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REVIEW ARTICLE

Analgesic Treatment in Laparoscopic Gastric Bypass Surgery: a Systematic Review of Randomized Trials

Lars P. H. Andersen · Mads U. Werner · Jacob Rosenberg · Ismail Gögenur

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Abstract This review aimed to present an overview of the randomized controlled trials investigating analgesic regimens used in laparoscopic Roux-en-Y gastric bypass (LRYGB) surgery. Literature search was performed in PubMed and EMBASE databases in August 2013 in accordance to PRISMA guidelines. The literature search identified nine studies eligible for inclusion. The administration of nonsteroidal anti-inflammatory drugs, local anesthetics (intraperitoneally or subfascially/subcutaneously), transversus abdominis plane block, dexmedetomidine, and ketamine may improve analgesia compared to placebo/controls in LRYGB. None of the studies incorporated multimodal procedure-specific analgesic regimens. The Oxford quality scoring system scores indicated a generally limited methodological quality of the included studies. This review documents a need for high-quality, procedure-specific literature concerning analgesic treatment in LRYGB surgery.

Keywords Pain · Analgesia · Laparoscopic · Gastric bypass · Review

Introduction

Laparoscopic Roux-en-Y gastric bypass (LRYGB) is the preferred surgical treatment of obesity [1]. Studies have shown 82 % reduction in excess body mass index within the first 5 years following the procedure [2]. Moreover, bariatric surgery has been shown to improve long-term mortality and reduce comorbidity such as diabetes, heart disease, and cancer [3]. However, up to 41 % of patients experience severe pain within the first 48 h after the surgical procedure [4], which may influence the postoperative complication rate. Patients undergoing bariatric surgery are already in high risk of postoperative complications, due to prevalent preoperative concomitant morbidity and specific anesthesiological and surgical intraoperative challenges [5]. These concerns require an optimized multimodal approach to analgesic treatment in this high-risk patient category.

In this review of randomized controlled studies, we aimed to present an overview of the literature investigating analgesic regimens administered in LRYGB.

L. P. H. Andersen (✉) · J. Rosenberg · I. Gögenur
Department of Surgery D, Herlev Hospital, University of Copenhagen, 2730 Herlev, Denmark
e-mail: lphandersen@gmail.com

J. Rosenberg
e-mail: Jacob.Rosenberg@regionh.dk

I. Gögenur
e-mail: Ismail.Gogenur@regionh.dk

M. U. Werner
Multidisciplinary Pain Center 7612, Neuroscience Center, Rigshospitalet, University of Copenhagen, 2100 Copenhagen, Denmark
e-mail: mads.u.werner@gmail.com

Materials and Methods

The systematic review was conducted in accordance to the PRISMA guidelines [6] (PROSPERO register, registration number CRD42013005614). Literature search was performed in August 2013 in PubMed and EMBASE databases. The objective of the review was to identify and evaluate analgesic treatment modalities applied in the LRYGB procedure. We included randomized, controlled studies written in English investigating the analgesic effect of specific analgesic regimens in a treatment group, compared to a standard analgesic regimen used in a placebo/control group. Studies were identified using the search terms *analgesia* or *analgesic* or *pain* with the operator setting "OR." Search terms were combined with the search terms *laparoscopic* and *gastric bypass*, using the operator setting "AND." The "all field" setting was applied for every search term. Moreover, a manual "snowball" search was performed in the reference lists of the studies included. Two authors (LPHA, IG) individually assessed all

abstracts of studies found in the primary search. Disagreements between the two authors (LPHA, IG) were resolved by consensus. Full-text articles were obtained, evaluated, and included on the basis of the inclusion criteria. Study design, number of patients, operative technique, premedication (only including sedatives, anxiolytics, and analgesics), anesthetic regimen, postoperative analgesic regimen, and patient-related outcomes were evaluated for each study. Data from each study is referred with no interpretation or transformation. Furthermore, studies were assessed with respect to risk of bias and quality using the Oxford quality scoring system [7]. The scoring system is an assessment tool to evaluate the quality and risk of bias in clinical reports (RCTs). The score depends on the quality of randomization, if the study is double blinded and if withdrawals/dropouts are explained. The score ranges from 0 to 5, with 5 as maximal score, indicating a low risk of bias. Moreover, documentation of pre-study sample size calculation, placebo treatment, and blinding procedure were evaluated for

