

Chronic abdominal pain after bariatric surgery: a narrative review

R. VOGELAERTS¹, L. VAN PACTENBEKE¹, M. RAUDSEPP¹, B. MORLION¹

¹University Hospitals of Leuven, Herestraat 49 3000 Leuven, Belgium.

Corresponding author: Vogelaerts R., University Hospitals of Leuven, Herestraat 49 3000 Leuven, Belgium. E-mail: Randy.l.vogelaerts@uzleuven.be

Abstract

Objective: This paper reviews the prevalence, etiology, risk factors, diagnosis and prevention of chronic abdominal pain after bariatric surgery.

Introduction: Chronic pain is a very common and complex problem that has serious consequences on individuals and society. It frequently presents as a result of a disease or an injury. Obesity and obesity-related comorbidities are a major health problem and are dramatically increasing year after year. Dieting and physical exercise show disappointing results in the treatment of obesity. Therefore, bariatric surgery is increasingly widely offered as a weight reducing strategy. In our pain clinic we see a lot of patients who suffer from chronic abdominal pain after bariatric surgery. This review aims to explore the link between chronic abdominal pain and bariatric surgery in this specific type of patients.

Method: The review is based on searches in PubMed, Embase and Cochrane databases. Keywords are used in different combinations. We did a cross-reference of the articles included.

Results: Chronic abdominal pain after bariatric surgery is very common. Around 30% of the bariatric patients experience persistent abdominal pain. An explanation for the abdominal pain is found in 2/3 of these patients. There is a wide variety of causes including behavioral and nutritional disorders, functional motility disorders, biliary disorders, marginal ulceration and internal hernia. Another, frequently overlooked, cause is abdominal wall pain. Unexplained abdominal pain after bariatric surgery is present in 1/3 of the patients with persistent abdominal pain. More studies are needed on the risk factors and prevention of unexplained abdominal pain in bariatric patients.

Keywords: Bariatric Surgery, Gastric bypass, Sleeve gastrectomy, Chronic abdominal pain, Abdominal wall pain.

Introduction

Chronic pain is a complicated and distressing problem that has serious consequences on individuals and society. It is very common and frequently presents as a result of a disease or an injury¹. Chronic pain has been recognized as pain that persists for more than 3 to 6 months². Obesity and obesity-related comorbidities are also a major health problem and are dramatically increasing year after year. Dieting and physical exercise show disappointing results in the treatment of obesity³. Bariatric surgery is widely performed given its high effectiveness for weight loss and resolution of comorbidities with major improvements in quality of life⁴. The International Federation for the Surgery

of Obesity surgery and metabolic disorders (IFSO) reported that in 2018 more than 800 000 bariatric operations were performed worldwide. In recent years, sleeve gastrectomy has surpassed Roux-en-Y gastric bypass as the most common bariatric surgical technique. Both techniques account for 82% of all bariatric operations worldwide^{5,6}.

In the pain clinic at the University Hospitals of Leuven, patients regularly suffer from chronic abdominal pain after bariatric surgery. A wealth of literature is available on chronic pain after abdominal surgery. However, literature on chronic abdominal pain after bariatric surgery is scarce. The aim of this review is to assess the existing literature on prevalence, etiology, risk factors, diagnosis and prevention regarding the occurrence

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of chronic abdominal pain after bariatric surgery. Additionally, this review describes the link between chronic abdominal pain and bariatric surgery in this specific type of patients.

Methods

The review is based on searches in PubMed, Embase and Cochrane Library databases. Search terms used are ‘chronic abdominal pain’, ‘abdominal wall pain’, ‘bariatric surgery’, ‘sleeve gastrectomy’ and ‘gastric bypass’ in different combinations as displayed in Appendix Table I. The included articles were cross-referenced. Inclusion criteria are peer-reviewed journal articles, patients who underwent bariatric surgery, primary data on chronic pain and no limitation in date of publication. Exclusion criteria are abstracts, letters or editorials, full text not available, non-English languages, sources and publications not relevant or lacking adequate detail on chronic pain. The latest search was performed in October 2022. A quality check was performed on these articles using the ‘Standard quality assessment criteria for evaluating primary research papers from a variety of fields’, as seen in Table II’. This checklist consists of 14 items research articles must meet. For each item, the score was calculated depending on the extent to which the specific criteria were met (“yes” = +, “partially” = +/-, “no” = -). An article that met more than half of the criteria was considered to be of good quality.

