OBES SURG (2013) 23:397–407
DOI 10.1007/s11695-012-0852-4

REVIEW

Concomitant Cholecystectomy During Laparoscopic Roux-en-Y Gastric Bypass in Obese Patients Is Not Justified: A Meta-Analysis

Rene Warschkow · Ignazio Tarantino · Kristjan Ukegjini · Ulrich Beutner · Ulrich Güller · Bruno M. Schmied · Sascha A. Müller · Bernd Schultes · Martin Thurnheer

Published online: 12 January 2013

Abstract While LRYGB has become a cornerstone in the surgical treatment of morbidly obese patients, concomitant cholecystectomy during LRYGB remains a matter of debate. The aim of this meta-analysis was to estimate the rate and morbidity of subsequent cholecystectomy after laparoscopic Roux-en-Y gastric bypass (LRYGB) in obese patients. A meta-analysis was performed analyzing the rate and morbidity of subsequent cholecystectomy in patients who underwent LRYGB without concomitant cholecystectomy. Thirteen studies met the inclusion criteria. The rate of subsequent cholecystectomy was 6.8 % (95 % CI, 5.0–8.7 %) based on 6,048 obese patients who underwent LRYGB without concomitant cholecystectomy. The rate of subsequent cholecystectomy due to biliary colic or gallbladder dyskinesia was 5.3 %; due to cholecystitis, 1.0 %; choledocholithiasis, 0.2 %; and biliary pancreatitis, 0.2 %. The mortality after subsequent cholecystectomy was 0 % (95 % CI, 0–0.1 %). The surgery-related complication rate after subsequent cholecystectomy was 1.8 % (95 % CI, 0.7–3.4 %) resulting in a risk of 0.1 % (95 % CI, 0.03–0.3 %) to suffer from a cholecystectomy-related complication in patients undergoing LRYGB without concomitant cholecystectomy. A prophylactic concomitant cholecystectomy during LRYGB should be avoided in patients without cholelithiasis and exclusively be performed in patients with symptomatic biliary disease.

Keywords Laparoscopic Roux-en-Y gastric bypass · LRYGB · Symptomatic cholelithiasis · Bariatric surgery · Morbid obesity · Meta-analysis

R. Warschkow and I. Tarantino contributed equally to this study.

R. Warschkow · I. Tarantino (✉) · K. Ukegjini · U. Beutner · B. M. Schmied · S. A. Müller · B. Schultes · M. Thurnheer
Department of Surgery, Kantonsspital St. Gallen, 9007 St. Gallen, Switzerland
e-mail: ignazio.tarantino@kssg.ch

R. Warschkow
Institute of Medical Biometry and Informatics, University of Heidelberg, 69120 Heidelberg, Germany

U. Güller
University Clinics for Visceral Surgery and Medicine, University Hospital Berne, 3010 Berne, Switzerland

U. Güller
Department of Medical Oncology and Hematology, Kantonsspital St. Gallen, 9007 St. Gallen, Switzerland

Introduction

In recent years, the prevalence of morbid obesity treated with bariatric surgery was rapidly increasing [1]. Laparoscopic Roux-en-Y gastric bypass (LRYGB) is currently the standard bariatric procedure and the number of performed LRYGB almost tripled from 2003 to 2008 [2]. The gallbladder management during LRYGB is controversial. Three different approaches have been proposed: first, prophylactic concomitant cholecystectomy in all obese patients undergoing LRYGB [3–6]; second, a selective approach, based on which cholecystectomy is only performed in the presence of gall stones [7–9] or biliary symptoms [10–16]; third, a wait and see approach, based on which no concomitant cholecystectomy is performed and patients receive prophylactic medication against biliary disease (ursodeoxycholic acid) [3–5, 7, 9, 12, 16–19]. Recently, Worni et al. [2] demonstrated in a nationwide US cohort with 70,287 patients undergoing LRYGB that a selective approach is favored because of better short-term outcomes with significantly lower rates of mortality, morbidity, reinterventions, and shorter hospital stay in patients who did not undergo concomitant cholecystectomy. The authors of this publication reported a significantly decreased rate

of concomitant cholecystectomy from 26.3 % in 2001 to 3.7 % in 2008. However, the long-term biliary morbidity requiring subsequent cholecystectomy was not assessed in this analysis [2].

Thus, we do not know whether the short-term benefits of leaving the gallbladder in situ might be offset by an increased long-term biliary morbidity. Therefore, we performed this meta-analysis to estimate the rate and the morbidity of subsequent cholecystectomy after LRYGB in obese patients.

Methods

This meta-analysis was conducted according to the consensus statement for meta-analysis of observational studies (MOOSE statement) [20]. All criteria of the MOOSE checklist were fulfilled including the structured abstract, introduction (rational for review), methods (search, study selection, data extraction, study characteristics, and quantitative data synthesis), results (trial flow, study characteristics, and quantitative data synthesis), discussion (summary of key findings and discussion of validity), and conclusion (alternative explanation and generalization).

Literature Search

Studies were identified by searching the PubMed database. The search was performed in March 2012. It was restricted to publications in English. The following search term was used: ("concomitant cholecystectomy" AND "gastric bypass") OR ("gastric bypass" [MeSH] OR "laparoscopic gastric bypass" [TIAB] OR "Roux-en-Y gastric bypass" [TIAB] OR "gastric bypass") AND ("cholecystectomy" [MeSH] OR "gallbladder" [MeSH] OR "cholecystectomy"). Two investigators (U.B. and K.U.) independently performed the literature search. To broaden the search, the "related article" function of PubMed and the journal websites was used. Articles referenced in the publications retrieved were also reviewed to identify additional relevant studies.

Selection Criteria

Any study reporting the number of patients with the gallbladder in situ after LRYGB for obesity and the rate of subsequent cholecystectomies of these patients was included in the present meta-analysis. However, if follow-up was shorter than 3 months, the study was excluded. Furthermore, no abstracts were considered. If the outcome was reported on a cohort with open as well as laparoscopic Roux-en-Y bypass surgery, a rate of up to 12 % open surgeries was considered acceptable for inclusion. This cut-off was chosen to allow the inclusion of two relevant studies in our meta-analysis [15, 16]. Studies not stating the number of patients with previous cholecystectomy were excluded unless the number of patients with the gallbladder in situ after LRYGB was explicitly reported. Studies reporting other weight loss operations in addition to LRYGB were only included if the data for patients undergoing LRYGB were separately reported. Patients undergoing a distal variant of the LRYGB in the study of Tarantino et al. [6] were omitted. If multiple studies reported on the same patient cohort or a subgroup of the same patients, the study with the largest cohort reporting the required data was chosen for the analysis. Authors of selected studies were not contacted. Each trial was critically appraised by two investigators (R.W. and U.B.).

