Surgical Reintervention After Failed Antireflux Surgery: 
A Systematic Review of the Literature

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Abstract
Background Outcome and morbidity of redo antireflux surgery are suggested to be less satisfactory than those of primary surgery. Studies reporting on redo surgery, however, are usually much smaller than those of primary surgery. The aim of this study was to summarize the currently available literature on redo antireflux surgery.

Material and Methods A structured literature search was performed in the electronic databases of MEDLINE, EMBASE, and Cochrane Central Register of Controlled Trials.

Results A total of 81 studies met the inclusion criteria. The study design was prospective in 29, retrospective in 15, and not reported in 37 studies. In these studies, 4,584 reoperations in 4,509 patients are reported. Recurrent reflux and dysphagia were the most frequent indications; intraoperative complications occurred in 21.4% and postoperative complications in 15.6%, with an overall mortality rate of 0.9%. The conversion rate in laparoscopic surgery was 8.7%. Mean (±SEM) duration of surgery was 177.4±10.3 min and mean hospital stay was 5.5±0.5 days. Symptomatic outcome was successful in 81.1% and was equal in the laparoscopic and conventional approach. Objective outcome was obtained in 24 studies (29.6%) and success was reported in 78.3%, with a slightly higher success rate in case of laparoscopy than with open surgery (85.8% vs. 78.0%).

Conclusion This systematic review on redo antireflux surgery has confirmed that morbidity and mortality after redo surgery is higher than after primary surgery and symptomatic and objective outcome are less satisfactory. Data on objective results were scarce and consistency with regard to reporting outcome is necessary.

Keywords Gastro esophageal reflux disease · Antireflux surgery · Nissen fundoplication · Dysphagia · Reoperation

Introduction

Antireflux surgery for refractory gastroesophageal reflux disease (GERD) has satisfactory outcome in 85–90% of patients.1–6 In the remaining 10–15%, reflux symptoms persist, recur, or complications occur. Dysphagia is a frequent complication of fundoplication.7 The indications for reoperation are far from straightforward, varying from severe recurrent symptoms with a more than adequate anatomical result to recurrent abnormal anatomy without any symptoms at all. Studies on reoperations also show similar wide variations with a full range of abnormal anatomy, symptoms and objective failure documented by esophageal manometry, and pH monitoring.

In our recently published study on redo antireflux surgery, morbidity and mortality were higher than after primary antireflux surgery, with a symptomatic and objective success rate of 70% which is obviously inferior to the outcome of primary surgery.4,8 Several other studies have been published describing causes of failure of conventional and laparoscopic antireflux surgery. Most studies have
included only a small group of patients, so an adequate impression on the outcome of reoperation is hard to extract from such studies.

This study aims to summarize the currently available literature on surgical reintervention after primary antireflux surgery focusing on morbidity, mortality, and outcome in order to get a more complete overview of the results of redo antireflux surgery and to give guidelines about how patients should be informed on their chances of success.

Material and Methods

Search Strategy

A literature search was performed in three electronic databases, MEDLINE using the Pubmed search engine, EMBASE, and the Cochrane Central Register of Controlled Trials. The databases were searched for all years, up to November 2008. Search terms were entered to identify the relevant studies. Separate search terms were entered for the intervention, i.e., surgical reintervention, and the disease, i.e., GERD. For the disease, dysphagia was also used because this is a frequent indication for reoperation. For both the intervention and the disease, headwords in the thesaurus of the three databases [Medical Subject Heading (MeSH) Thesaurus in Pubmed and the Cochrane library and the Emtree Thesaurus in EMBASE] and free text words in title and abstract were used as search terms. The headwords from the thesaurus and the different synonyms for free text words were coupled by the Boolean operator “OR”. The combination of search terms for the intervention and disease were subsequently coupled by the Boolean operator “AND”. The free text words and headwords identified in the thesauruses are listed in Table 1.