Results

The search in PubMed, Embase and Cochrane Library resulted in respectively 34, 109 and 42 articles, a total of 185. After exclusion of 49 duplicate articles, 136 articles were respectively screened for relevance on title, abstract and full text. 103 articles were excluded on title, abstract or full text. 15 articles were included via cross-reference. This brings the total number of articles included to 48. The selection strategy can be found as a flowchart in Figure 1.

Prevalence

Chronic abdominal pain after bariatric surgery is a common complication. Blom-Hogestol et al.

Table I. — Search strategy.

Pubmed	((Bariatric surgery[Title/Abstract]) OR (Gastric bypass[Title/Abstract]) OR (Sleeve gastrectomy[Title/Abstract])) AND ((Chronic abdominal pain[Title/Abstract]) OR (abdominal wall pain[Title/Abstract]))
Embase	(‘bariatric surgery’:ti,ab OR ‘gastric bypass’:ti,ab OR ‘sleeve gastrectomy’:ti,ab) AND (‘chronic abdominal pain’:ti,ab OR ‘abdominal wall pain’:ti,ab)
Cochrane Library	((bariatric surgery):ti,ab,kw OR (Gastric bypass):ti,ab,kw OR (Sleeve gastrectomy):ti,ab,kw) AND ((Chronic abdominal pain):ti,ab,kw OR (abdominal wall pain):ti,ab,kw)