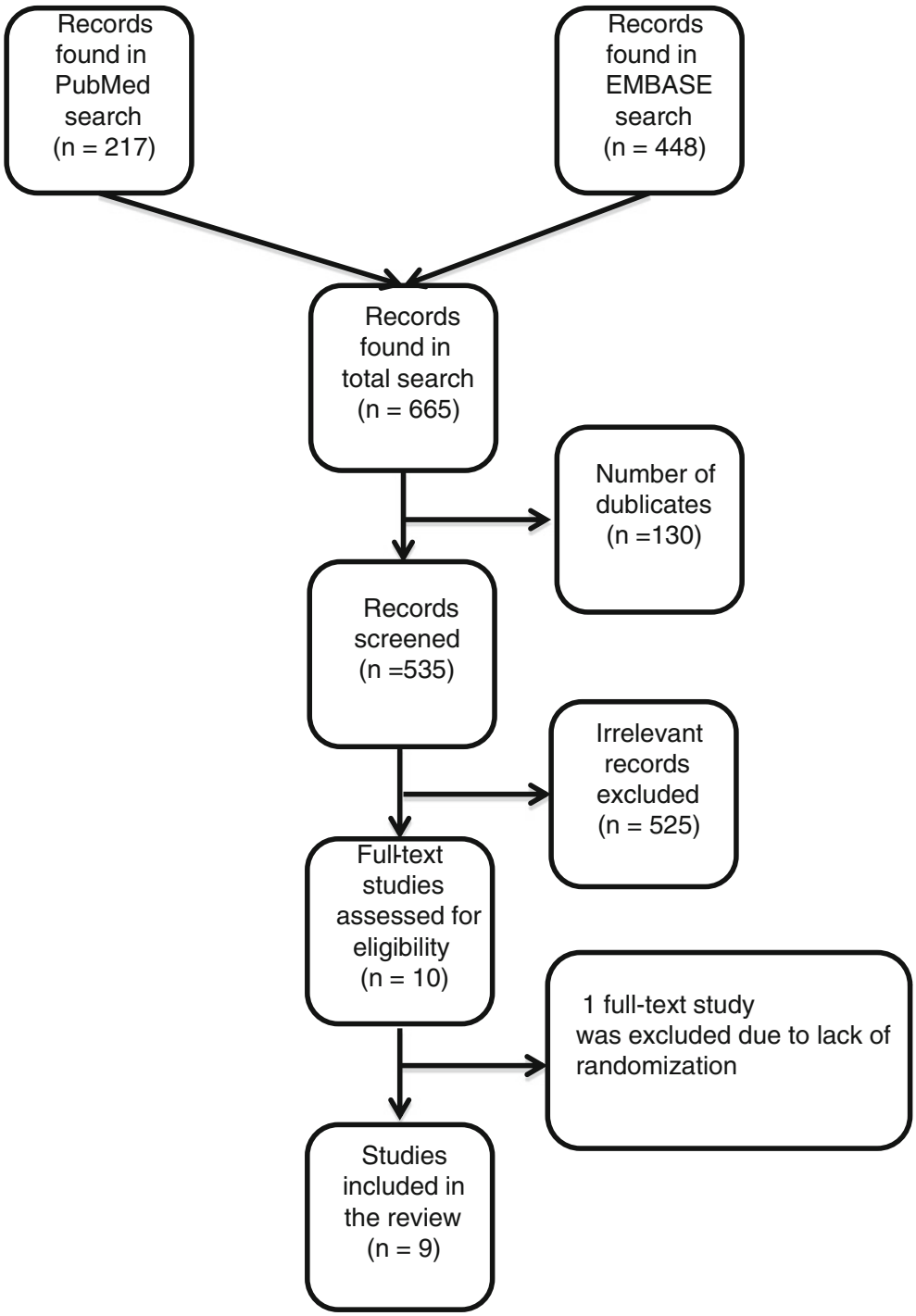

Fig. 1 PRISMA flowchart

each of the included studies. In this review, the authors chose to define *multimodal*, as an analgesic regimen consisting of a basic treatment including acetaminophen, nonsteroidal anti-inflammatory drugs (NSAIDs), opioids, and possible local anesthetics/other analgesics administered concurrently in the postoperative period.

Results

The primary literature search identified 665 records (Fig. 1). One hundred thirty records were excluded as duplicates. Five hundred thirty-five records were screened for full-text evaluation. Ten full-text studies were assessed for eligibility. One full-text study was excluded due to lack of randomization. The complete literature search identified nine studies eligible for inclusion.

