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Systematic Review / Meta-analysis

Regional techniques for pain management following laparoscopic elective colonic resection: A systematic review

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ABSTRACT

Introduction: Pain management is an integral part of Enhanced Recovery After Surgery (ERAS) following laparoscopic colonic resection. A variety of regional and neuraxial techniques were proposed, but their efficacy is still controversial. This systematic review evaluates published evidence on analgesic techniques and their impact on postoperative analgesia and recovery for laparoscopic colonic surgery patients.

Methods: We conducted bibliographic research on May 10, 2021, through PubMed, Cochrane database, and Google scholar. We retained meta-analysis and randomized clinical trials. We graded the strength of clinical data and subsequent recommendations according to the Oxford Centre for Evidence-Based Medicine.

Results: Twelve studies were included. Thoracic epidural analgesia improved postoperative analgesia and bowel function following laparoscopic colectomy. However, it lengthens the hospital stay. Transversus abdominis plane block was as effective as thoracic epidural analgesia concerning pain control but with better postoperative recovery and lower length of hospital stay. Moreover, Lidocaine intravenous infusion improved postoperative pain management and recovery; Quadratus lumborum block provided similar postoperative analgesia and recovery. Finally, wound infiltration reduced postoperative pain without improving recovery of bowel function, and it could be proposed as an alternative to thoracic epidural analgesia.

Conclusions: Several analgesic techniques have been investigated. We found that abdominal wall blocks were as effective as thoracic epidural analgesia for pain management but with lower hospital stay and better recovery. We registered this review on PROSPERO (ID: CRD42021279228).

1. Introduction

Colorectal surgery is one of the most common surgical operations worldwide due essentially to an increasing incidence of colonic and rectal tumors [1]. It is also related to a high rate of morbidity, which ranges from 24.6 to 48.3% [2,3]. Therefore, in 2005, The Enhanced Recovery After Surgery (ERAS) Society proposed a new concept to reduce perioperative stress, maintain the postoperative physiological function, and accelerate recovery after surgery to shorten hospital stay length [4]. Since then, minimally invasive techniques using laparoscopy-assisted colonic and rectal resection have been well-established and become the standard of care in many countries [5]. Although, during postoperative recovery, adequate and efficient analgesia is essential and is associated with early mobilization, fast return of bowel function, minimization of side events, and reduced length of hospital stay (LOS) by avoiding opioid use [6,7]. Multimodal analgesia is considered the backbone for postoperative pain management after laparoscopic colorectal surgery. However, it is recommended in combination with a locoregional technique [5]. Thoracic epidural analgesia (TEA) has been proposed as the gold standard in open colorectal surgery; however, its benefits and efficacy have not been demonstrated yet in a patient undergoing laparoscopic colorectal surgery and may even increase LOS [8]. Therefore, alternative co-analgesic techniques have been proposed, such as abdominal wall block (9], intravenous lidocaine infusion [10] or wound infusion of local anaesthetics [11]; however, there is no international consensus about the optimal analgesic regimens.

This systematic review of randomized controlled trials aimed to

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provide an overall comparison between the different co-analgesic techniques used in laparoscopic colonic surgery regarding their post-operative pain management and recovery effect.

2. Methods

We conducted this review according to the Cochrane Handbook of Systematic Reviews and Interventions, the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines and AMSTAR (Assessing the methodological quality of systematic reviews) guidelines [12,14]. It was registered on PROSPERO (ID: CRD42021279228).

We performed an electronic search of the relevant literature on May 10, 2021, for the publications during the last two decades. We have not used language restriction. We sought trials in the United States National Library of Medicine, Cochrane Library's Controlled Trials Registry and systematic review database, Embase, National Institutes of Health PubMed/MEDLINE, and Google Scholar databases. We used the following Keywords: "analgesia", "pain management", "laparoscopy/ laparoscopic", "colonic surgery", "colectomy", "sigmoid resection", "colonic resection" "patient-controlled analgesia (PCA)", "epidural analgesia", "Transversus abdominis plane (TAP) block", "lidocaine infusion", "quadratus lumborum (QL) block", "wound infiltration/ infusion" and "randomized clinical trials". We checked the reference list of relevant reviews for eligible clinical trials.

