REVIEW ARTICLE

Total vs Partial Fundoplication in the Treatment of Gastroesophageal Reflux Disease

A Meta-analysis

Oswald Varin, MD; Berit Velstra, MD; Stijn De Sutter, MD; Wim Ceelen, MD

Objective: To perform a meta-analysis of randomized trials comparing partial fundoplication (PF) with total (Nissen) fundoplication (TF) for gastroesophageal reflux disease in terms of morbidity, efficacy, and long-term symptomatology.

Data Sources: A structured Medline search for published studies.

Study Selection: The available literature from 1975 until June 2007 was searched using the Medical Subject Headings of the National Library of Medicine term *fundoplication* and the free-text terms *fundoplication*, *surgery*, and *reflux*. Data were analyzed using Review Manager software (Cochrane Collaboration, Oxford, England).

Data Extraction: Eleven trials were identified comparing TF with PF in 991 patients.

Data Synthesis: Total fundoplication resulted in a significantly higher incidence of postoperative dysphagia (odds ratio [OR], 1.82-3.93; $P<.001$), bloating (OR, 1.07-2.56; $P=.02$), and flatulence (OR, 1.66-3.96; $P<.001$). No significant differences were noted in the incidence of esophagitis (OR, 0.72-2.7; $P=.33$), heartburn (OR, 0.48-1.52; $P=.58$), or persisting acid reflux (OR, 0.77-1.79; $P=.45$). The reoperation rate was significantly higher after TF compared with PF (OR, 1.13-3.95; $P=.02$). No significant differences were present in the proportion of patients experiencing a good or excellent long-term outcome (OR, 0.54-1.38; $P=.53$) or in the proportion of patients with a Visick I or II score (OR, 0.62-1.59; $P=.99$).

Conclusions: Partial fundoplication is a safe and effective alternative to TF, resulting in significantly fewer reoperations and a better functional outcome. The poor quality of the included trials warrants caution in the interpretation of the results of this meta-analysis.

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Gastroesophageal reflux disease (GERD) is defined as chronic symptoms or mucosal damage caused by abnormal reflux of gastric contents into the esophagus. It was estimated that 44% of adults in the United States experience at least 1 episode of heartburn per month.[1] Chronic GERD is an established risk factor for the development of Barrett metaplasia, estimated to develop in 5% to 15% of patients with acid reflux.[2]

Surgery has gained an established role in the management of complicated GERD since the incidental discovery by Nissen of the antireflux effect created by a fundoplication. Compared with medical therapy, fundoplication is more effective in overall symptom control.[3,4] Surgery does not, however, seem to affect the risk of developing Barrett metaplasia or adenocarcinoma of the esophagus.[5]

Recently, recognition of specific long-term morbidity and failure rates associated with surgery has caused a decline in the use of antireflux procedures.[6] Creation of a 360° fundoplication has been shown to induce dysphagia, inability to belch or vomit, and flatulence in many patients.[7] It is uncertain whether the creation of a partial fundoplication alters the risk of postoperative functional complaints.[8]

The aim of the present study was to compare total (Nissen) fundoplication (TF) with partial fundoplication (PF) in terms of safety, efficacy, and adverse effects using a formal meta-analysis.

METHODS

We performed a systematic search of the literature using the Cochrane Central Register of Controlled Trials, the Institute for Scientific Information Web of Science (science citation in-

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dex, current contents), and PubMed from 1975 until June 2007 using the Medical Subject Headings of the National Library of Medicine term *fundoplication* and the free-text terms *fundoplication*, *surgery*, and *reflux* (**Figure 1**). Eleven studies randomized patients to either TF or PF. Studies that did not compare TF with PF and studies comparing fundoplication with Hill gastropexy were excluded. The following outcome parameters were analyzed: postoperative morbidity, mortality, incidence of symptomatic adverse events (dysphagia, bloating, flatulence, esophagitis, heartburn), reoperation rate, recurrence rate, and Visick score. Data were extracted from the selected studies and entered into the Review Manager software (Cochrane Collaboration, Oxford, England). Summary statistics were calculated using the odds ratio (OR) and associated 95% confidence intervals (CI). The methodological quality of the selected studies was assessed using the method of Jadad.[9] Heterogeneity was tested using the χ^2 statistic and assumed to be present when $P<.1$.