Outcome Data Extraction

The data were extracted independently by the same two reviewers and cross-checked. Any discrepancies between the two reviewers were resolved by discussion. For continuous variables, the mean and standard deviation were extracted when available. Otherwise, they were approximated from the median and range as described by Hozo et al. [21]. The primary outcome was the incidence of subsequent cholecystectomy in patients without concomitant cholecystectomy during LRYGB. Secondary outcomes were the reasons for performing a subsequent cholecystectomy, the surgical approach (laparoscopic or open cholecystectomy), the conversion rate, and the intra- and postoperative morbidity of the subsequent cholecystectomy. The reasons for subsequent cholecystectomy were grouped according to the following conditions: biliary colic or gallbladder dyskinesia, cholecystitis, choledocholithiasis, and biliary pancreatitis, which were determined from the reported clinical presentation. If the clinical presentation was not reported, the reason was assumed from the reported pathology instead.

Quality Assessment

Two reviewers (U.B. and K.U.) independently assessed the quality of reporting of the included studies using a modified Newcastle−Ottawa Scale [22]. The Newcastle−Ottawa Scale was designed to assess the quality of nonrandomized studies in meta-analysis. This scale was modified for single cohort studies by omitting all items assessing the quality of the control group. While the maximum score of the Newcastle−Ottawa Scale is nine stars, our modified scale has a maximum score of six. Adequacy of follow-up was considered for at least 1 year of follow-up, ≥80 % follow-up

rate, and ≤10 % lost to follow-up rate. Discrepancies were resolved by consensus in presence of a third investigator (I.T.). The score was not used for weighting or as inclusion criterion in the analysis.

Statistical Analysis

Statistical analysis was performed using the R environment version 2.14.2 (http://www.r-project.org). All meta-analyses were pooled using a random-effects model to adjust for possible variation in the effects between studies [23]. Additionally, fixed-effect models were conducted as sensitivity analysis. If a meta-analysis contained a study reporting no event (rate of 0), the rates were Freeman–Tukey transformed to avoid continuity corrections [24]. Confidence intervals of individual studies in the Forest plots are exact binomial (Clopper–Pearson) intervals. All proportions reported throughout the manuscript are results of random effect meta-analysis, which usually differ from the simple proportion of the sum of all events over the number of patients at risk. Statistical heterogeneity was quantified using Cochran's Q statistic [25] and I^2 and was assessed by visual examination of the forest plot [26]. A funnel plot and the rank correlation test of funnel plot asymmetry were used to examine the possibility of publication bias [27]. To further assess statistical heterogeneity, random effects restricted maximum likelihood meta-regressions were performed to analyze potential factors influencing the rate of subsequent cholecystectomy [28].

Results

Study Selection and Data Extraction

PubMed search identified 133 studies, and 12 studies were found by cross-references. Of these 145 studies, 13 studies met the inclusion criteria for this meta-analysis with 6,048 patients without concomitant cholecystectomy during LRYGB (Fig. 1, Table 1). Two studies were excluded because of subgroup publication [18, 29]. Quality of reporting was moderate to high ranging between 4 and 6 on a modified Newcastle–Ottawa scale (Table 1).

Outcomes Data Extraction

From all 13 studies, follow-up, postoperative intake of ursodeoxycholic acid, and the therapeutic strategy for performing a concomitant cholecystectomy (symptomatic versus all patients with gallstones) could be ascertained. For one study the raw data were available [6]. The results of the data extraction for the long-term biliary morbidity in patients without concomitant cholecystectomy during LRYGB are summarized in Table 2.

Primary Outcome Analyses

The rate of subsequent cholecystectomies was 6.8 %[1] (95 % CI, 5.0–8.7 %) based on 6,048 patients without concomitant cholecystectomy during LRYGB (398 reported cholecystectomies; Fig. 2). In the fixed-effect model, performed as sensitivity analysis, the rate of subsequent cholecystectomies was 5.2 %. The forest plot, the I^2 value and the Cochran's Q statistic indicated statistical heterogeneity. The funnel plot (Fig. 3) and the rank correlation test did not show evidence of a publication bias (P=0.272). In a sensitivity analysis omitting two studies including 4.5 and 11.7 % patients after open RYGB [15, 16], the incidence of subsequent cholecystectomy did not differ significantly and was 5.7 % (95 % CI, 4.0–7.5 %).

If the indication for concomitant cholecystectomy during LRYGB was symptomatic biliary disease, the rate of subsequent cholecystectomies was 8.0 % (95 % CI, 6.0–10.0 %, 5 studies [4, 7–9, 30] with 2,323 patients), while if the indication was cholecystolithiasis, the rate was reduced to 4.8 % (95 % CI, 1.9–7.7 %, 8 studies [6, 10, 12–17] with 3,725 patients) (P=0.273).

The follow-up time varied considerably between the studies and thus might influence the observed rates of subsequent cholecystectomies. To address this issue, a random-effects meta-regression between the follow-up time and the cholecystectomy rate of each study was performed. Cholecystectomy rate significantly correlated with the follow-up time (P=0.001), for every year of follow-up the rate increased by 3.1 % (95 % CI, 1.6–4.6 %) (Fig. 4). No significant influence on the cholecystectomy rate could be found for postoperative ursodeoxycholic acid therapy (p=0.814) and for the proportion of patients in each study who had their gallbladder removed before or during LRYGB (P=0.527).

Reason for Subsequent Cholecystectomy

The rate of subsequent cholecystectomies due to biliary colic or dyskinesia was 5.3 % (95 % CI, 3.2–7.9 %) (Fig. 5) and due to cholecystitis 1.0 % (95 % CI, 0.7–1.4 %) (Fig. 6) based on 9 studies with 3,349 patients. The rate of cholecystectomy due choledocholithiasis was 0.2 % (95 % CI, 0.07–0.4 %; 10 studies, 4,333 patients) (Fig. 7), and due to biliary pancreatitis was 0.2 % (95 % CI, 0.1–0.4 %; 9 studies, 4,100 patients) (Fig. 8).

[1] All proportions throughout the manuscript are results of random effect meta-analysis. Therefore, they may differ from plain numerical proportions.