The analgesic regimens used in the eligible studies included NSAIDs [8], local anesthetics [9–11], transversus abdominis plane (TAP) block [12, 13], dexmedetomidine (DXM) [14, 15], and ketamine [16] (Table 1).

Table 2 shows analgesics used in the perioperative period. All included studies applied an opioid-based intravenous analgesic regimen as the main treatment in the postoperative period [8–16]. Seven of the nine studies used intravenous patient-controlled analgesia (PCA) [8–11, 14–16].

The Oxford quality score system scores and documentation of sample size calculation of the included studies are given in Table 3. Median score of the studies was 2 with a range of 0 to 5. Four of nine studies documented pre-study sample size calculation [9, 12, 13, 15]. All included studies were randomized; however, blinding procedures differed between the studies, and four of nine studies were not placebo controlled (Table 1) [8, 11, 13, 16].

NSAIDs

Intravenous ketorolac infusion was investigated in a randomized study including 47 patients [8]. Premedication consisted of midazolam. Induction of anesthesia was accomplished with propofol and maintained with desflurane/nitrous oxide. Laparoscopic ports were infiltrated with bupivacaine. Patients were randomized to either ketorolac or remifentanil infusion during surgery. The ketorolac group continued ketorolac infusion for 24 h postoperatively. All patients received PCA with fentanyl postoperatively. The authors demonstrated shorter duration of stay in the post-anesthesia care unit (PACU), improved pain scores within the first 24 h, lower requirements of PCA fentanyl, increased patient satisfaction, better ability to cooperate to pulmonary physiotherapy, and lower incidence of postoperative nausea and vomiting (PONV) in patients receiving ketorolac infusion compared with remifentanil controls.

Local Anesthetics (Intraperitoneally, Subfascially/Subcutaneously)

A randomized, placebo-controlled, double-blinded study including 133 patients evaluated the effect of intraperitoneal bupivacaine [9]. Patients were treated with preoperative midazolam and anesthetized with propofol and fentanyl. Occasional inhalational anesthetics were used for maintenance of anesthesia at the discretion of the anesthesiologist. Before the surgical incision, all patients received port site infiltration with bupivacaine. Furthermore, the treatment group received intraperitoneal instillation of bupivacaine, whereas the placebo group received normal saline. Postoperative pain management consisted of PCA hydromorphone and later orally administered hydrocodone/acetaminophen as rescue treatment. The authors found that the requirements of postoperative hydrocodone/acetaminophen were significantly reduced in the treatment group compared with the placebo group.

Alkhamesi and colleagues also investigated the administration of intraperitoneal bupivacaine in a randomized, placebo-controlled, double-blinded study including 50 patients [10]. Preoperatively, patients received fentanyl and midazolam. Anesthesia was induced with propofol and fentanyl and maintained with sevoflurane and morphine. The treatment group received aerosolized bupivacaine intraperitoneally using a special nebulization device (type or origin of nebulization device was not described in the study). All patients received port infiltration with bupivacaine at the end of surgery. PCA morphine was administered for postoperative analgesia. The treatment group showed significantly improved pain scores within the first 24 h postoperatively compared with the placebo group.

A randomized study including 40 patients investigated the administration of postoperative subfascial/subcutaneous infusion of bupivacaine compared to controls receiving standard analgesic treatment (ON-Q® pain pump) [11]. Patients received preoperative dexamethasone and midazolam. Anesthesia was induced with propofol and fentanyl and maintained with sevoflurane and fentanyl. All patients received port infiltration with bupivacaine at the end of the operation. In the treatment group, catheters for postoperative subfascial/subcutaneous infusion of local anesthetics were inserted below the xiphoid process and tunneled bilaterally below the rib curvatures. Rescue medication consisted of PCA meperidine in both groups. Patients in the treatment group were switched to oral oxycodone/acetaminophen at 19:00 h on the day of surgery, while patients in the control group were switched to oral oxycodone/acetaminophen at 06:00 h on the day after surgery. Pain scores did not differ between the two groups. However, PCA meperidine requirements in the treatment group were reduced from the PACU until the morning after surgery.