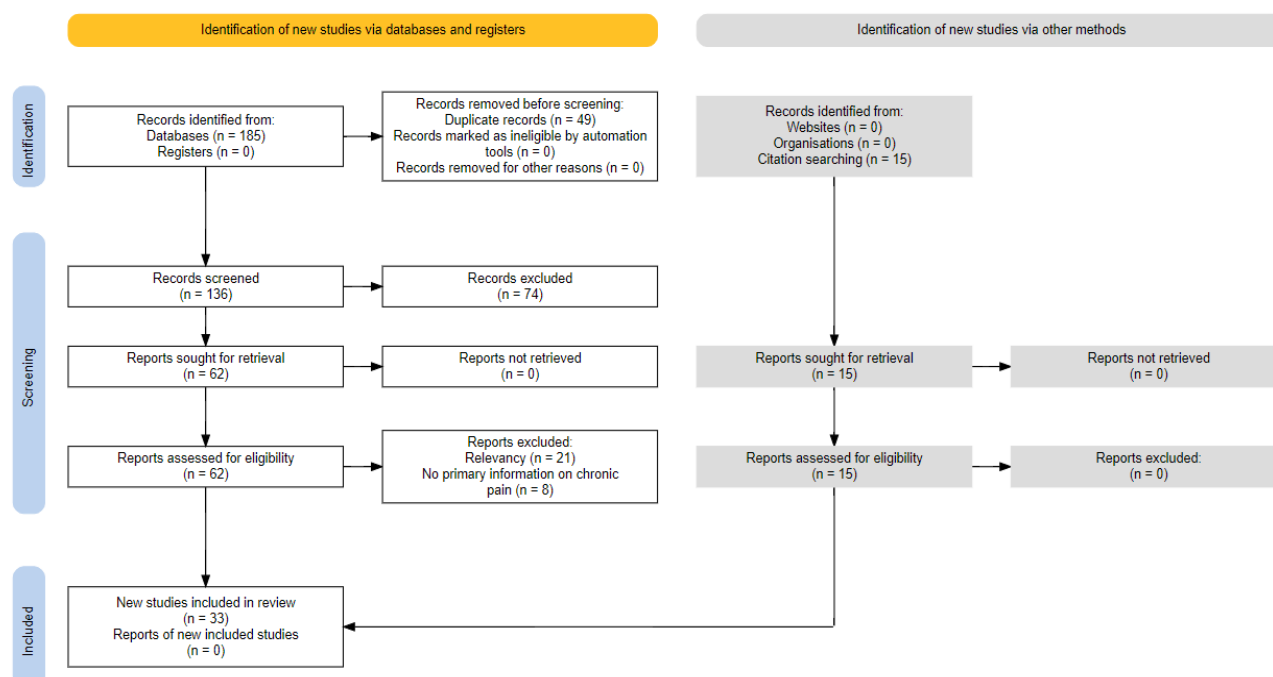


Fig. 1 — Flowchart: Selection strategy.

Table II. — Part I. – Using the ‘Standard quality assessment criteria for evaluating primary research papers from a variety of fields’.

14 criteria: (“yes” = +, “partially” = +/-, “no” = -):

1. Question / objective sufficiently described?
2. Study design evident and appropriate?
3. Method of subject/comparison group selection or source of information/input variables described and appropriate?
4. Subject (and comparison group, if applicable) characteristics sufficiently described?
5. If interventional and random allocation was possible, was it described?
6. If interventional and blinding of investigators was possible, was it reported?
7. If interventional and blinding of subjects was possible, was it reported?
8. Outcome and (if applicable) exposure measure(s) well defined and robust to measurement / misclassification bias?
Means of assessment reported?
9. Sample size appropriate?
10. Analytic methods described/justified and appropriate?
11. Some estimate of variance is reported for the main results?
12. Controlled for confounding?
13. Results reported in sufficient detail?
14. Conclusions supported by the results?

	1	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	TOT.
[8]	+	+	+	+	NA	NA	NA	+	NA	+	+	NA	+	+/-	17/18
[9]	+	+	+	+	NA	NA	NA	+/-	NA	+	-	NA	+/-	+/-	13/18
[10]	+	+	+	+	NA	NA	NA	+/-	NA	+	+	NA	+	+	17/18
[11]	+	+	-	+	NA	NA	NA	+	NA	+	+/-	NA	+	+	15/18
[12]	+	+	+/-	+	NA	NA	NA	+/-	NA	+	-	NA	+/-	+	13/18
[13]	+	+	+/-	+	NA	NA	NA	+	NA	+	+	NA	+	+	17/18
[14]	+	+	+	+	NA	NA	NA	+	NA	+	+/-	+/-	+	+	18/20
[15]	+	+	+	+/-	NA	NA	NA	+	NA	+	-	NA	+	+	15/18
[16]	+	+	NA	+	NA	NA	NA	NA	NA	NA	NA	NA	+/-	+/-	8/10
[17]	+	+	NA	+	NA	NA	NA	NA	NA	NA	NA	NA	+	-	8/10
[18]	+	+	+	+	NA	NA	NA	+/-	NA	+	+	NA	+	+	17/18
[19]	+/-	+	+	+/-	NA	NA	NA	+/-	+/-	+	-	NA	+/-	+	13/20
[20]	+	+	+	+	NA	NA	NA	+	+/-	+	+/-	NA	+	+	18/20
[21]	+	+	+	+/-	NA	NA	NA	+	NA	-	-	NA	+	+	13/18
[22]	+/-	+	+	+	NA	NA	NA	+/-	NA	+	+	NA	+	+	16/18
[23]	+	+	+	+	+/-	+	+	+	+/-	+	+	NA	+	+	24/26
[24]	+	+	+/-	-	NA	NA	NA	+/-	+/-	+	-	NA	+/-	+	12/20
[25]	+	+	+	+/-	NA	NA	NA	+	NA	+	+	NA	+	+	17/18
[26]	+	+	+/-	+	NA	NA	NA	+/-	+	+	-	NA	+	+/-	15/20
[27]	+	+	+	+	NA	NA	NA	+/-	NA	+	+	NA	+	+	17/18
[28]	+	+	+	-	NA	NA	NA	+	+/-	+	+/-	-	+	+	16/22
[29]	+	+	+/-	+/-	NA	NA	NA	+/-	-	+	+/-	-	+/-	+	13/22
[30]	+	+	+/-	-	NA	NA	NA	+	NA	+	+	NA	+	+	15/18
[31]	+/-	+	+	+	NA	NA	NA	+	NA	+/-	+/-	NA	+	+	15/18
[32]	+	+/-	+	-	NA	NA	NA	-	NA	-	-	+/-	+/-	+	9/20
[33]	+	-	NA	+	NA	NA	NA	NA	NA	NA	NA	NA	+/-	+	7/10
[34]	+	+	+/-	+	NA	NA	NA	+	NA	-	+	NA	+	+	15/18
[35]	+	+	+	+/-	NA	NA	NA	+	NA	+	+/-	NA	+	+	16/18
[36]	+/-	+	NA	+	NA	NA	NA	NA	NA	NA	NA	NA	+	+	9/10
[37]	+	+	+/-	+	NA	NA	NA	+	NA	+	+	NA	+	+	17/18
[38]	+	+	+	+	NA	NA	NA	+	NA	+	+/-	NA	+	+	17/18