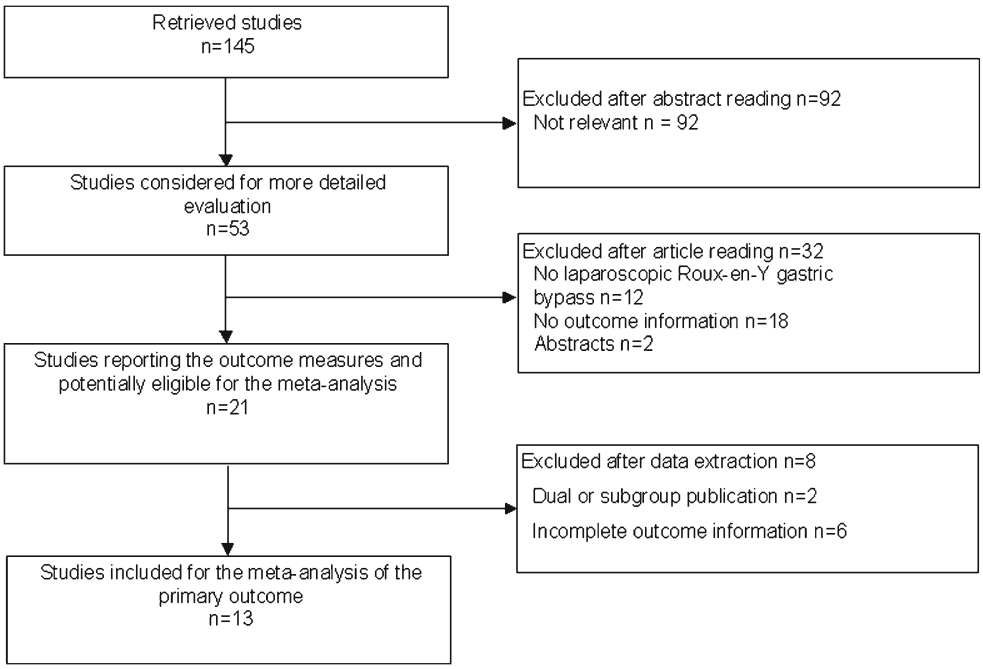


Fig. 1 Flow chart for data inclusion

Mortality and Morbidity of Subsequent Cholecystectomy

No deaths were reported for the 398 patients undergoing subsequent cholecystectomy (0 %; 95 % CI, 0–0.1 %). Subsequent cholecystectomies were performed laparoscopically in 95.6 % (95 % CI, 90.9–98.7 %) (9 studies [4, 6, 8, 9, 12–14, 16, 17] with 4,045 patients and 259 subsequent cholecystectomies). The conversion rate to open cholecystectomy was 1.2 % (95 % CI, 0.2–2.9 %). For all patients without concomitant cholecystectomy during LRYGB, the risk of an open operation was 0.4 % (95 % CI, 0.1–0.8 %).

The complication rate of the subsequent cholecystectomy was 1.8 % (95 % CI, 0.7–3.4 %, 9 studies [6, 8, 9, 12–17] including 4,796 patients with 336 subsequent cholecystectomies) (Table 2). This corresponds to a risk of 0.1 % (95 % CI, 0.03–0.3 %) for all LRYGB patients with gallbladder in situ to suffer a complication during a subsequent cholecystectomy.

Eight studies [6, 8, 9, 12–14, 16, 17] reported additional procedures to treat subsequent biliary disease beyond cholecystectomy with a total rate of 0.3 % (95 % CI, 0.1–0.6 %, 3,812 patients) (Table 2).

Discussion

The present meta-analysis based on 13 studies including 6,048 patients provides profound evidence that a prophylactic concomitant cholecystectomy during LRYGB should be avoided in patients without cholelithiasis and exclusively be performed in patients with symptomatic biliary disease. This is based on several important findings of this meta-analysis: First, the rate of subsequent cholecystectomy after LRYGB is low (6.8 %); second, the main cause for the subsequent cholecystectomy was uncomplicated biliary disease; while choledocholithiasis and biliary pancreatitis occurred very rarely, third, about 95 % of the subsequent cholecystectomies were performed laparoscopically with a very low conversation rate, and finally, the risk to suffer a complication from a subsequent cholecystectomy was extremely low (0.1 %) for all patients without concomitant cholecystectomy during LRYGB. Therefore, a routine concomitant cholecystectomy cannot be recommended when weighting the observed low long-term morbidity against the known potential detrimental effect on the short-term outcome [2].

A recent review indicated a high prevalence of gallstone disease of 10–20 % in the general population in industrialized nations [31–34]. However, only 1–5 % of the patients will progress to a symptomatic disease necessitating a cholecystectomy [31]. In patients after bariatric surgery, the incidence of gallstones or sludge is clearly higher compared to the overall population, ranging from 28 to 71 %. Rapid weight loss and altered gallbladder function increase the risk of biliary stone formation [35–41]. This meta-analysis demonstrated that only 6.8 % of the patients without concomitant cholecystectomy during LRYGB progress to symptomatic disease requiring a cholecystectomy. The progression to symptomatic biliary disease in bariatric patients seems therefore comparable to the general population and hence should not be treated differently.

One of the reasons to routinely perform a concomitant cholecystectomy with LRYGB is the concern of later severe biliary complications such as choledocholithiasis or biliary pancreatitis, particularly since endoscopic retrograde cholangiopancreatography (ERCP) is difficult if not impossible

Table 1 Study description

Study	Study period	Operation	Study design[a]	Quality score[b]	Follow up (months)	Study size for LRYGB (*N*)	Ursodeoxy-cholic acid therapy	Indication concomitant CCE	Cholecystectomy (*N*)[c]			Mean age[d] (years)	Mean BMI[d] (kg/m^2)	Gender[d] (male %)
									prev	conc	none			
Hamad GG [7]	1997–2001	LRYGB	r	4	8.4	556	Yes	Lithiasis	108	94	354	42.2	48.8	18.4
Villegas L [9]	1999–2002	LRYGB	r	4	11.4	289	Yes	Lithiasis	60	40	151	39.7	48.2	11.3
Swartz DE [16]	2003–2004	LRYGB (4.5 % open)	r	4	17.5	692	Yes	Symptoms	92	6	319	41.4	46.9	15.4
Patel KR [13]	2003–2005	LRYGB	r	5	17.8	407	No	Symptoms	84	1	193	43.0	50.1	14.1
Papasavas PK [12]	1999–2004	LRYGB	r	4	15.4	644	Yes	Symptoms	155	20	469	43.2	47.7	24.3
Puzziferri N [30]	1999–2001	LRYGB[e]	P	5	39.0	59	Yes	Lithiasis	16	3	40	47.0	48.0	5.1
Fuller W [17]	2003	LRYGB	r	5	12.0	144	Yes	Symptoms	29	9	106[f]	42.8[g]	45.8[g]	11.3[g]
Portenier DD [15]	2000–2005	LRYGB (11.7 % open)	r	4	29.5	1,391	No	Symptoms[h]	334	73	984	42.0	49.0	14.5
Tucker ON [8]	2000–2006	LRYGB	r	5	30.5	1,711	No	Lithiasis	42	123	1,545	n.s.	n.s.	n.s.
Kim JJ [4]	1996–2006	LRYGB (subgroup)	r	5	22.0	438	Yes	Lithiasis	96	109	233	42.6[i]	51.7[i]	17.3[i]
Patel JA [14]	2002–2007	LRYGB	r	6	32.3	1,376	No	Symptoms	289	37	1,050	43.4	49.3	24.8
D'Hondt M [10]	2003–2009	LRYGB	r	5	51.0	724	No	Symptoms	83	16	625	38.1	41.5	31.0
Tarantino I [6]	2000–2006[j]	LRYGB[k]	r	6	43.6	105	No	Symptoms	11	22	72	43.4	46.4	22.2