Table 1 Table showing differences in clinical outcomes between treatment group and placebo/control group after laparoscopic Roux-en-Y gastric bypass surgery

Study reference	Study design	Placebo	Blinding	*n* (ITT)	Intervention	Outcome parameter	Outcome
[8]	RCT	Not placebo controlled	Patient: + Surgeon: not documented Anesthetic personnel: not documented Care personnel: not documented Investigators: +	47	IV ketorolac versus IV remifentanil (infusions)	Pain scores PCA fentanyl use Patient satisfaction PACU stay Lung physiotherapy ability PONV	↓ ↓ ↑ ↓ ↑ ↓
[9]	RCT	Placebo controlled	Patient: + Surgeon: + Anesthetic personnel: + Care personnel: + Investigators: +	133	IP bupivacaine versus placebo	Pain scores PCA hydromorphone use Hydrocodone/acetaminophen use	→ → ↓
[10]	RCT	Placebo controlled	Patient: + Surgeon: + Anesthetic personnel: + Care personnel: + Investigators: not documented	50	Aerosol IP bupivacaine versus placebo	Pain scores PCA morphine/ hydromorphone use	↓ →
[11]	RCT	Not placebo controlled	Patient: − Surgeon: − Anesthetic personnel: − Care personnel: − Investigators: −	40	Bupivacaine pain pump (SF/SC bupivacaine) (infusion) versus PCA meperidine	Pain scores Meperidine use (PACU) PCA meperidine use	→ → ↓
[12]	RCT	Placebo controlled	Patient: + Surgeon: not documented Anesthetic personnel: + Care personnel: + Investigators: not documented	100	TAP block versus placebo	Pain scores (24 h) Tramadol use (24 h) Sedation scores (6 h) Time to ambulate Patient satisfaction	↓ ↓ ↑ ↓ ↑
[13]	RCT	Not placebo controlled	Patient: + Surgeon: − Anesthetic personnel: − Care personnel: + Investigators: +	57	TAP block versus controls	Pain scores Morphine (equivalents) use Time to first analgesic request Length of hospital stay Pruritus PONV	→ → → → → →
[14]	RCT	Placebo controlled	Patient: + Surgeon: not documented Anesthetic personnel: − Care personnel: + Investigators: +	80	IV dexmedetomidine versus placebo (infusions)	Pain scores PCA morphine use Intraoperative propofol use Intraoperative fentanyl use Hemodynamic stability Recovery profile	↓ ↓ ↓ ↓ ↑ ↑
[15]	RCT	Placebo controlled	Patient: + Surgeon: + Anesthetic personnel: + Care personnel: + Investigators: +	77	IV dexmedetomidine versus placebo (infusions)	Pain scores PCA morphine use (POD 1+2) Fentanyl use (PACU) Intraoperative desflurane use PACU stay Antiemetic use (PACU) Blood pressure (PACU)	→ → ↓ ↓ ↓ ↓ ↓
[16]	RCT	Not placebo controlled	Patient: + Surgeon: not documented Anesthetic personnel: − Care personnel: not documented Investigators: +	60	IV remifentanil versus IV remifentanil + ketamine (infusions)	Pain scores (PACU) PCA morphine use (24 h) Intraoperative propofol use Intraoperative remifentanil use	↓ ↓ ↓ ↓

The symbol +/− indicates sufficient/lack of blinding. Symbols ↑/↓/→ relate to significantly increased/decreased/unchanged values compared to the placebo/control group

RCT randomized controlled trial, *PCA* patient-controlled analgesia, *IV* intravenous, *IP* intraperitoneal, *SC* subcutaneous, *SF* subfascial, *TAP* transversus abdominis plane block, *POD* postoperative day, *PACU* post-anesthetic care unit, *PONV* postoperative nausea and vomiting