Table II. — Part II.

[39]	+	+	-	+/-	NA	NA	NA	+/-	NA	-	NA	NA	+	+	10/16
[40]	+	+	+	+	NA	NA	NA	+/-	NA	+	+	NA	+	+	17/18
[41]	+	+	+	+	NA	NA	NA	+	NA	+	+	NA	+	+	18/18
[42]	+	+	+	+	NA	NA	NA	+	NA	+/-	+	NA	+	+	17/18
[43]	+	+/-	-	-	NA	NA	NA	+	NA	+/-	+	NA	+	+	12/18
[44]	+	+	NA	+/-	NA	NA	NA	+	NA	NA	NA	NA	+	+	11/12
[45]	+	+	+	+	NA	NA	NA	+	NA	-	+/-	NA	+	+	15/18
[46]	+	+	+/-	+/-	NA	NA	NA	+	NA	+	+/-	NA	+	+	15/18
[47]	+	+	+/-	+	NA	NA	NA	+/-	NA	+/-	+/-	NA	+	+	14/18
[48]	+	+	-	+	NA	NA	NA	+	NA	+	+	NA	+	+	16/18
[49]	+	+	+	+	+	+	+	+	+	+	+	+	+	+	28/28
[50]	+	+	+	+	+	+	+	+	+	+	+	+	+	+	28/28
[51]	+	+	+	+/-	+	+	+	+	+	+	+	+	+	+	27/28
[52]	+	+	+	+	+	-	+	+	+	+	+	+	+	+	26/28
[53]	+	+	+	+	-	-	-	+	+	+	+	+	+	+	22/28
[54]	+	+	+	+/-	+	+	+	+	+	+	+	+/-	+	+	26/28
[55]	+	+	-	+	NA	NA	NA	+	NA	+	+	NA	+	+	16/18

reported that 34% of the patients suffered from chronic abdominal pain at a 5-year follow-up^{8,9}. Gribsholt et al. performed a large retrospective study of 1429 patients after bariatric surgery. 489 patients (34.2%) showed symptoms of abdominal pain¹⁰. A Norwegian study of 569 patients 8 years after Roux-en-Y gastric bypass observed that 40% of the patients suffered from abdominal pain needing medical imaging¹¹. In one retrospective study abdominal pain was presented in 387 out of 1788 patients (21.6%) after bariatric surgery¹². Gormsen et al. defined 177/787 patients (23%) as having abdominal pain after laparoscopic gastric bypass¹³. Chahal-Kummen et al. investigated the prevalence of abdominal pain before and after Roux-en-Y gastric bypass and found that 11.9% of the patients at baseline and 28.7% of the patients after 2 years experienced abdominal pain¹⁴. Another study of Chahal-Kummen et al. compared the prevalence of chronic abdominal pain before and after sleeve gastrectomy and noted that it was reported in 14.3% before and in 26.9% of the patients after the bariatric surgery¹⁵.

