplication is beyond the remit of this review but the decision will be influenced by a number of factors particular to the patient and operating surgeon. However, crural sutures should be avoided in ‘re-do’ surgery where neuroma is the suspected cause of the pain.

Despite extensive investigation, appropriate treatment and revision surgery if indicated, a small proportion of patients may experience persisting discomfort. They need to be managed in a specialist pain environment with full access to the medical, physical and psychological/behavioural treatments available.

**Prevention of pain**
Understanding the mechanisms behind postoperative pain may allow modification of techniques in order to reduce the incidence of this problem in the future. Before surgery, it is important to complete a full history and examination, identifying details of pain, its relationship to dysphagia/reflux and seeking any pre-existing relevant conditions. Preoperative investigations should include pH testing with correlation to symptoms if pain is a feature and manometry if there is a suspicion of dysphagia/achalasia.

Performing numerous clinical trials to assess different operative techniques is not feasible. However, attention to detail in the technical aspects of fundoplication may improve outcomes. A full review of the complications and how to avoid them is beyond the remit of this discussion, and has been published previously.29 Nevertheless, the hiatal dissection should be complete and oesophageal mobilisation sufficient to allow an adequate intra-abdominal oesophageal length, preserving the vagus nerves.21,29 Hiatal closure should be snug but not too tight. Short gastric vessel division should not be performed routinely but used as necessary to achieve a ‘floppy’ fundoplication.3,5,11,24,29

**Study limitations**
Pain is a subjective phenomenon to which patients have variable tolerance and it is influenced by multiple factors. Postoperative discomfort is anticipated to some degree and the severity/duration considered disproportionate is subjective. Dysphagia, gastro-oesophageal reflux and bloating are common, and patients may find it difficult to distinguish these from pain. Most studies did not include pain as a primary outcome measure. Many did not include details on preoperative pain so the clinical significance of postop-
erative pain is difficult to interpret. Further studies need to measure preoperative pain in addition to postoperative pain. Patient satisfaction studies should investigate postoperative pain specifically.

Conclusions

Pain after anti-reflux surgery is poorly reported, occurs in over 20% of patients and is severe in more than 3%. It is persistent and the frequency does not reduce over time. Some patients will have an obvious complication or a diagnosis made through routine investigation. In others, diagnosis is more challenging but systematic investigation can be rewarding and enable successful treatment. When tests do not aid a diagnosis, repeat laparoscopy with histological analysis of dense or extensive scar tissue and fundoplication revision has been shown to be beneficial, and should be considered. All patients should be warned about the possibility of postoperative pain and those presenting with pain that does not correlate with reflux have a higher likelihood of persisting discomfort.

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