CCE Cholecystectomy, *n.s.* Not stated

[a] Study design: *r* retrospective, *P* prospective

[b] Newcastle–Ottawa Scale modified for single cohort studies, maximal score of 6

[c] Number of patients with cholecystectomy previous (prev) to, or concomitant (conc) to LRYGB, resp. none at all

[d] For patients with gallbladder in situ after LRYGB unless otherwise stated

[e] Randomized trial comparing laparoscopic (*N*=59) versus open gastric bypass (*N*=57)

[f] Only for 13 of the 106 patients follow-up data regarding subsequent cholecystectomy were reported

[g] Data from all patients with LRYGB

[h] First year of study with routine prophylactic cholecystectomy in some patients

[i] Data from all study patients

[j] Study period 2006–2008 with routine concomitant cholecystectomy omitted

[k] Patients undergoing a distal variant of LRYGB (*N*=93) excluded

Table 2 Long-term biliary morbidity of patients with gallbladder left in situ

Study	*N* at risk (*N*)	Subsequent cholecystectomy (*N*)	Time to subsequent CCE (months)	Indication for subsequent cholecystectomy (*N*)[a]				Subsequent cholecystectomy (N)			Perioperative complications (*N*)	Additional procedures (*N*)
				CD	CY	CDL	BP	Laparoscopic	Converted	Open or converted		
Hamad et al. [7]	354	8	12.4	8	0	0	0	n.s.	n.s.	n.s.	n.s.	n.s.
Villegas et al. [9]	151	11	11.4	8	2	1	0	10	0	1	0	1[b]
Swartz and Felix [16]	319	47	7.2	45	2	0	0	44	0	3	2[c]	0
Patel et al. [13]	193	12	11.0	5	5	0	2	11	1[d]	1	0	0
Papasavas et al. [12]	469	38	10.6	31	2	2	3	36	1[e]	2	2[f]	4[g]
Puzziferri [30]	40	12[h]	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Fuller et al. [17]	13[i]	1	12.0	1	0	0	0	1	0	0	0	0
Portenier et al. [15]	984	80	11.2	n.s.	n.s.	0	1	n.s.	n.s.	n.s.	1[j]	n.s.
Tucker et al. [8]	1545	85[k]	18.2	75[k]	22[k]	4[k]	3[k]	85	0	0	0	5[l]
Kim and Schirmer [4]	233	3	17.3	3	0	0	0	3	0	0	n.s.	n.s.
Patel et al. [14]	1050	52	10.9	n.s.	n.s.	n.s.	n.s.	52	0	0	0	0
D'Hondt et al. [10]	625	39	17.4	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Tarantino et al. [6]	72	10	17.1	5	4	1	0	9	0	1	0	0

CCE Cholecystectomy, *n.s.* Not stated

[a] *CD* colic or dyskinesia, *CY* cholecystitis, *CDL* choledocholithiasis, *PB* biliary pancreatitis

[b] Emergent open cholecystectomy, common bile duct exploration, and T-tube placement due to suppurative cholangitis with septic shock

[c] Abscess requiring computed tomography-guided drainage and one rectus sheath hematoma from a port-site bleed

[d] Due to bleeding

[e] Due to extensive gallbladder inflammation

[f] Intraoperative bleeding (*N*=1) causing a conversion from laparoscopic to open cholecystectomy, abscess in the gallbladder bed (*N*=1) treated by percutaneous drainage

[g] Successful laparoscopic transgastric endoscopic retrograde cholangiopancreatography (*N*=3), open common bile duct exploration (*N*=1)

[h] One as staged procedure

[i] Only 13 of 106 patients at risk had follow-up data for subsequent cholecystectomy

[j] Injury to the common bile duct

[k] 19 patients with symptomatic cholelithiasis in the postoperative course did not undergo subsequent cholecystectomy

[l] Laparoscopic transgastric endoscopic retrograde cholangiopancreatography (*N*=1), laparoscopic transcystic common bile duct exploration (*N*=4) for biliary pancreatitis (*N*=2) and for obstructive jaundice (*N*=2)