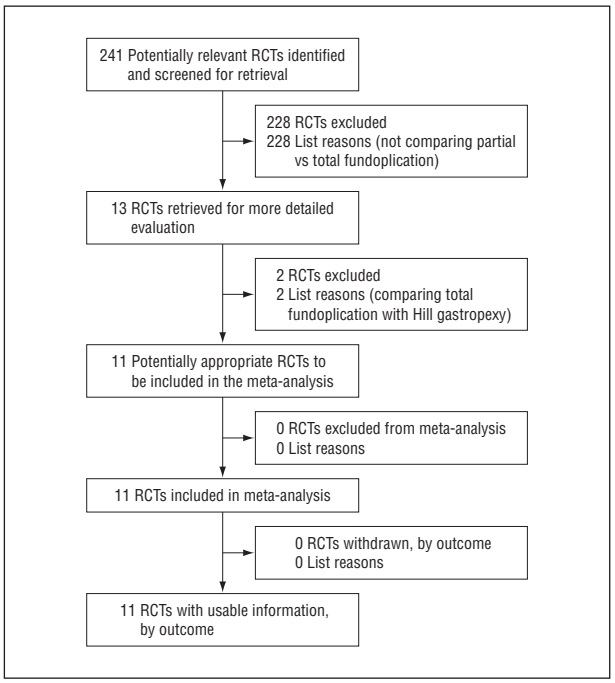

Figure 1. Quorum diagram showing study methodology. RCT indicates randomized controlled trial.

RESULTS

Eleven prospective randomized trials were identified comparing TF with PF, including a total of 991 patients. Two studies comparing TF with Hill gastropexy were left out of the analysis.[10,11] The characteristics of the studies are detailed in the **Table**. Overall, the methodological quality of the identified trials was low, with 7 of the 11 trials having a Jadad score of 3 or less. All trials recruited a small number of patients, while no formal primary endpoint identification, sample size calculation, or power calculation was reported in any of the identified trials.

Postoperative mortality was not present in any of the included trials. No significant differences were observed in postoperative morbidity (**Figure 2**). The functional outcome parameters are detailed in **Figure 3**. Compared with PF, TF resulted in a significantly higher incidence of postoperative dysphagia (OR, 1.82-3.93; $P<.001$), bloating (OR, 1.07-2.56; $P=.02$), and flatulence (OR, 1.66-3.96; $P<.001$). **Figure 4** highlights the postoperative parameters related to the efficacy of surgery. No significant differences were noted between PF and TF in the incidence of esophagitis (OR, 0.72-2.7; $P=.33$), heartburn (OR, 0.48-1.52; $P=.58$), or persisting acid reflux (OR, 0.77-1.79; $P=.45$). There was, however, significant heterogeneity associated with the pooled analysis of the incidence of persistent reflux. Long-term outcome parameters are given in **Figure 5**. The reoperation rate was significantly higher after TF compared with PF (OR, 1.13-3.95; $P=.02$). However, significant heterogeneity was identified between trials. No significant differences were present in the proportion of patients experiencing a good or excellent long-term outcome (OR, 0.54-1.38; $P=.53$) or in the proportion of patients with a Visick I or II score (OR, 0.62-1.59; $P=.99$).

COMMENT

Gastroesophageal reflux disease and its long-term complications represent an important health care burden in the developed world, and there is evidence that the prevalence of GERD has increased during the past 2 de-

Table. Details of Prospective Randomized Trials Comparing TF With PF in the Treatment of Patients With Gastroesophageal Reflux Disease

Source	Score[a]	Type	Patients With TF, No.	Patients With PF, No.	°PF	FU
Segol et al, 1989[12]	1	Open	20	18	180	24
Thor et al, 1989[13]	1	Open	12	19	180-200	60
Lundell et al, 1991[14-16]	2	Open	65	72	180-200	138
Walker et al, 1992[17]	1	Open	26	26	300	13
Laws et al, 1997[18]	1	Laparoscopic	23	16	200	27
Watson et al, 1999[19]	5	Laparoscopic	53	54	180	6
Fibbe et al, 2001[20,21]	2	Laparoscopic	100	100	270	4
Chrysos et al, 2003[22]	3	Laparoscopic	14	19	270	12
Watson et al, 2004[23]	5	Laparoscopic	52	60	90	6
Baigrie et al, 2005[24]	5	Laparoscopic	84	79	180	24
Spence et al, 2006[25]	5	Laparoscopic	39	40	90	12

Abbreviations: FU, mean follow-up time in months; PF, partial fundoplication; °PF, circumferential degrees of the partial wrap; TF, total (Nissen) fundoplication.
[a] Jadad methodological quality score (range, 1-5).