Selection of Studies

The studies identified by the search strategy were independently selected by two reviewers (E.F. and W.D.) based on title, abstract, and full text. The literature was searched for randomized controlled trials, cohort studies, and case–control studies on the feasibility and/or outcome of surgical reinterventions. Studies in children, on other indications for primary surgery than GERD, conservative treatment of symptoms following primary antireflux surgery, surgical reintervention within 30 days after primary surgery, and patients cohorts with less than ten patients were not included. Only articles in English were included. Addition-

| Table 1 Search Terms used in this Review |
|------------------------------------------|
| **Intervention**                      | **Disease**                        |
| Refundoplication(s)                  | Gastro esophageal reflux           |
| Redo                                    | Gastro esophageal reflux disease(s)|
| Redo surgery                           | Gastro esophageal reflux disorder(s)|
| Redo surgical procedure               | Gastro oesophageal reflux          |
| Redo Nissen (fundoplication)          | Gastro oesophageal reflux disease(s)|
| Redo antireflux procedure             | Gastro oesophageal reflux disorder(s)|
| Redo antireflux surgery               | Gastroesophageal reflux            |
| Reoperative antireflux surgery        | Gastroesophageal reflux disease(s)|
| Revisinal surgery                     | Gastroesophageal reflux disorder(s)|
| Reoperation(s)                        | GERD                               |
| Reintervention(s)                     | GORD                               |
| Surgical revision(s)                  | Reflux disorder(s)                 |
| Second look surgery                   | Esophagitis                        |
|                                        | Oesophagitis                       |
|                                        | Dysphagia                          |
| Headwords in the Medical Subject Head (MeSH) Thesaurus of Pubmed and the Cochrane library |
| Reoperation                            | Deglutition disorders              |
| Second-look surgery                    | Esophagitis                        |
| Headwords in the Emtree Thesaurus of EMBASE |
| Reoperation                            | Stomach function disorder          |
| Second look surgery                    | Dysphagia                          |
|                                        | Esophagitis                        |
ally, references of all selected publications were reviewed for other relevant studies. In case of a difference in opinion between the two reviewers about in- or exclusion of a study, the opinion of a third reviewer was decisive.

Analysis of Data from Selected Studies

Data of the selected studies were independently acquired by two reviewers (E.F. and W.D.). Study design, time period, number of patients, sex ratio, and mean age were retrieved from the studies. Based on the study design, each study was qualified by a level of evidence according to the Oxford Centre for Evidence Based Medicine Levels of Evidence.9 Type and approach of primary antireflux interventions and reoperations, mean period between both interventions, causes of failure of primary surgery and perioperative information, i.e. intra- and postoperative complications, mortality, number and causes of conversions in case of laparoscopic reoperations, mean intraoperative blood loss, duration of reoperations, and hospital stay were also extracted from the included studies. Completeness of follow-up, number of patients available, mean duration of follow-up, method of obtaining outcome at follow-up, and the definition and percentage of patients with successful symptomatic and objective outcome were extracted from all studies.

Data Analysis

Data were analysed using SPSS version 15.0 for Windows (SPSS Inc., Chicago, IL, USA). Values were expressed as mean±SEM. Statistical analysis was not performed owing to the lack of statistically appropriate data from the included studies.

Results

General Results

One thousand six hundred twenty-five articles were eligible for further selection after removing duplicate hits, and finally, 73 articles met the inclusion criteria (Fig. 1). The references of these articles yielded eight more articles for inclusion. These articles had not been identified with the initial search strategy because of absence of abstracts in the databases or atypical description for the intervention or disease. Eventually, 81 articles were eligible for inclusion in this study. According to the Oxford Centre for Evidence Based Medicine Levels of Evidence, 27 studies had a level of evidence IIB (33.3%)8, 10–35, two level of evidence IIb (2.5%)36, 37, and 15 level of evidence IV (18.5%)38–52. The remaining 37 studies (45.7%) were cohort studies, but a level of evidence could not be adjudged owing to unknown study design53–89. Baseline characteristics extracted from the individual studies are shown in Table 2.

Primary Antireflux Procedures

Total fundoplication performed by laparoscopy, laparotomy, or thoracotomy was the most frequently reported primary antireflux procedure followed by partial fundoplication (Table 3). The type of primary antireflux procedure was not reported in almost one third, and 241 patients (5.3%) underwent more than one previous operation before inclusion in the original studies.

Causes of Failure of Primary Antireflux Surgery

Causes of failure of the previous antireflux procedure were reported on 3,175 reoperations in total. Intrathoracic wrap migration, total or partial disruption of the wrap, and telescoping were the most common anatomical abnormalities encountered (Table 4). Esophageal motility disorder or erroneous diagnosis, i.e., another primary disease than GERD, were the causes of failure of the previous operation in 62 patients (2.0%). In 194 reoperations (6.1%), no cause of failure could be identified.