Table 2 The analgesic regimens of the included studies

Study	Opioids	NSAIDs	Acetaminophen	Local anesthetics	TAP block	Other analgesics
[8]	PCA fentanyl (IV) (ND)	Ketorolac (IV) (INFU)	–	Bupivacaine (INF)	–	–
[9]	PCA hydromorphone (IV) (ND) 1. postoperative day: Hydrocodone–acetaminophen (PO)	–	1. postoperative day: Hydrocodone–acetaminophen (PO)	Bupivacaine (INF + IP)	–	–
[10]	PCA morphine/hydromorphone (IV) (ND)	–	–	Bupivacaine (INF + IP)	–	–
[11]	PACU: Meperidine (IV) Surgical ward: PCA meperidine (IV) (ND) Oxycodone-acetaminophen (PO)	–	Oxycodone–acetaminophen (PO)	Bupivacaine (INF) (SC + SF) (INFU)	–	–
[12]	Tramadol (IV)	–	–	–	Ropivacaine (TAP)	–
[13]	PACU: Fentanyl (IV) Morphine (IV) Hydromorphone (IV) Surgical ward: Oxycodone (PO) Morphine (IV)	Ketorolac (IN-OP) (IV)	Acetaminophen (PO)	Bupivacaine (INF)	Bupivacaine (TAP)	Dexamethasone (IN-OP) (IV)
[14]	PCA morphine (IV) (ND)	–	–	–	–	Dexamethasone (PRE-OP) (IV) Dexmedetomidine (IV) (INFU)
[15]	PACU: Fentanyl (IV) PACU and surgical ward PCA morphine (IV) (bolus)	Celecoxib (PRE-OP) (PO)	–	Bupivacaine (INF)	–	Dexmedetomidine (IV) (INFU)
[16]	PCA morphine (IV) (bolus)	–	–	–	–	Ketamine (IN-OP) (IV) (INFU) Dexamethasone (PRE-OP) (IV)

The type of patient-controlled analgesia is documented in the table. Anesthetic regimens are not described (see text). The dashes indicate that the type of analgesic was not administered in the study

NSAIDs nonsteroidal anti-inflammatory drugs, *PACU* post-anesthetic care unit, *PCA* patient-controlled analgesia, *PRE-OP* preoperative, *IN-OP* intraoperative, *IV* intravenous, *IP* intraperitoneal, *SC* subcutaneous, *SF* subfascial, *TAP* transversus abdominis plane block, *IF* infiltration, *INFU* infusion, *ND* not documented

Table 3 Oxford quality scoring system score of the included studies. Moreover, the presence of pre-study power calculation in each included study is documented in the table

Study reference	Oxford quality scoring system score	Pre-study power calculation
[8]	1	–
[9]	5	+
[10]	2	–
[11]	0	–
[12]	5	+
[13]	5	+
[14]	1	–
[15]	5	+
[16]	1	–

TAP Block

Two recent randomized double-blinded studies have investigated the use of TAP block [12, 13]. The first study included 100 patients and did not report the premedication procedure or the anesthetic regimen [12]. TAP block using ropivacaine was administered at the end of the operative procedure in the treatment group and compared to placebo using infiltration with normal saline in transversus abdominis plane. Postoperative pain management consisted of intravenous tramadol. The study demonstrated reduced pain scores, time to ambulate, and opioid requirements in the treatment group. In addition, patient satisfaction was significantly improved in the TAP group compared to placebo.

The second study included 57 patients [13]. Anesthesia was induced with fentanyl and propofol and maintained with

desflurane and remifentanil. In the treatment group, TAP block using bupivacaine was performed before the surgical procedure and compared to controls not receiving the TAP procedure. Prior to extubation, the patients received ketorolac, dexamethasone, and port infiltration with bupivacaine. In the PACU, intravenously administered fentanyl, morphine, or hydromorphone was used for preliminary pain control. Standard analgesic treatment consisted of oral acetaminophen and oral hydromorphone at fixed intervals and intravenously administered morphine, if needed. The study could not document any differences in pain scores, opioid requirements, time to first analgesic request, length of hospital stay, pruritus, or PONV.

DXM

Two studies have investigated the use of the α_2-adrenergic receptor agonist, dexmedetomidine [14, 15]. A randomized, placebo-controlled study including 80 patients compared the use of intraoperative DXM infusion with placebo [14]. Premedication included midazolam and dexamethasone. Anesthesia was induced and maintained with propofol and fentanyl. Postoperative pain management consisted of PCA morphine. Intraoperative propofol and fentanyl use were significantly reduced, hemodynamic stability was increased, and patient recovery profile was improved in the DXM group. Furthermore, pain scores and postoperative PCA opioid requirements were reduced in the treatment group.

A randomized, placebo-controlled, double-blinded, dose–response study of intraoperatively administered DXM investigated 77 patients undergoing laparoscopic gastric banding and laparoscopic gastric bypass [15]. All patients received celecoxib and midazolam preoperatively. Anesthesia was induced with propofol, and desflurane was used for maintenance. The treatment group received infusion of DXM intraoperatively. Laparoscopic ports were infiltrated with bupivacaine at the end of surgery. Rescue fentanyl boluses in the early postoperative period were nurse administered. In addition, patients received PCA morphine. The authors documented reduced intraoperative desflurane requirement. Moreover, the authors demonstrated reduced arterial blood pressure on admission to PACU, reduced rescue fentanyl and antiemetic requirements in the PACU, and decreased length of stay in the PACU, in the treatment group.