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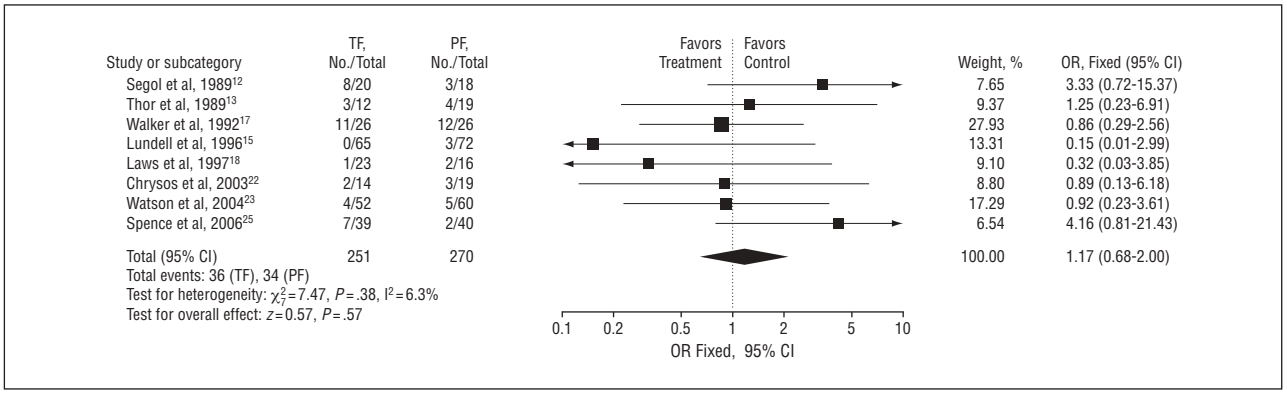

Figure 2. Analysis of morbidity after total (Nissen) fundoplication (TF) or partial fundoplication (PF). Odds ratios (ORs) are shown with 95% confidence intervals (CIs).