Only trials meeting the PICOs criteria were allowed to be included [14]:

P (patients): Patients undergoing laparoscopic surgery for benign or malignant colon diseases received locoregional analgesia techniques. We excluded trials concerning rectal surgery, open colorectal surgery or using laparotomy. The only adult population were considered (aged >18-year-old).

I (intervention) and C (control): trials are comparing different locoregional analgesia techniques with systematic opioids (placebo or PCA morphine) or with other locoregional techniques.

O (outcome): The primary outcome was the postoperative analgesia: visual analogue pain scores reported from 0 to 10 (VAS) at rest and effort during the first three postoperative days (H24, H48 and H72) and total opioid consumption during the first postoperative day (converted to IV-morphine equivalent [13]).

The secondary outcome was the postoperative recovery: the length of hospital stay (LOS), time to first flatus, time to first bowel movement (first defecation), time to tolerate diet and complications (urinary retention, urinary tract infection, surgical site infection (SSI), anastomotic leak, ileus, vomiting and nausea).

S (study types): We retained only meta-analyses of RCTs and RCTs. Data from controlled clinical trials, non-comparative studies, editorials letters, abstract only, comments and case series (fewer than ten cases) were excluded from the analysis. Two authors (MAD and MAC) independently reviewed all abstracts. We retained all studies accompanied by the full text that met inclusion criteria. Disagreements were resolved by discussion after consulting a third member of the review team (MO). Meta-analyses were assessed according to the methodological index of the PRISMA guidelines [12], and RCTs were evaluated according to the CONSORT Statement of quality assessment [15]. We excluded the RCTs that were included in the retained meta-analyses to avoid redundancy.

After evaluating the methodology, we excluded reviews, meta-analyses, or RCTs if they had a PRISMA <13/27 or CONSORT <13/ 25. Clinical data strength and subsequent recommendations were graded according to the Oxford Center for Evidence-Based Medicine levels of evidence [16]. The gradation was done by two authors independently, and discrepancies were resolved through discussion. The levels of evidence are as follows: level 1A, systematic reviews (with homogeneity of RCTs); level 1B, individual RCTs (with narrow confidence intervals); level 2A, systematic reviews (with homogeneity of cohort studies); and level 2B, individual cohort studies (including low-quality RCTs). The grades of recommendation are as follows:

- A: consistent level 1 studies.
- B: consistent level 2 or 3 studies or extrapolations from level 1 studies.
- C: level 4 studies or extrapolations from level 2 or 3 studies.
- D: level 5 evidence or troublingly inconsistent or inconclusive studies of any level.

3. Results

3.1. Study identification and characteristics

The literature search yielded a total of 762 unique articles(**Fig. 1**). After removing duplicates and screening based on titles and abstracts, we retrieved 56 potentially relevant articles. Finally, we retained 11 RCTs [17–25] and one systematic review with meta-analysis [2] that met inclusion and exclusion criteria published between 2007 and 2018. Forty-four studies were excluded with reasons: six studies were meta-analysis including rectal resection [9,26–30], seven RCTs including patients undergoing only open colorectal surgery [31–37], four RCTs were included in the retained meta-analysis [38–41], twenty RCTs assessed rectal surgery, one RCT compared two different approaches of the same analgesic technique [42] and four non-randomized trials [43–46]. Tables 1 and 2 summarise the included meta-analysis and RCTs. Table 3 summarizes studies' findings and evidence levels. An ERAS program was employed in six studies, including standardized postoperative pain management, early oral feeding, early mobilization, and early discharge.

3.2. Thoracicepiduralanalgesia

Perivoliotis et al. [2], in a meta-analysis (level 1a) including eight RCTs (492 patients), concluded that TEA was related to lower walking and resting pain levels at the first postoperative days compared to patient-controlled analgesia (PCA). There was a significant difference concerning the overall VAS scores on the first day but not on the third day favouring the TEA group. LOS was higher in the TEA group concerning the postoperative recovery, whereas the time for first bowel movement and time to tolerate diet was lower in the TEA group. Although, there was no significant difference in urinary retention, SSI, anastomosis leak, ileus, nausea and vomiting.

Thoracic epidural analgesia improved postoperative analgesia and bowel function following laparoscopic colectomy but increased length of hospital stay (grade of recommendation A).