Ketamine

A single study has investigated the *N*-methyl-D-aspartate receptor antagonist, ketamine, in a randomized placebo-controlled study including 60 patients [16]. Premedication included dexamethasone and midazolam. Patients were anesthetized with propofol and randomized to remifentanil with or without ketamine. Patients received PCA morphine in the postoperative period. The study demonstrated reduced intraoperative requirements of remifentanil and propofol. Moreover, the study documented improved pain scores the first 2 h postoperatively and reduced PCA morphine requirements in the PACU and within the first 24 h of surgery in the group receiving ketamine.

Discussion

This systematic review demonstrates that the existing literature presents limited evidence concerning pain management after LRYGB. Unimodal interventions of NSAIDs, local anesthetics (intraperitoneally or subfascially/subcutaneously), TAP block, dexmedetomidine, and ketamine may improve analgesia after LRYGB, but conclusions are severely limited by the heterogeneous quality and design of the included studies.

Methodological Aspects

Six of nine studies did not present a satisfactory pre-study sample size calculation, thus inducing a possible increased risk of a type II error, due to lack of statistical power [8, 10, 11, 13, 14, 16]. One study included a pre-study power calculation, but did not include the estimated number of required patients [13]. Another issue was an incomplete blinding procedure of the participants/investigators, with inadequate blinding techniques of anesthetic and surgical personnel [8, 10–14, 16], introducing a potential risk of dissimilar patient handling between the treatment groups. Furthermore, four studies were not placebo controlled [8, 11, 13, 16]. Finally, only one study documented if pain scores were recorded at rest or during movement [17]. Movement-evoked pain is often more severe than resting pain and may have clinically important consequences such as reduced mobilization of the patient, increasing the risk of postoperative complications such as delirium, pneumonia, bowel dysfunction, pulmonary atelectasis, and thromboembolic events [18, 19].

NSAIDs

Only one study investigated the analgesic effect of NSAIDs in LRYGB surgery [8]. The limitation of the study was the fact that the treatment group (ketorolac) and the control group (remifentanil) did not receive identical intra- and postoperative pain management regimens (apart from the intervention) and was therefore not a placebo-controlled study. A recent study has linked certain types of NSAIDs to an increased risk of anastomotic leakage after colorectal surgery [20]. It is possible that similar risks are relevant in procedures involving anastomoses of the small intestine and stomach. Moreover, very recent studies have documented that the administration of NSAIDs may increase the risk of cardio- and cerebrovascular

events [21, 22]. Despite well-documented opioid-sparing and analgesic effects through a wide range of abdominal procedures [23], these potential risks of serious side effects in surgical patients should be investigated further, both in this procedure and in general.

Local Anesthetics

Three studies investigated the administration of intraperitoneal or subfascial/subcutaneous local anesthetics in LRYGB. A series of limitations of the studies should be addressed. The *first* study investigated the effect of intraperitoneal bupivacaine and documented a lower requirement of hydrocodone/acetaminophen on the day after surgery [9]. The absolute difference in the requirements of hydrocodone/acetaminophen was 9.9 mL (recommended single dose=15 mL, corresponding to 7.5 mg of hydrocodone (equi-analgesic with 10 mg of orally administered morphine) and 500 mg of acetaminophen), and this limited dose difference may only be of minor clinical relevance. Moreover, the conclusions of the study were limited by an inadequate description of the postoperative analgesic regimen. The *second* study used a special aerosol technique, which was assumed to cover the peritoneum more effectively than conventional instillation [10]. However, this low-powered study showed conflicting results with respect to analgesic requirements and pain scores, making final conclusions difficult. The *third* study investigated the use of subcutaneous/subfascial bupivacaine infusions [11]. The study showed that patients in the treatment group required less PCA meperidine units in the period from the PACU to 06:00 h the day after surgery. However, this result could be expected since the patients in the treatment group received PCA meperidine for a shorter period of time postoperatively, compared to the control group.