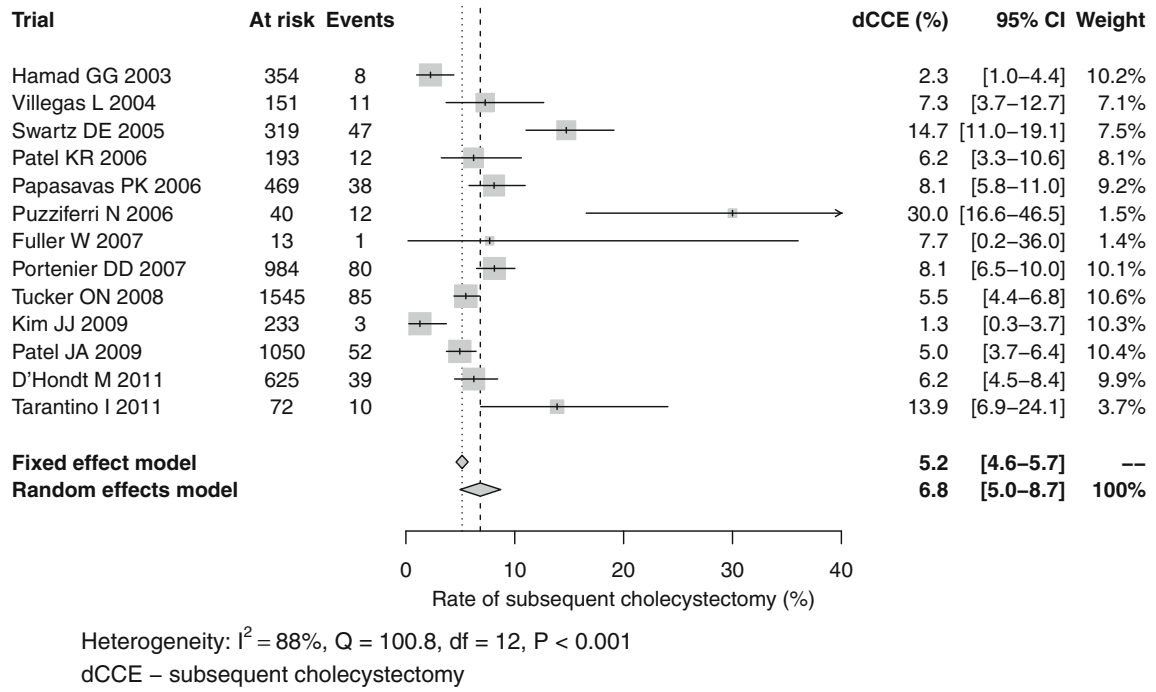


Fig. 2 Meta-analysis of rate of subsequent cholecystectomy

to perform after LRYGB. Although there are reports about transgastric or retrograde ERCP through the biliopancreatic limb, these procedures are difficult to perform and often unsuccessful [42–44]. However, the existing data for the general population in industrialized nations indicate that the majority of patients rarely develop complications without first having at least one previous episode of biliary colic [31, 34]. In analogy, in this meta-analysis choledocholithiasis and biliary pancreatitis were very rare complications occurring in only 0.2 % of the patients after LRYGB. Therefore, this rare phenomenon does certainly not justify a concomitant cholecystectomy as a routine procedure during LRYGB for obese patients.

Some surgeons may argue that routine concomitant cholecystectomy performed by an experienced laparoscopic

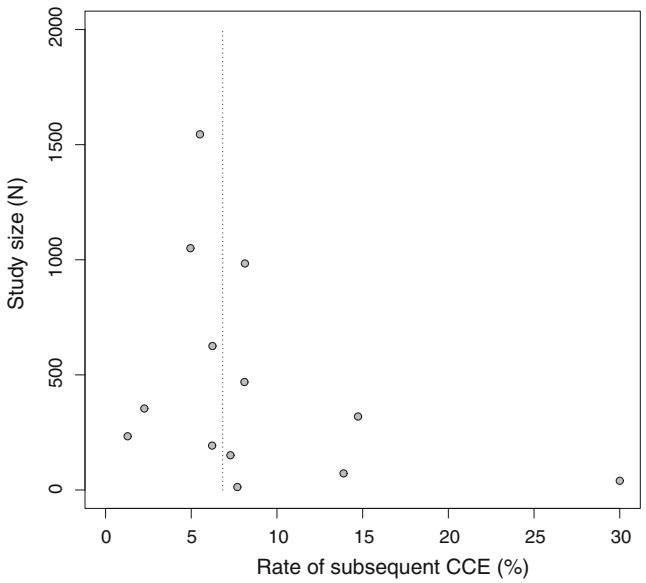


Fig. 3 Funnel plot for subsequent cholecystectomy. Study size was plotted over the rate of cholecystectomy. The *vertical line* represents the pooled random effects rate of subsequent cholecystectomy

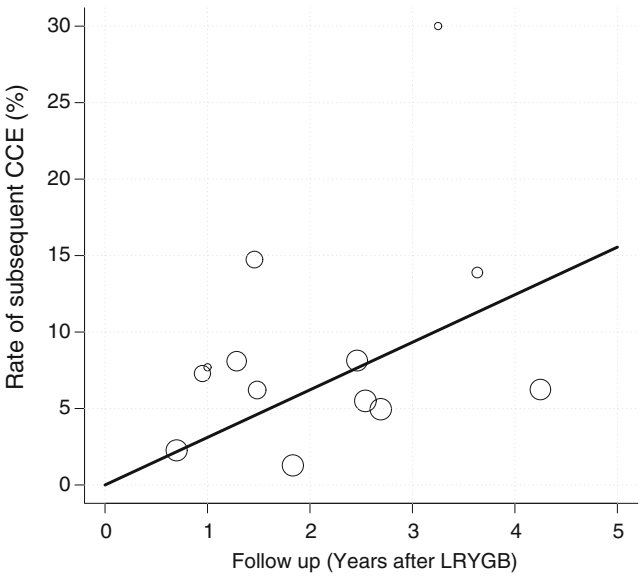


Fig. 4 Meta-regression for follow-up time and subsequent cholecystectomy. The rate of subsequent cholecystectomy was plotted over the follow-up time of the studies. Each *circle* represents one individual study. The *circle area* is proportional to the weight of the study. The *solid line* represents the meta-regression of follow-up time on the rate of subsequent cholecystectomy

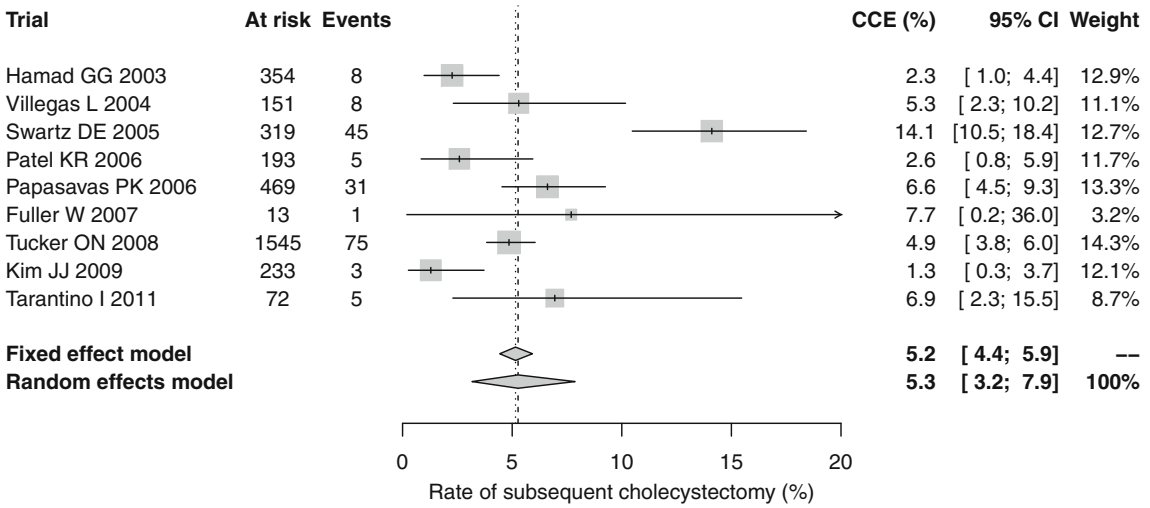


Fig. 5 Meta-analysis of subsequent cholecystectomy for biliary colic or dyskinesia

surgeon puts no or so little extra burden on the patient that the additional procedure might be justified even if only a minority of the patients will benefit from it. However, a recent study by Worni et al. including 70,287 patients reported that laparoscopic gastric bypass surgery with concomitant cholecystectomy had a significantly higher mortality rate compared to gastric bypass surgery alone (0.2 % versus 0.1 %, p=0.012), albeit the mortality of this procedure in absolute terms is low [2]. More importantly, however, the concomitant cholecystectomy increased the overall perioperative complication rate by 1.1 % (6.2 % with concomitant cholecystectomy versus 5.1 % without concomitant cholecystectomy). For comparison, this meta-analysis showed that the risk to suffer a complication during subsequent cholecystectomy is only 0.1 %. A possible explanation for the rather low morbidity might be the change in body habitus during the time between LRYGB and