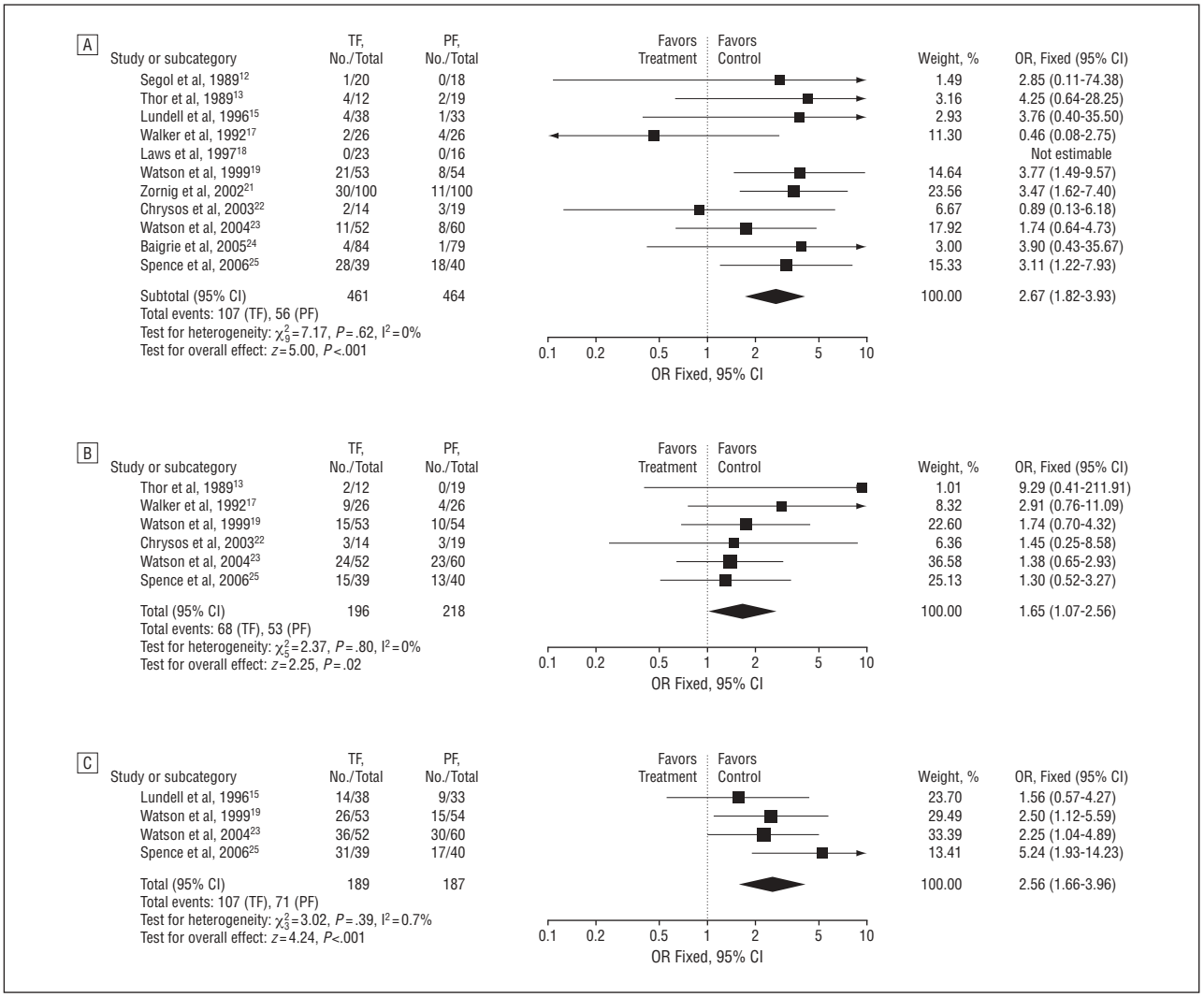

Figure 3. Analysis of dysphagia (A), bloating (B), and flatulence (C) after total (Nissen) fundoplication (TF) or partial fundoplication (PF). Odds ratios (ORs) are shown with 95% confidence intervals (CIs).

cades.[26] The mainstay of therapy consists of lifestyle and dietary modification, acid suppression therapy, and, in selected patients, surgery. Recently, a variety of endoscopic antireflux procedures have been introduced in clinical practice. Owing to questions regarding the safety, efficacy, and durability of endoscopic procedures, their routine use is at present not recommended.[27] The exact place of surgery in the management of GERD remains a matter of debate. Accepted indications for surgery include anatomic abnormalities such as a large hiatus hernia, persistent regurgitation despite adequate medical therapy, and incomplete response to medical therapy in

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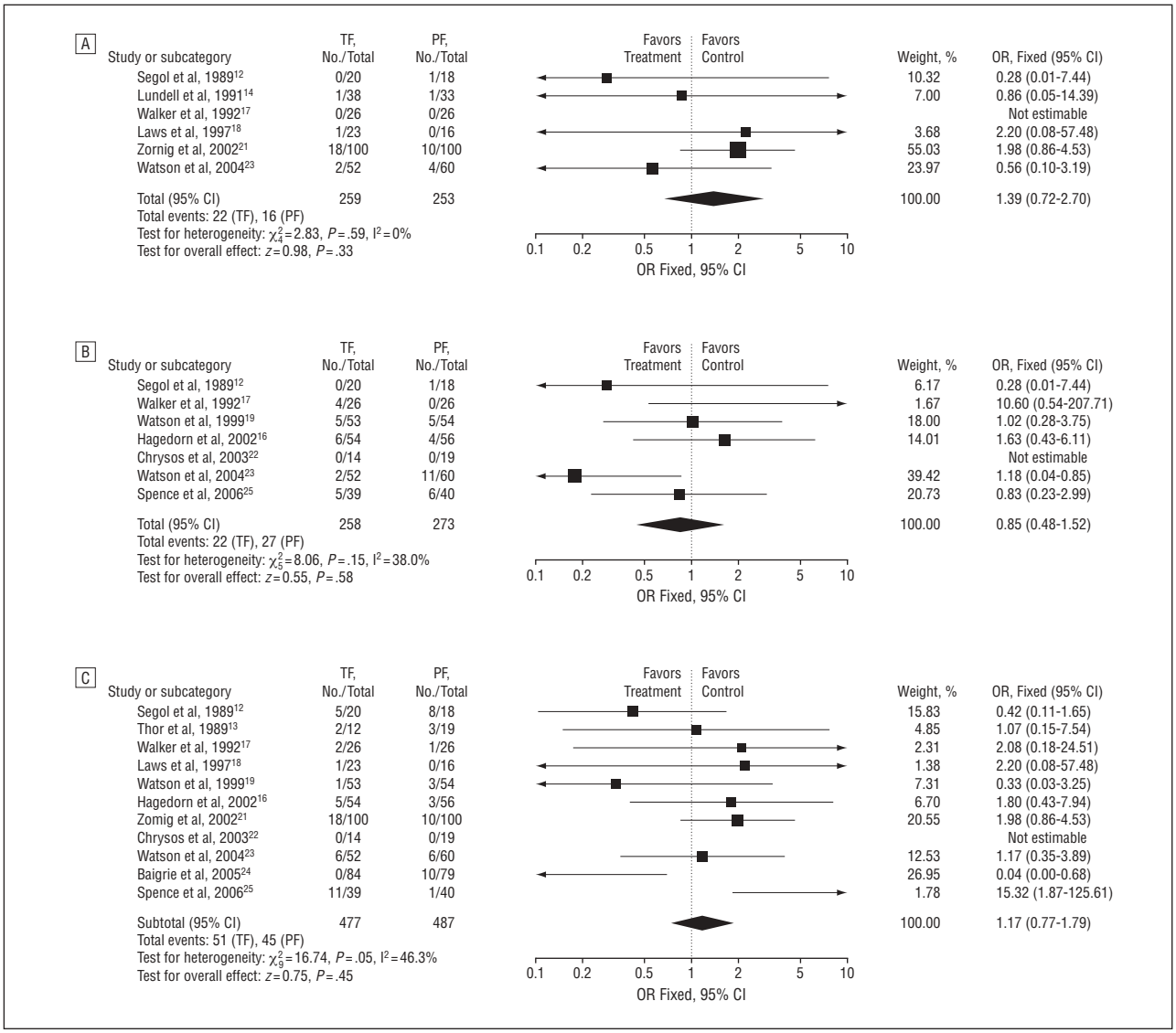