The administration of local anesthetics as infiltration analgesia and intraperitoneal administration provides a simple, inexpensive analgesic alternative and is without serious side effects in recommended doses [24]. However, previous studies investigating the administration of local anesthetics in comparable abdominal surgery have shown conflicting results with respect to analgesic efficacy [24, 25]. The procedure-specific studies included in this review suggest that local anesthetics might be effective for LRYGB. However, infiltration analgesia and intraperitoneal instillation of local anesthetics need to be investigated further with respect to clinical effect and optimal route of administration in a multimodal regimen in LRYGB.

Transversus Abdominis Plane Block

The use of TAP block in LRYGB has been investigated in two recent studies, using pre- and postsurgical administration [12, 13]. One randomized, double-blinded, placebo-controlled study documented beneficial effect on both pain scores and analgesic requirements [12]. The other study could not demonstrate any beneficial effect of TAP block, but the study did not include the number of estimated patients according to the pre-study power calculation, and the negative findings could be attributed to lack of statistical power [13]. Moreover, the study was not placebo controlled [13]. In comparable abdominal procedures, findings have been similarly conflicting [26]. The TAP block affects somatic and autonomic pain fibers in the abdominal wall, and hence, no hemodynamic or motor impairment is present, when compared to neuraxial blocks [27]. The use of ultrasound guidance has facilitated clinical use of TAP. However, the anatomy of the obese patient may distort relevant anatomical structures and can potentially impede TAP block in this patient category. The use of TAP block may be incorporated in future multimodal pain regimens, but the technique needs to be investigated further in both LRYGB and in other abdominal procedures.

Dexmedetomidine

DXM is an α_2-agonist with sedative and analgesic effects, not likely to produce clinically significant respiratory depression [28]. The first study by Bakhamees and colleagues showed reduced postoperative pain scores and a reduction in postoperative opioid requirements [14]. The limitation of this study was the short investigation period of postoperative pain scores (2 h after surgery), which could have ignored a possible pain problem in the later postoperative period. The second study also showed reduced anesthetic and analgesic requirements in the DXM group [15]. DXM treatment was associated with decreased PACU stay of average 15–20 min and showed decreased fentanyl use in the PACU of about 75 μg (equivalent of approximately 4 mg of intravenously administered morphine). The clinical impact of these findings is probably of minor importance. Dexmedetomidine provides an interesting analgesic alternative for in patients with increased risk of respiratory depression. However, DXM demands cardiovascular monitoring due to frequent side effects such as bradycardia and hypotension. Furthermore, DXM cannot be administered as bolus injection and require continuous infusion, which also limits the use to intensive care units or during surgery. These considerations should be addressed in future studies and related to the limited clinical effects that documented the procedure-specific studies investigating the administration DXM in LRYGB surgery.

Ketamine

One study by Hasanein and colleagues investigated the administration of low-dose intraoperative ketamine in LRYGB and demonstrated improved pain scores and reduced postoperative opioid requirements [16]. The study did not document

any differences in side effects, such as hallucinations or PONV between the groups. Ketamine is nonetheless associated with well-known psychotropic side effects, such as confusion and hallucinations, and should be investigated further in a larger patient material in LRYGB, before final conclusion concerning a potential clinical use can be made.

Multimodal Approach

Several previous studies have documented that optimal pain management should be procedure specific and multimodal in order to address the specific requirements of the patient in relation to the surgical procedure [29]. Our review documents that the concept of a procedure-specific multimodal approach is not recognized in the existing literature and that all studies have applied an intravenous opioid-based analgesic regimen for postoperative pain management (Table 2). An opioid-based analgesic regimen is not of unequivocal benefit to the patient undergoing bariatric surgery, due to well-known risks of hypoventilation and a potential risk of opioid-induced respiratory depression [30]. It can be recommended that a procedure-specific multimodal approach should be incorporated in future studies investigating this procedure.

Conclusion

This review documents a need for high-quality randomized controlled studies concerning analgesic treatment following LRYGB. Unimodal interventions with NSAIDs, local anesthetics (intraperitoneally or subfascially/subcutaneously), TAP block, dexmedetomidine, and ketamine have demonstrated significant analgesic efficacy, albeit often of limited clinical relevance. An optimal analgesic treatment strategy in LRYGB is not possible to delineate at the moment, but await future studies applying a multimodal, procedure-specific approach.

Conflict of Interest Lars P. H. Andersen, Mads U. Werner, Jacob Rosenberg, and Ismail Gögenur have no conflict of interests to declare.

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