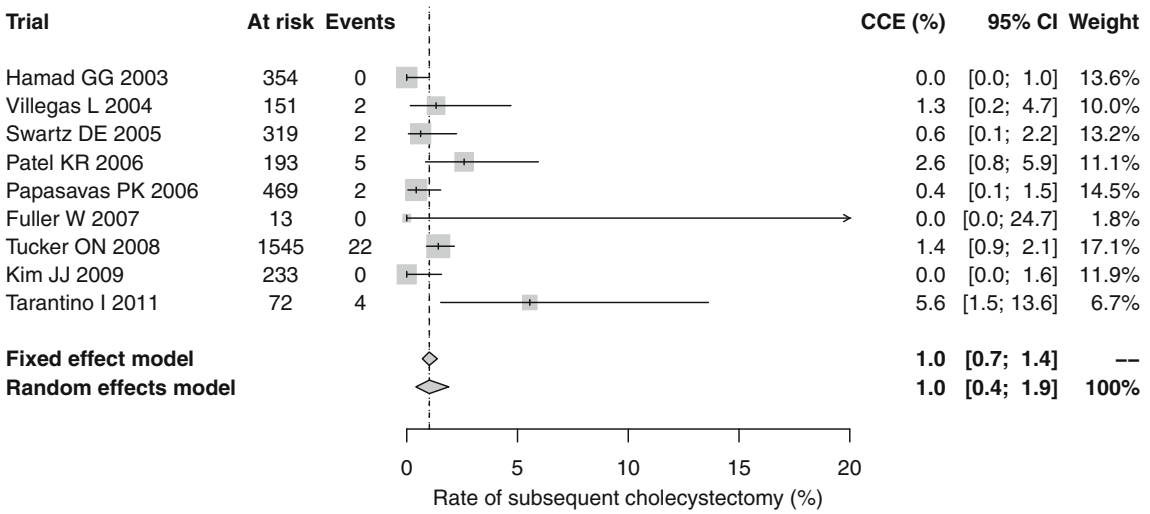
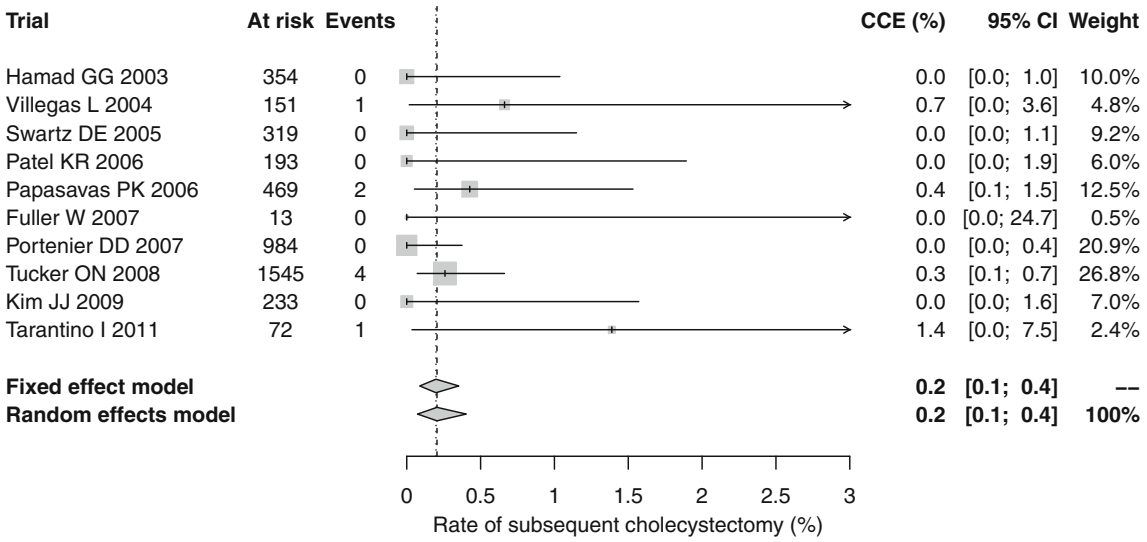


Fig. 6 Meta-analysis of subsequent cholecystectomy for cholecystis



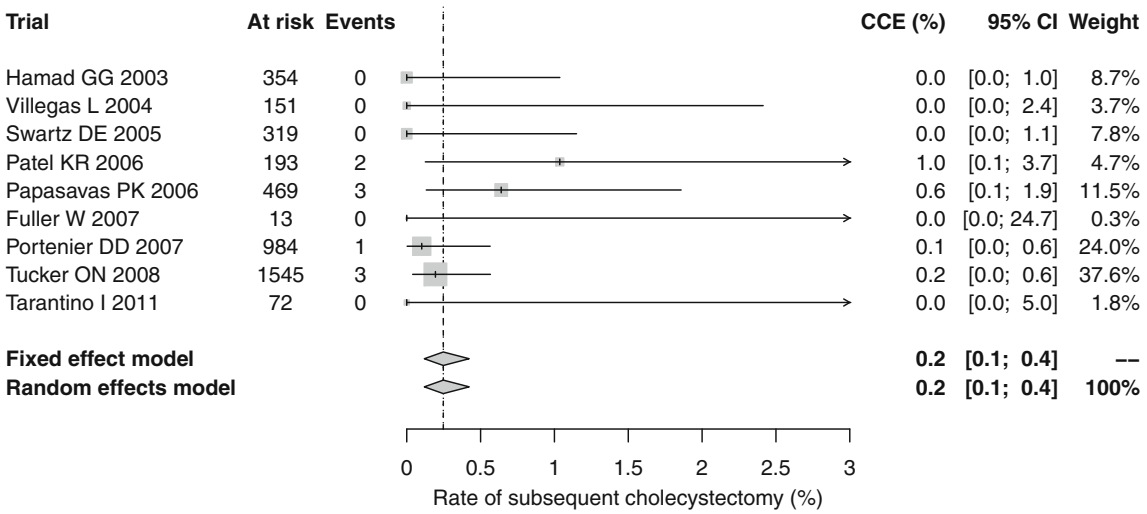
Heterogeneity: $I^2 = 20\%$, Q = 11.2, df = 9, P = 0.263

CCE – subsequent cholecystectomy for choledocholithiasis

Fig. 7 Meta-analysis of subsequent cholecystectomy for choledocholithiasis

subsequent gallbladder removal enabling the use of standard laparoscopic port placements during cholecystectomy [11]. Furthermore, since only laparoscopic gastric bypass procedures were considered for this meta-analysis, little adhesions are to be expected during subsequent cholecystectomy [10]. Finally, not a single death occurred after subsequent cholecystectomy in the present meta-analysis, putting the upper 95 % confidence limit to 0.1 %, which is similar to the actually observed increase in mortality for concomitant cholecystectomy in the study by Worni et al. [2].