Figure 4. Analysis of esophagitis (A), heartburn (B), and acid reflux (C) after total (Nissen) fundoplication (TF) or partial fundoplication (PF). Odds ratios (ORs) are shown with 95% confidence intervals (CIs).

patients with proven reflux.[28] Recent evidence suggests that, compared with medical therapy, surgery is associated with a higher probability of regression of Barrett's metaplasia, although the risk of malignant change does not seem to differ.[29]

Fundoplication procedures are nowadays usually performed using a minimally invasive approach. The evidence comparing open with laparoscopic fundoplication is equivocal. Some randomized comparisons have found the laparoscopic approach to be beneficial in terms of hospital stay, overall cost, and wound morbidity.[30] Others were unable to demonstrate any difference in outcome, and one prospective trial was terminated early when a significantly higher complication rate in the laparoscopic group was detected at interim analysis.[31-33] Most authors agree, however, that the subjective and symptomatic outcome is similar following open or laparoscopic fundoplication.

One of the drawbacks of surgery is the risk of long-term adverse functional effects due to the imposed mechanical obstruction of the lower esophagus.[34] Partial fundoplication techniques have been proposed to prevent postoperative dysphagia and retain the ability to belch. The current meta-analysis confirms that dysphagia, bloating, and flatulence are all significantly less common after PF. It should be noted, however, that the exact length of the Nissen wrap in the analyzed trials could not be identified. It is possible that a short (1 cm) gastric wrap, as currently recommended,[35] results in less postoperative dysphagia. Moreover, it seems likely that division vs preservation of the short gastric vessels alters functional outcome.[36] The higher incidence of dysphagia following TF coexisted with a significantly higher reoperation rate, although reoperation may be related to other variables such as presence of a hiatal hernia and closure thereof. Despite the creation of a theoretically less effective mechanical barrier, PF was not associated with lower efficacy in terms of acid reflux control. More specifically, the incidence of esophagitis, heartburn, and reflux episodes was comparable. Taken together, the results of the