Etiology

Chronic abdominal pain can have multiple etiologies, but the cause is not always ascertainable. Blom-Hogestol et al. showed that diagnosis and treatment were established in 76% of the patients, while 24% had unspecified abdominal pain^{8,9}. The study of Pierik et al. found an explanation in

only 246 patients (63.6%). 133 patients (34.4%) experienced persistent abdominal pain of unknown origin¹².

Behavioral and nutritonal disorders: In the first 6 months after bariatric surgery abdominal pain can be caused by maladaptive eating behavior resulting in pouch distention and by food intolerance.¹⁶ Abdominal pain after bariatric surgery may be caused by bacterial overgrowth in the remnant stomach or small intestine¹⁷. Increased inflammation may be associated with intestinal bacterial overgrowth leading to chronic abdominal pain¹⁸.

Functional motility disorders: Patients with obesity are at risk for a range of motility disorders and other functional gastrointestinal disorders. Obstipation and irritable bowel syndrome can be altered after bariatric surgery^{19,20}. Dumping syndrome can also cause abdominal pain after bariatric surgery, although it isn't a dominant symptom. Studies found that chronic abdominal pain and persistent opioid use are prevalent after bariatric surgery. Opioids can also induce functional abdominal pain due to obstipation and opioid-induced bowel dysfunction. If patients are experiencing unexplained abdominal pain after bariatric surgery the usage of opioids should be stopped^{21,22}.

Biliary disorders: The risk of developing cholangitis and pancreatitis is increased after bariatric surgery due to extreme weight loss and

increased bile lithogenicity. Ursodiol prophylaxis may reduce the prevalence of choledocholithiasis from 40% to 3%²³. Kumar et al. compared treatment of biopsy-confirmed chemical gastropathy after Roux-en-Y gastric bypass. Ursodiol treatment had a significantly higher rate of abdominal pain resolution compared to proton pump inhibitors²⁴. Schulman et al. used ursodiol to treat 61 patients with chronic abdominal pain after bariatric surgery and suspected bile acid gastritis. 52 patients (85.2%) had significant improvement in symptoms²⁵.

Other intra-abdominal causes: Abdominal pain can also be caused by marginal ulceration after gastric bypass and occurs in 6-7% of the patients^{26,27}. It can be caused by gastrogastric fistulas, excessive tension on the anastomosis, NSAIDs, H. pylori infection and foreign material such as staples or sutures. In most cases (85%) gastroesophageal reflux disease (GERD) is resolved after bariatric surgery²⁸. Persistent GERD can be worsened by bile reflux and hiatal hernia²⁹. Another important cause of abdominal pain after bariatric surgery is internal hernia, which is reported in 3-6% of the cases^{30,31}. Since the surgical shift to laparoscopic bariatric surgery, incisional hernia has been replaced by trocar site hernia with an incidence of less than 1%³². Intussusception is a rare but

unneglectable cause of abdominal pain with an incidence of 0.1%³³.

Abdominal wall: Another possible cause for chronic abdominal pain in bariatric patients is abdominal wall pain, such as Anterior Cutaneous Nerve Entrapment Syndrome (ACNES). It is caused by local entrapment of the intercostal nerves by the anterior fascia of the abdominal wall and causes neuropathic pain. Nizak et al. performed a retrospective observational cohort study of 34 patients diagnosed with ACNES and a history of gastric bypass or sleeve gastrectomy. They estimate the incidence of ACNES after bariatric interventions at 2-5%. 11 patients (32%) were successfully treated with lidocaine infiltration and 23 patients (68%) underwent additional neurectomy which was successful in 92%³⁴. Heukensfeldt Jansen et al. treated 49 patients with chronic abdominal wall pain after bariatric surgery. 4 patients (8%) experienced long-term pain relief after one abdominal wall infiltration, 10 patients (20%) after 2-5 infiltrations and 27 patients (54%) after a neurectomy. Carnett's test and a 'pinch' test should be performed at physical examination at follow-up³⁵. In two case reports the diagnosis of ACNES was made after a long diagnostic period and proves that abdominal wall pain is often

Table II. — Prevalence of chronic abdominal pain.