3.3. Transversus abdominis plane block

First described in 2001, TAP block is considered a relatively new locoregional technique that targets the lower intercostal, iliohypogastric and ilioinguinal nerves [47]. Tikuisis et al. [18] (level 1b) reported the outcomes of 64 patients randomized into two groups to receive either TAP block or placebo. Pooled results showed that VAS scores were lower on the first postoperative day at rest and movement ($p < 0.01$), and the opioid consumption was also lower after the TAP block (24.76 mg versus 73.14 mg, $p = 0.002$). The mean length of hospital stay was shorter by 2.7 days in the TAP group ($p = 0.001$), and recovery of intestinal function was faster if TAP block was done ($p < 0.001$). A second RCT was published in 2016 by Torup et al. [17] (level 1b), comparing TAP block with placebo and showed that the only significant difference was a lower morphine consumption in the TAP block (30 mg versus 43 mg, $p = 0.008$).

One RCT comparing TAP block and thoracic epidural analgesia was published in 2018 by Pirrera et al. [48] and included 182 patients (level 1b). There was no significant difference concerning the VAS scores between the two groups. Length of hospital stay was 2.93 ± 1.60 days in

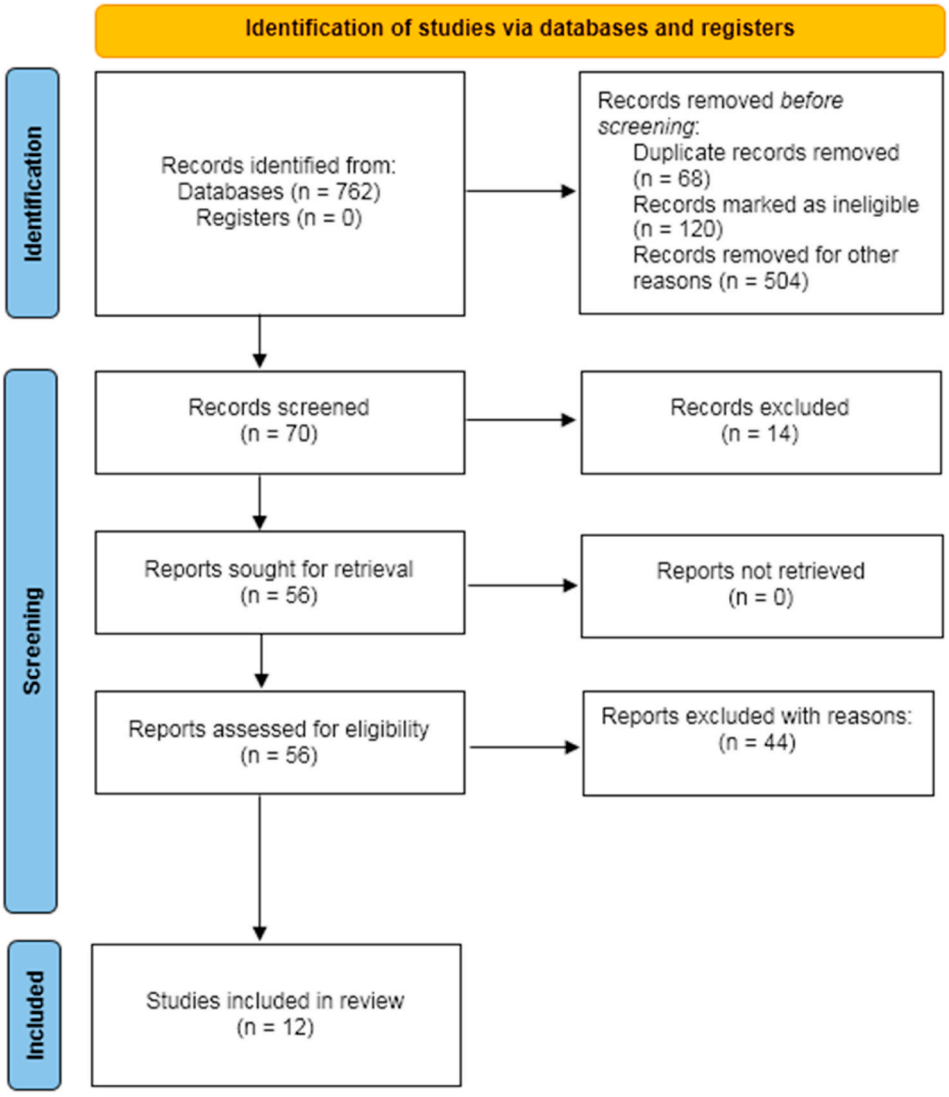

Fig. 1. Flow diagram of the systematic review.