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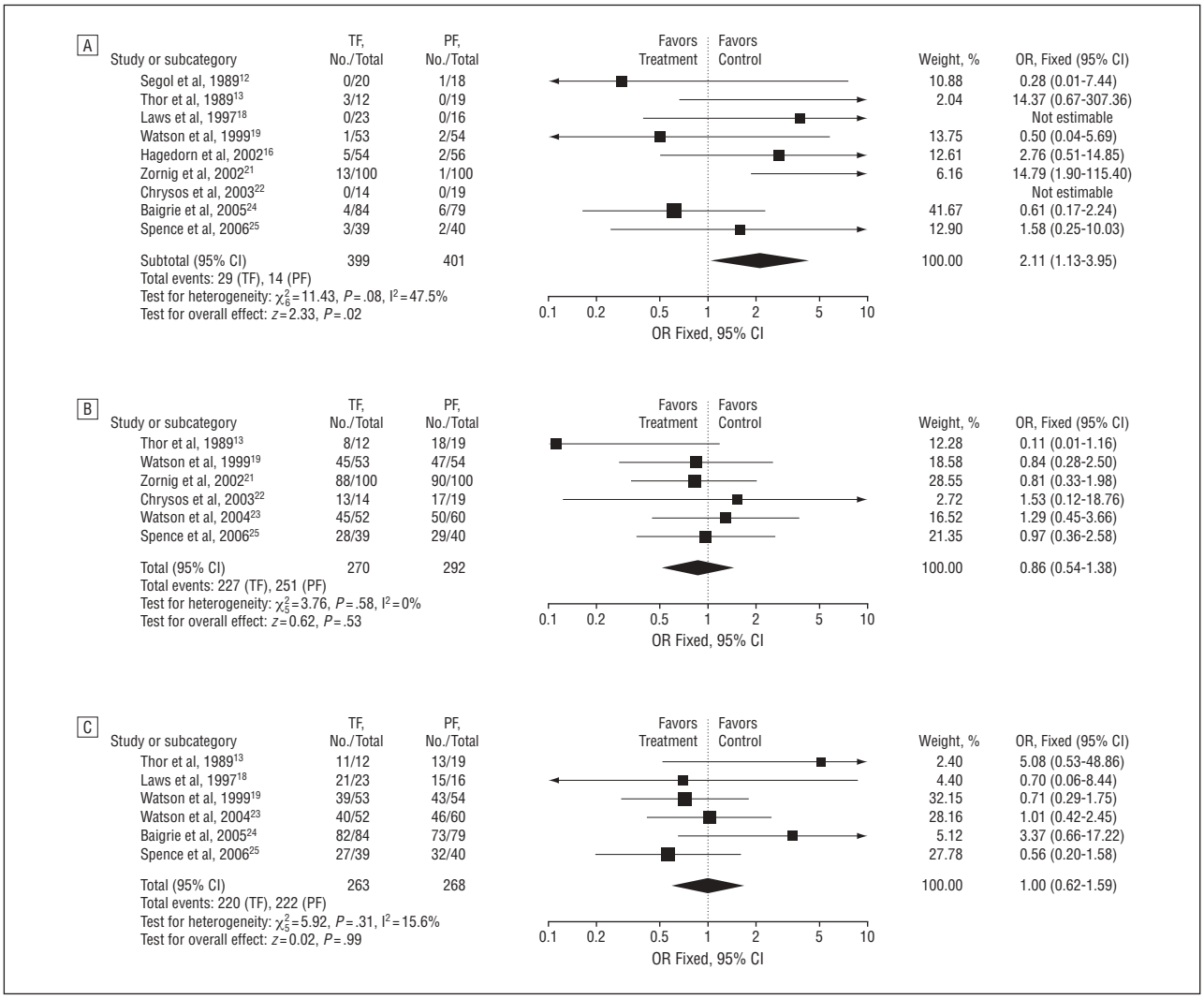

Figure 5. Analysis of reoperation rate (A), outcome (B), and Visick I and II score (C) after total (Nissen) fundoplication (TF) or partial fundoplication (PF). Odds ratios (ORs) are shown with 95% confidence intervals (CIs).

present meta-analysis suggest that PF is the procedure of choice in patients with GERD selected for surgery. Several limitations should, however, be taken into account. First, the general methodological quality of the included trials is low owing to small patient numbers, inadequate trial design or methodology, lack of standardization, and lack of objective outcome assessment. Second, the validity of several of the reported pooled analyses is hampered by statistically significant heterogeneity related to small sample sizes. Therefore, the individual decision as to what type of antireflux barrier to create should be tailored according to the available (limited) evidence, the experience of the operator, and to specific patient-related variables such as preexisting dysphagia, extent of acid reflux, hiatal anatomy, and manometry data. Preoperative manometry could be helpful in the surgical decision-making process.[37] Large scale, multicenter, randomized trials including objective outcome assessment will be required to definitely establish the value of partial vs total fundoplication.

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