Article reference	Type of article	Prevalence of postoperative chronic abdominal pain	Time after surgery	Abdominal pain prior to surgery
8 Hogestol et al.	Retrospective analysis	54/160 (33.7%)	5 years after surgery	10/54
9 Blom-hogestol et al.	Retrospective analysis	54/165 (32.7%)	5 years after RYGB surgery	6/54
10 Gribsholt et al.	Survey study	778/1429 (54.4%)	Median of 4.7 years after RYGB surgery	/
11 Sandvik et al.	Prospective cohort study	227/569 (39.9%)	8 years after RYGB surgery	/
12 Pierik et al.	Retrospective analysis	89/1788 (5%)	1 month after RYGB surgery, LSG surgery, revising banding to RYGB surgery/LSG surgery	/
13 Gormsen et al.	cohort study	87/784 (11.1%)	5.3 years after RYGB surgery	106/784
14 Chahal-Kummen et al.	Prospective cohort study	60/209 (28.7%)	2 years after RYGB surgery	28/236
15 Chahal-Kummen et al.	Prospective longitudinal study	50/186 (26.9%)	2 years after sleeve gastrectomy surgery	32/223
20 Blom-hogestol et al.	Prospective cohort study	61/233 (26.2%)	2 years after RYGB surgery	27/233
37 Gormsen et al.	Retrospective cohort study	177/787 (22.5%)	5.3 years after RYGB surgery	/
49 Boerboom et al.	Randomized Controlled Trial	27.2% - 40% placebo group - 13% Bupivacaine group	1 year after RYGB surgery	/

Abbreviations: RYGB: Roux-en-Y Gastric Bypass; LSG: laparoscopic Sleeve Gastrectomy.

overlooked. Both patients had successful diagnostic lidocaine injections and remained pain-free after neurectomy³⁶.

Risk factors

The cohort study of Gormsen et al. pointed out following risk factors for developing chronic abdominal pain after bariatric surgery: preoperative use of strong analgesics, unemployment, retirement, smoking and postoperative complications¹³. Gormsen et al. also performed a retrospective, single-center cohort study of 787 patients. Risk factors for atherosclerosis were significantly associated with the development of chronic abdominal pain³⁷. Furthermore, psychosocial factors should be taken into account. Hogestol et al. described depression as a predictive factor for chronic abdominal pain⁸. An observational cohort study found a significant correlation between the preoperative state anxiety score and postoperative pain after sleeve gastrectomy, however there was no correlation between the preoperative trait anxiety score and postoperative pain³⁸. This might not come as a surprise since these are all well-known risk factors for developing Persistent Post-Surgical Pain in general^{39,40}. Alizai et al. examined the prevalence of common psychiatric diagnoses in obese individuals interested in bariatric surgery and found that 85% had screened positive for at least one and more than half of the participants for three or more psychiatric disorders⁴¹. Gota et al. reported a high incidence of fibromyalgia among obese patients⁴². Fibromyalgia was also found as independent preoperative predictor for IBS-like symptoms two years after RYGB surgery in the cohort study of Blom-Hogestol et al²⁰. A recent systematic review by Chin et al. showed that obesity is linked to chronic pain by several mechanisms including an increased systemic inflammatory status, sleep disturbance associated with OSAS and impaired physical activity. The review also states that obese patients have a significantly lower pain threshold⁴³.

Conclusion

A balanced isotonic solution with 1-2,5% glucose should be used as perioperative maintenance IV fluid in children (1 month to 18 years). Colloids can be used in children when inadequate effect in volume correction is achieved with crystalloids. The preferred synthetic colloid for children is a third generation HES in a balanced solution. To date, most clinicians use the “4-2-1 rule” for calculating fluid rate. This may not be the optimal fluid rate. More

research is necessary. Preoperative fasting for clear fluids should be limited to 1 hour, children should even be encouraged to drink up until 1 hour before induction. Respiratory variation of aortic blood flow peak velocity (ΔV_{peak}) with echocardiography is currently the most reliable technique for evaluating fluid responsiveness in children but is limited in practical use. Other techniques are promising but require further investigation and validation in the pediatric population.