From six studies, it was shown that wrap disruption and telescoping were more frequent after conventional primary surgery, whereas disruption of hiatal repair and a tight wrap were more frequent after laparoscopic primary repair (Table 5).18,49,61,67,84,85 Intrathoracic wrap migration was reported by Serafina et al.85 to be more frequent after conventional primary procedures (13/17, 76.5% vs. 5/11, 45.5%), whereas Heniford et al.67 showed that this was more frequent after laparoscopic primary repair (16/22, 72.7% vs. 13/33, 39.4%). In the study by Salminen et al.,84 intrathoracic wrap migration was equal after conventional and laparoscopic primary surgery.

In five other studies,8,11,12,31,72 it was shown that intrathoracic wrap migration and wrap disruption were more frequent in the case of recurrent reflux, whereas in the case of dysphagia, no cause of failure could be demonstrated more frequently (Table 5).

Indications for Reoperations

Recurrent reflux and dysphagia were the most frequent indications for reoperations (Table 3). In 1,435 reoperations (31.3%), the indication for reoperation was not reported. Preoperative symptoms were assessed by questionnaire in 26 studies (32.1%).10,14,17,18,23–35,28,30,33,36,45,53,54,56,61–66,71,74,76,87,88 In most studies (93.8%), preoperative work-up consisted of esophagogastroduodenoscopy, barium
Table 2 Baseline Characteristics Extracted from the Included Studies

| Characteristic                             | Value          |
|--------------------------------------------|----------------|
| Number of patients \((n)\)                | 4,509          |
| Male                                       | 1,524 (33.8%)  |
| Female                                     | 1,762 (39.1%)  |
| Sex not reported                           | 1,223 (27.1%)  |
| Age (years)                                | 51.3±0.8       |
| Number of reoperations \((n)\)             | 4,584          |
| Study period (months)                      | 10.8±0.7       |
| Duration between primary surgery and reoperation (months) | 38.3±4.1 |
| Study design of the individual studies     |                |
| Prospective cohort study                   | 27 (33.3%)     |
| Retrospective cohort study                 | 14 (17.3%)     |
| Prospective case–control study             | 2 (2.5%)       |
| Retrospective case–control study           | 1 (1.2%)       |
| Not reported                               | 37 (45.7%)     |

Values are given as mean±SEM unless otherwise stated.
swallow, and/or esophageal pH monitoring.\textsuperscript{10–28,30–41,43–46,48–76,78,79,81–89}

Type and Route of Reoperations

Total or partial fundoplication was the most frequently performed reoperation (Table 3), whereas the type of reoperation was not reported in 124 patients (2.7%). The laparoscopic approach was used in 1,666 reoperations (36.3%); 1,589 reoperations (34.7%) were performed by the conventional (open) abdominal route and 1,041 (22.7%) by thoracotomy. The approach of reoperation was not reported in the remaining 288 reoperations (6.3%). More than one reintervention was performed in 75 patients (1.7%).

The esophagus was totally or partially resected during 125 reoperations (2.7%). The reasons to perform esophageal resection were severe esophagitis with or without Barrett metaplasia,\textsuperscript{15,25,59} peptic stricture of the esophagus,\textsuperscript{10,33,51,57,72,81} severely disturbed esophageal motility,\textsuperscript{26,44,57,81} or short esophagus.\textsuperscript{70,82} In 202 reoperations (4.4%), gastric resection was performed. Indications for this were alkaline reflux,\textsuperscript{10} dense adhesions on attempted reflunpolation,\textsuperscript{33,59,86} or severe gastric paresis.\textsuperscript{25,81}

Table 4 Causes of Failure of Previous Antireflux Procedure

| n=3,175 |
|---|
| Anatomical abnormalities |
| Intrathoracic wrap migration | 885 (27.9%) |
| Wrap disruption | 722 (22.7%) |
| Telescopyng | 448 (14.1%) |
| Para-esophageal hiatal herniation | 195 (6.1%) |
| Hiatal disruption | 167 (5.3%) |
| Tight wrap | 168 (5.3%) |
| Stricture | 60 (1.9%) |
| Wrong primary diagnosis |
| Achalasia | 37 (1.2%) |
| Esophageal spasms | 7 (0.2%) |
| Scleroderma | 4 (0.1%) |
| Esophageal carcinoma | 1 (0.03%) |
| Disturbed esophageal motility | 13 (0.4%) |
| No cause for failure identified | 194 (6.1%) |
| Miscellaneous | 347 (10.9%) |
| Not reported | 120 (3.8%) |

Percentages exceed 100% since more than one cause of failure was found during several reoperations