Often patients with an intact gallbladder after LRYGB are prescribed a prophylactic ursodeoxycholic acid therapy [3–5, 7, 9, 12, 16–18]. This study could not show a positive effect of this treatment on the rate of subsequent



Heterogeneity: $I^2 = 0.1\%$, Q = 8.0, df = 8, P = 0.433

CCE – subsequent cholecystectomy for biliary pancreatitis

Fig. 8 Meta-analysis of subsequent cholecystectomy for biliary pancreatitis

cholecystectomies. However, most studies clearly indicated very poor compliance of the patients to take this medication [9, 12, 16]. Thus, the results of this meta-analysis do not provide any evidence against or in favor of this treatment.

Based on this meta-analysis, we clearly recommend against performing a routine concomitant cholecystectomy during LRYGB in patients without gallstones. The question that remains to be answered is how to proceed with patients with asymptomatic cholelithiasis. While this meta-analysis showed a reduced rate of subsequent cholecystectomies when concomitant cholecystectomy was performed even for asymptomatic disease compared to only symptomatic disease, this difference was not statistically significant. Considering the known higher morbidity when performing a concomitant cholecystectomy in bariatric patients [2], it is questionable to adhere to the recommendations for the general population. In the general population, relative indications for prophylactic cholecystectomy include calculi smaller than 3 mm or larger than 2 cm, life expectancy over 20 years, or diabetes mellitus [31]. Patients with these indications are at greater risk to develop symptomatic disease or complications [31]. The relative indications for the general population concern the majority of patients undergoing LRYGB. However, the available evidence is not sufficient to answer the question if watchful waiting, a staged procedure for cholecystectomy after weight loss, or a concomitant cholecystectomy is the optimal treatment for patients with asymptomatic cholelithiasis undergoing LRYGB.

We would like to acknowledge the limitations of the present meta-analysis. All data were derived from cohort studies with the exception of one randomized controlled trial comparing open with laparoscopic gastric bypass. The included studies differed considerably in their study design, particularly in the indication for concomitant LRYGB, the postoperative ursodeoxycholic acid therapy, and the primary study outcome. Two studies even included some patients after open RYGB [15, 16] possibly biasing the final result. However, a sensitivity analysis for the rate of subsequent cholecystectomy omitting these two studies did not differ significantly from the main result. The statistical heterogeneity observed in the meta-analyses reflects the differing study designs. Although the statistical heterogeneity seems high, this is probably of no clinical relevance. Perhaps with the exception of one study reporting a rate of 30 % subsequent cholecystectomies [30], none of the included studies reported an outcome that would contradict the conclusions of this meta-analysis. A major concern of this meta-analysis is the varying time of follow-up in the studies and the increasing rate of subsequent cholecystectomies over the follow-up time in the meta-regression. The main outcome that we report is the rate of subsequent cholecystectomies in all studies independent of the follow-up time, which varied between 8 and 51 months. Ideally, one should report the annual incidence of subsequent cholecystectomies for each of the 5 years following surgery. However, for such an analysis, time to event data would be required, which were only reported by two studies [6, 12]. Both studies indicated that, after 5 years, about 20 % of the patients at risk had subsequent cholecystectomy in a Kaplan–Meier analysis. However, one of these studies included a relevant part of patients undergoing a distal variant of LRYGB (excluded from this meta-analysis), which is associated with an increased risk for subsequent cholecystectomy [6]. In the other study, this rate applied only to patients without preoperative ultrasound [12]. To further increase the evidence about the true incidence of subsequent cholecystectomy, a large prospective trial including a time-to-event analysis is warranted.

Conclusion

In summary, this meta-analysis provides compelling evidence that prophylactic cholecystectomy in the absence of biliary disease at the time of LRYGB should be avoided. The risk to develop choledocholithiasis or biliary pancreatitis is very low in patients without undergoing a concomitant cholecystectomy during LRYGB. Moreover, the vast majority of subsequent cholecystectomies can safely be performed laparoscopically. Further studies should evaluate how to treat patients with asymptomatic cholelithiasis.

Conflicts of Interest The authors declare that they have no conflict of interest.

References

1. Kohn GP, Galanko JA, Overby DW, et al. Recent trends in bariatric surgery case volume in the United States. Surgery. 2009;146:375–80.
2. Worni M, Guller U, Shah A, et al. Cholecystectomy concomitant with laparoscopic gastric bypass: a trend analysis of the nationwide inpatient sample from 2001 to 2008. Obes Surg. 2011;22:220–9.
3. Ahmed AR, O'Malley W, Johnson J, et al. Cholecystectomy during laparoscopic gastric bypass has no effect on duration of hospital stay. Obes Surg. 2007;17:1075–9.
4. Kim JJ, Schirmer B. Safety and efficacy of simultaneous cholecystectomy at Roux-en-Y gastric bypass. Surg Obes Relat Dis. 2009;5:48–53.
5. Nougou A, Suter M. Almost routine prophylactic cholecystectomy during laparoscopic gastric bypass is safe. Obes Surg. 2008;18:535–9.
6. Tarantino I, Warschkow R, Steffen T, et al. Is routine cholecystectomy justified in severely obese patients undergoing a laparoscopic Roux-en-Y gastric bypass procedure? A comparative cohort study. Obes Surg. 2011;21:1870–8.
7. Hamad GG, Ikramuddin S, Gourash WF, et al. Elective cholecystectomy during laparoscopic Roux-en-Y gastric bypass: is it worth the wait? Obes Surg. 2003;13:76–81.
8. Tucker ON, Fajnwaks P, Szomstein S, et al. Is concomitant cholecystectomy necessary in obese patients undergoing laparoscopic gastric bypass surgery? Surg Endosc. 2008;22:2450–4.