Diagnosis

When persistent abdominal pain is present at a follow-up consultation after bariatric surgery, special attention should be made for clinical examination, symptom description, biochemistry, intake of strong analgesics, physical activity, psychological well-being and quality of life. Carnett’s test and a ‘pinch’ test should be performed at physical examination at follow-up to not overlook abdominal wall pain³⁵. If the patient reports persistent abdominal pain, first-line investigations include computed tomography, ultrasonography and endoscopic evaluation. Endoscopy can also provide management of several causes mentioned above⁴⁴. Depending on symptoms and suspected cause, other investigations are possible because of the wide causal variety of chronic abdominal pain. Pitt et al. found diagnostic laparoscopy to be useful in 84.6% of the patients who experienced unexplained persistent abdominal pain after bariatric surgery. The benefit of diagnostic laparoscopy in the diagnosis and the treatment outweighed the potential complications⁴⁵. Two other studies evaluated the effect of diagnostic laparoscopy after bariatric surgery, in one study 73% of the patients were pain-free after diagnostic laparoscopy⁴⁶. The second study pointed out long-term success in 71.4% of the patients⁴⁷. Ryou et al. studied 21 patients with chronic abdominal pain after Roux-en-Y gastric bypass who underwent endoscopic foreign body removal of exposed sutures and staples. 15 (71%) patients reported immediate symptomatic improvement⁴⁸.

Prevention

A Dutch study evaluated the effect of preperitoneal infiltration with bupivacaine in patients receiving bariatric surgery. Postoperatively, patients experienced less pain and needed less opioid rescue therapy. At one year follow-up the prevalence of persistent abdominal pain was 13% in patients who received bupivacaine and 40% in patients who received placebo⁴⁹. A few studies compared the effect of a Transversus

Abdominis Plane (TAP) block after bariatric surgery to a control group. Patients who received a TAP block had lower pain scores and lower opioid requirements postoperatively^{50,51}. Sun et al. found that perioperative intravenous infusion of lidocaine provided better analgesia compared with TAP block 24 hours postoperatively⁵². Bagaphou et al. proved that the TAP block and the Erector Spinae Plane (ESP) block are both very effective in postoperative pain management 48 hours after bariatric surgery. The ESP block was more effective in the first 12 hours⁵³. Elshazly et al. performed a randomized controlled trial comparing the effect on postoperative analgesia between a TAP-block and a bilateral ESP block. They found that a bilateral ESP block is more effective the first 24 hours postoperatively⁵⁴. One study investigated the possible benefit from a multidisciplinary chronic pain program after bariatric surgery. It showed that bariatric patients are less likely to complete the program and are less likely to reduce medication use in the treatment of chronic pain than the control group⁵⁵.

Discussion

The prevalence of chronic abdominal pain after bariatric surgery observed in the literature varies from 5% to 54,4%^{10,12}. This review shows that it is a very common and serious complication. This large percentage probably points out that a lot of patients don't seek medical help when experiencing chronic abdominal pain. A possible reason could be believing abdominal pain comes along with bariatric surgery. A cause of chronic abdominal pain is found in 63.6% to 76% of the patients^{8,9,12}. This means a large number of patients suffer from unexplained chronic abdominal pain after bariatric surgery. We believe that it's in the best interest of the patient to be informed and educated on this preoperatively.

Another possible explanation for chronic abdominal pain after bariatric surgery is the hormonal change. Bariatric surgery can reverse amenorrhea, anovulation and infertility caused by obesity. It's possible that these changes induce abdominal pain⁵⁶. Evidence on the effect of endocrinologic changes on abdominal pain in bariatric patients is lacking.