Intra- and Postoperative Results

The different intra- and postoperative parameters were only reported in a subset of the original studies. Intraoperative complications were reported in 454 of 2,123 reoperations (21.4%) and were more frequent during laparoscopic than during open abdominal reoperations (150/770, 19.5% vs. 5/92, 5.4%). Laceration or perforation of the esophagus and/or stomach was the most common (Table 6). Postoperative complications were present after 546 of 3,491 reoperations (15.6%). Infectious, pulmonary, and cardiac complications were the most common postoperative complications (Table 6). Open abdominal reoperations were accompanied with more complications than laparoscopic reoperations (55/317, 17.4% vs. 98/642, 15.3%). Thirty-seven of 4,329 patients (0.9%) died intra- or postoperatively (Table 6). No mortality occurred in studies only reporting on laparoscopic reoperations, while the mortality rate was 1.3% in studies in which all reoperations were performed by a conventional abdominal approach.

Mean duration of reoperation was 177.4±10.3 min, mean intraoperative blood loss 205.5±35.6 ml, and mean...
hospital stay 5.5±0.5 days. Comparing results of laparoscopic reoperations with laparotomy regarding the preceding parameters was not possible due to the small number of well-documented studies in the laparotomy group.

Reoperation was performed laparoscopically in 36.3% of all cases with a conversion rate of 8.7%. Causes of conversion were dense adhesions (n=57, 39.3%), severe intraoperative bleeding (n=11, 7.6%), poor visualization (n=3, 2.1%), and other (n=15, 10.3%). In the remaining 59 cases (40.7%), the reason for conversion was not reported.

### Symptomatic Outcome after Reoperations

Symptomatic outcome after reoperation was determined in 79 studies (97.5%) and reported as successful in 81% of patients, although with different definitions of success (Table 7). Data were obtained by questionnaires in 29 studies (36.7%), by interview in 21 (26.6%), and this was not reported in the remaining 29 studies (36.7%).

The mean success rate in studies only reporting on laparoscopic reoperations (17 studies) was 84.2±2.5% and 84.6±3.4% in studies in which all reoperations were performed by a conventional abdominal approach (ten studies). In patients in whom the reoperation was performed for symptoms only, 82.0±10.7% had successful symptomatic outcome, and the success rate was 81.0±12.1% in patients with recurrent reflux documented by pH monitoring.

### Objective Outcome after Reoperations

Objective outcome was reported in 696 patients (15.4%) in 24 studies (29.6%), without a definition of success, or with different definitions of success.
the number of successful cases, however, in seven studies. In the remaining 17 studies, successful objective outcome was defined as normal acid exposure during pH monitoring in absence of esophagitis in four, combination of these both in one, and the absence of reflux during radiologic imaging in another one. In these 17 studies, 78% had a successful objective outcome (Table 7). The mean success rate of laparoscopic reoperation (four studies) seemed higher than in the case of a conventional abdominal approach (four other studies), 85.8±5.6% and 78.0±10.1%, respectively.

**Discussion**

The often reported observations that morbidity and mortality are higher after redo antireflux surgery and symptomatic outcome is inferior to primary antireflux surgery have been confirmed in this systematic review on all studies currently available. Very few had a prospective study design, and in almost half of all, the type of analysis was not even reported. Moreover, most studies only present symptomatic outcome, and data on anatomy and function of the esophagogastric junction are scarce.

Morbidity was most frequently caused by direct injury of the esophagus and stomach during reoperation in the current review, and this was confirmed in our own data on redo surgery, mainly as a result of increased complexity due to adhesions after the primary operation. Most primary interventions in the studies reviewed were performed by the conventional approach. Nowadays, with laparoscopy as the golden standard, less adhesions may be encountered if redo surgery is required. This might improve the outlook for these patients with a lower chance of iatrogenic organ damage, but this has to be proven in future studies. Although postoperative morbidity and mortality appeared to be lower after laparoscopic reoperations compared to the open abdominal approach, intraoperative complications occurred more frequently during laparoscopic surgery. These data, however, are not based on comparison between both approaches within individual studies, and therefore, this should, in our opinion, be interpreted with caution.

The cause of failure was recognized in 93.8% and mainly consisted of anatomical abnormalities or an erroneous indication for primary surgery. Disruption of hiatal repair and a too tight wrap were more frequently observed after the laparoscopic than after the open approach. This again underlines the difficulty of doing an adequate hiatal repair and creating a “floppy” wrap by laparoscopy. Achalasia was the most frequently reported incorrect diagnosis as the cause of failure, and this supports the inclusion of esophageal manometry and 24-h pH monitoring in the preoperative workup. It has also been suggested that a too tight fundoplication can cause an achalasia-like clinical picture. Esophageal manometry shows, in those circumstances, a non-relaxing lower esophageal sphincter, but not an aperistaltic esophagus.