9. Villegas L, Schneider B, Provost D, et al. Is routine cholecystectomy required during laparoscopic gastric bypass? Obes Surg. 2004;14:60–6.
10. D'Hondt M, Sergeant G, Deylgat B, et al. Prophylactic cholecystectomy, a mandatory step in morbidly obese patients undergoing laparoscopic Roux-en-Y gastric bypass? J Gastrointest Surg. 2011;15:1532–6.
11. Ellner SJ, Myers TT, Piorkowski JR, et al. Routine cholecystectomy is not mandatory during morbid obesity surgery. Surg Obes Relat Dis. 2007;3:456–60.
12. Papasavas PK, Gagne DJ, Ceppa FA, et al. Routine gallbladder screening not necessary in patients undergoing laparoscopic Roux-en-Y gastric bypass. Surg Obes Relat Dis. 2006;2:41–6.
13. Patel KR, White SC, Tejirian T, et al. Gallbladder management during laparoscopic Roux-en-Y gastric bypass surgery: routine preoperative screening for gallstones and postoperative prophylactic medical treatment are not necessary. Am Surg. 2006;72:857–61.
14. Patel JA, Patel NA, Piper GL, et al. Perioperative management of cholelithiasis in patients presenting for laparoscopic Roux-en-Y gastric bypass: have we reached a consensus? Am Surg. 2009;75:470–6.
15. Portenier DD, Grant JP, Blackwood HS, et al. Expectant management of the asymptomatic gallbladder at Roux-en-Y gastric bypass. Surg Obes Relat Dis. 2007;3:476–9.
16. Swartz DE, Felix EL. Elective cholecystectomy after Roux-en-Y gastric bypass: why should asymptomatic gallstones be treated differently in morbidly obese patients? Surg Obes Relat Dis. 2005;1:555–60.
17. Fuller W, Rasmussen JJ, Ghosh J, et al. Is routine cholecystectomy indicated for asymptomatic cholelithiasis in patients undergoing gastric bypass? Obes Surg. 2007;17:747–51.
18. Scott DJ, Villegas L, Sims TL, et al. Intraoperative ultrasound and prophylactic ursodiol for gallstone prevention following laparoscopic gastric bypass. Surg Endosc. 2003;17:1796–802.
19. Tucker O, Soriano I, Szomstein S, et al. Management of choledocholithiasis after laparoscopic Roux-en-Y gastric bypass. Surg Obes Relat Dis. 2008;4:674–8.
20. Stroup DF, Berlin JA, Morton SC, et al. Meta-analysis of observational studies in epidemiology: a proposal for reporting. Meta-analysis of Observational Studies in Epidemiology (MOOSE) group. JAMA. 2000;283:2008–12.
21. Hozo SP, Djulbegovic B, Hozo I. Estimating the mean and variance from the median, range, and the size of a sample. BMC Med Res Methodol. 2005;5:13.
22. Stang A. Critical evaluation of the Newcastle–Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. Eur J Epidemiol. 2010;25:603–5.
23. DerSimonian R, Laird N. Meta-analysis in clinical trials. Control Clin Trials. 1986;7:177–88.
24. Freeman MF, Tukey JW. Transformations related to the angular and the square root. Ann Math Stat. 1950;21:607–11.
25. Whitehead A, Whitehead J. A general parametric approach to the meta-analysis of randomized clinical trials. Stat Med. 1991;10:1665–77.
26. Higgins JP, Thompson SG. Quantifying heterogeneity in a meta-analysis. Stat Med. 2002;21:1539–58.
27. Begg CB, Mazumdar M. Operating characteristics of a rank correlation test for publication bias. Biometrics. 1994;50:1088–101.
28. Viechtbauer W. Conducting meta-analyses in R with the metafor Package. J Stat Softw. 2010;36:1–48.
29. Li VK, Pulido N, Fajnwaks P, et al. Predictors of gallstone formation after bariatric surgery: a multivariate analysis of risk factors comparing gastric bypass, gastric banding, and sleeve gastrectomy. Surg Endosc. 2009;23:1640–4.
30. Puzziferri N, Austrheim-Smith IT, Wolfe BM, et al. Three-year follow-up of a prospective randomized trial comparing laparoscopic versus open gastric bypass. Ann Surg. 2006;243:181–8.
31. Sakorafas GH, Milingos D, Peros G. Asymptomatic cholelithiasis: is cholecystectomy really needed? A critical reappraisal 15 years after the introduction of laparoscopic cholecystectomy. Dig Dis Sci. 2007;52:1313–25.
32. Attili AF, Carulli N, Roda E, et al. Epidemiology of gallstone disease in Italy: prevalence data of the Multicenter Italian Study on Cholelithiasis (M.I.COL.). Am J Epidemiol. 1995;141:158–65.
33. Muhrbeck O, Ahlberg J. Prevalence of gallstone disease in a Swedish population. Scand J Gastroenterol. 1995;30:1125–8.
34. Beckingham IJ. ABC of diseases of liver, pancreas, and biliary system. Gallstone disease. BMJ. 2001;322:91–4.
35. Iglezias Brandao DO, Adami CE, da Silva BB. Impact of rapid weight reduction on risk of cholelithiasis after bariatric surgery. Obes Surg. 2003;13:625–8.
36. Shiffman ML, Sugerman HJ, Kellum JM, et al. Gallstone formation after rapid weight loss: a prospective study in patients undergoing gastric bypass surgery for treatment of morbid obesity. Am J Gastroenterol. 1991;86:1000–5.
37. Everhart JE. Contributions of obesity and weight loss to gallstone disease. Ann Intern Med. 1993;119:1029–35.
38. Wudel Jr LJ, Wright JK, Debelak JP, et al. Prevention of gallstone formation in morbidly obese patients undergoing rapid weight loss: results of a randomized controlled pilot study. J Surg Res. 2002;102:50–6.
39. Amaral JF, Thompson WR. Gallbladder disease in the morbidly obese. Am J Surg. 1985;149:551–7.
40. Sugerman HJ, Brewer WH, Shiffman ML, et al. A multicenter, placebo-controlled, randomized, double-blind, prospective trial of prophylactic ursodiol for the prevention of gallstone formation following gastric-bypass-induced rapid weight loss. Am J Surg. 1995;169:91–6.
41. Schmidt JH, Hocking MP, Rout WR, et al. The case for prophylactic cholecystectomy concomitant with gastric restriction for morbid obesity. Am Surg. 1988;54:269–72.
42. Martinez J, Guerrero L, Byers P, et al. Endoscopic retrograde cholangiopancreatography and gastroduodenoscopy after Roux-en-Y gastric bypass. Surg Endosc. 2006;20:1548–50.
43. Mosler P, Fogel EL. Massive subcutaneous emphysema after attempted endoscopic retrograde cholangiopancreatography in a patient with a history of bariatric gastric bypass surgery. Endoscopy. 2007;39 Suppl 1:E155.
44. Patel JA, Patel NA, Shinde T, et al. Endoscopic retrograde cholangiopancreatography after laparoscopic Roux-en-Y gastric bypass: a case series and review of the literature. Am Surg. 2008;74:689–93.