Chronic abdominal pain after bariatric surgery has a wide variety of possible causes and can be explored by many diagnostic tools. When there is an identified cause, the pain can be managed and the patient can be helped. The patients presenting themselves at a pain clinic mostly suffer from abdominal wall pain and unexplained abdominal

pain. It is very likely this last group of patients have central sensitization of their pain system after a long diagnostic period. A helpful tool for diagnosing central sensitization could be the Central Sensitization Inventory (CSI) questionnaire. However more studies on this subject are needed.

Preoperatively, it's important to make a thorough assessment of the medical history. This includes the medication, smoking status, physical activity, psychological evaluation and a pain assessment. Co-morbidities like IBS, fibromyalgia and GERD should be inquired. We believe it can be useful to use specific questionnaires before and after surgery to frame these risk factors. In the included articles a lot of diagnostic and risk stratification tools are used as seen in Table IV. We would like to suggest a standard postoperative use of DN4-questionnaire since both abdominal wall pain and persistent postsurgical pain have neuropathic properties.

The question arises if preventive perioperative strategies could change the prevalence of chronic abdominal pain after surgery? Is there a place for locoregional anesthesia techniques in the prevention of chronic abdominal pain after bariatric surgery? Multimodal pain management is key after any surgery since this reduces the risk of persistent postsurgical pain. Strong analgesics, like opioids, should be avoided for a longer period of time. They can induce gastrointestinal dysmotility with a possible increase in muscular tone of the Roux limb, which can cause an increase in abdominal pain.

The aim of this review was to assess the existing literature on prevalence, etiology, risk factors, diagnosis and prevention regarding the occurrence of chronic abdominal pain after bariatric surgery. A major limitation of this review is the variability in reported clinical data of the patients in the different studies. Furthermore, different monomodal and multimodal pain assessment methods were applied. For future research we recommend structured assessment of the different risk domains for the development of chronic pain enabling better risk classification of patients considered for bariatric surgery. This approach would give more guidance to the surgical and anesthesiological planning.³⁹ Another limitation is cross-referencing the included articles which makes it prone to selection bias. In conclusion, about 30% of patients experience chronic abdominal pain after bariatric surgery. A wide variety of causes can be identified in two-thirds of patients, leaving one third of patients with unexplained pain. More solid prospective research is needed on the risk factors, diagnosis and prevention of chronic abdominal pain after bariatric surgery.

Table IV. — Tools used to assess abdominal pain and health status.

Tools	Definition	References
Gastro-intestinal Symptom Rating Scale (GSRS)	A rating scale consisting of 15 items for assessment of gastro-intestinal symptoms in irritable bowel syndrome and peptic ulcer disease.	8,9,14,15,20,22
ROME III Questionnaire	Questionnaire for the evaluation of functional gastrointestinal disorders.	8,9,14,15,20
Hospital Anxiety Depression Scale (HADS)	A scale that detects mood disorders, anxiety and depression in adults.	8,14,15
Pain Catastrophizing Scale (PCS)	A self-reporting scale to help quantify an individual's pain experience.	8,14,15
Short Form Health Survey (SF-36, SF-12)	A Health-related quality-of-life questionnaire consisting of 36 or 12 items to assess mental and physical health.	8,10,14,15,20
Brief Pain Inventory (BPI, BPI-SF)	A scale to assess the severity of pain and its impact on functioning.	8,14,15,22
Gastroesophageal Reflux Disease Questionnaire (GERD Questionnaire)	A self-reporting questionnaire for the frequency and severity of upper gastrointestinal symptoms.	15
State-Trait Anxiety Inventory (STAI-I, STAI-II)	A self-reporting questionnaire for the measurement of trait and state anxiety, to distinguish it from depressive syndromes.	38
Health-Related Quality of Life (HRQoL)	An individual's or group's perceived physical and mental health over time. SF-12 of SF-36 is an example of HRQoL.	20
EuroQol 5D (EQ-5D)	A questionnaire for the standardised measurement of health-related quality-of-life developed by the EuroQol Group.	22
Numeric Rating Scale (NRS)	Rating a patients pain on a defined scale.	49
Non-validated questionnaire	Non standardized questionnaires.	9,10,13,14,15,37

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