Preoperative workup before reoperation is, apparently, not standardized but tailored to the cause of failure and the indication for reoperation. In the case of dysphagia, this consists of barium swallow to evaluate the esophageal and gastric anatomy and esophageal manometry to detect whether or not a motility disorder may be an (additional) cause of failure. In patients with reflux symptoms, extensive reevaluation is essential. Symptoms have been shown, however, to be bad predictors of pathological reflux after primary antireflux surgery and unrelated to anatom-

**Table 7** Symptomatic and Objective Outcome after Reoperation

| Definition of successful symptomatic outcome in the individual studies | Symptomatic outcome | Objective outcome |
| --- | --- | --- |
| n=79 | | |
| Degree of symptoms at follow-up | 25 (31.6%) | – |
| Patient satisfaction | 22 (27.8%) | – |
| Satisfaction defined | 6 (27.3%) | – |
| Satisfaction not defined | 16 (72.7%) | – |
| Visick grading system | 7 (8.9%) | – |
| Visick grading system combined with patient satisfaction | 1 (1.3%) | – |
| Scores calculated from specific quality of life questionnaires | 5 (6.3%) | – |
| Miscellaneous | 5 (6.3%) | – |
| Not reported | 14 (17.7%) | – |
| Patients available at follow-up | 3 338 (74.0%) | 581 (12.9%) |
| Duration of follow-up (months) | 34.2±2.7 | 21.8±4.7 |
| Patients with successful outcome | 2 706 (81.1%) | 455 (78.3%) |

Values are given as mean±SEM unless otherwise stated.
surgical wrap position.\textsuperscript{93} Therefore, objective preoperative workup is equal to patients evaluated for primary antireflux surgery and consists of esophagogastroduodenoscopy, esophageal manometry, and 24-h pH monitoring, completed with barium swallow to evaluate the anatomy in addition to endoscopy.

Symptomatic outcome was described in most studies in this review with a success rate ranging from 56\% to 100\%. The definitions for success showed considerable variation and focus either on a more general or overall system or on specific symptoms with or without mentioning data on quality of life and the effect of surgery on quality of life aspects, compromising comparison between the individual studies. Patient satisfaction was a frequently used method for scoring symptomatic outcome. Patient’s satisfaction is important and clinically highly relevant, but it does not directly refer to the specific symptoms of the disease, and consequently, this type of scoring does not provide insight in which aspects of the disease have improved and whether or not reflux symptoms have been exchanged by, for example, dysphagia. The Visick grading system, indicating that the disease was cured or improved with Visick grades I and II or unchanged or worsened in grades III and IV considered a symptomatic failure,\textsuperscript{94} correlated well with postoperative daily reflux related symptoms and daily complaints of dysphagia in our patient group on redo antireflux surgery.\textsuperscript{97}

Objective outcome was only reported in less than one third of the included studies in this review, with a mean success rate of 78\%, which is slightly worse than after primary surgery. In our unit, all patients are encouraged to undergo stationary esophageal manometry and ambulatory 24-h esophageal pH monitoring before and after primary as well as redo antireflux surgery primarily for quality control, but also to be able to correlate the functional results with symptoms and to understand possible future symptoms. Although previous studies have shown that for a good symptomatic outcome after primary surgery optimal anatomical and functional results are not a prerequisite,\textsuperscript{92,93} more studies reporting the anatomical and functional status of the esophagus and stomach after redo surgery are required to outline a more complete overall picture of the outcome of redo antireflux surgery.

Conclusion

Redo antireflux surgery has a higher morbidity and mortality rate than primary antireflux surgery and symptomatic outcome is less satisfactory. Consistency with regard to reporting on symptomatic and objective outcome is necessary. Data on objective results after redo antireflux surgery are scarce and a plea can be made to subject all primary cases to full-scale evaluation, before and after antireflux surgery. Data to support this suggestion with evidence, like adequate cost-effectiveness studies, are lacking. The relative disappointing results of redo antireflux surgery with regard to morbidity, mortality, and symptomatic outcome support the opinion that redo surgery is tertiary referral center surgery and these centers should continue their efforts to collect prospective subjective and objective data.

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