Table 1
Summaries of included meta-analysis.

Authors	Year	Country	Number of studies	RCT in the meta-analysis	Sample size	Intervention/Comparison	PRISMA
1-Perivoliotis et al.	2018	Greece	8 studies	8 RCTs	492 patients	Thoracic epidural analgesia/patient-controlled analgesia	21/27

RCT: randomized controlled trial.

the TEA group and 2.92 ± 0.73 in the TAP group (p = 0.469). However, postoperative nausea and vomiting rates were lower in the TAP block group, as well as ileus and paresthesia rates.

Transversus abdominis plane block reduced postoperative opioid consumption and improved postoperative analgesia (grade of recommendation B).

Transversus abdominis plane block was as effective as thoracic epidural analgesia concerning pain control but with better postoperative recovery and lower length of hospital stay (grade of recommendation B).

3.4. Lidocaine IV infusion

Lidocaine IV infusion efficacy for pain management is well-established after several surgeries [49]; however, its efficacy following laparoscopic colonic resection is still controversial. The protocol used was an IV bolus of lidocaine 1.5 mg/kg (maximum 100 mg) before the induction of anaesthesia followed by an IV infusion of lidocaine 2 mg/kg/h during the surgical procedure and 1 mg/kg/h during the first 24 postoperative hours. Kaba et al. [21], in a RCT (level 1b), compared 20 patients (lidocaine IV group) to 20 patients (placebo group). They showed that lidocaine infusion improved postoperative analgesia (opioid consumption and VAS scores were shorter in the lidocaine group) in addition to facilitated acute postoperative recovery by reducing the length of hospital stay (2 [2,3] versus 3 [3,4], P = 0.001) and improving the return of bowel function. The other two RCTs (level 1b) confirmed lidocaine IV infusion's superiority in pain management and postoperative recovery compared to placebo [19,20].

Lidocaine IV infusion improved postoperative pain management and recovery following laparoscopic colonic surgery (grade of recommendation B).

Table 2
The included randomized controlled trials.

Author	Year	Country	Sample size	Intervention/comparison	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	CONSORT
1- Kaba et al.	2007	Belgium	40	Lidocaïne IV infusion/Placebo	Low	Low	Low	Low	14/25
2- Boulind et al.	2013	UK	34	Wound infusion (Levobupi0.125%)/TEA (Levobupi 0.125%)	Low	Low	Low	Low	15/25
3- Tikuisis et al.	2014	Lithuania	60	Lidocaine IV infusion/Placebo	Low	High/Unclear	Low	Low	19/25
4- Ahn et al.	2015	Korea	50	Lidocaine IV infusion/Placebo	Low	Low	Low	Low	16/25
5- Park et al.	2015	Korea	59	TAP block (40 mL of ropi 0.25%)/ Wound infiltration (40 mL of ropi 0.25%)	Low	Low	Low	Low	14/25
6- Rashid et al.	2016	UK	71	TAP block (40 mL of Bupi 0.25%)/Wound infiltration (40 mL of Bupi 0.25%)	High/Unclear	High/Unclear	High/Unclear	High/Unclear	20/25
7- Torup et al.	2016	Denmark	63	TAP block (40 mL of ropi 0.5%)/ Placebo	Low	Low	Low	Low	21/25
8- Tikuisis et al.	2016	Lithuania	64	TAP block (40 mL of ropi 0.375%)/Placebo	Low	Low	Low	Low	20/25
9- Dewinter et al.	2018	Belgium	100	QL block (30 mL of ropi 0.25%)/ Lidocaine infusion	Low	Low	Low	Low	22/25
10- Duffield et al.	2018	Australia	86	Wound infusion (Ropi 0.2%)/ PCA morphine	Low	Low	Low	Low	22/25
11- Pirrera et al.	2018	Italy	183	TAP block (20 mL of ropi 0.5%)/ TEA (ropi 0.5%)	High/Unclear	High/Unclear	High/Unclear	High/Unclear	14/25

Levobupi: Levobupivacaine; TEA: thoracic epidural analgesia; TAP: transversus abdominis plane; Ropi: ropivacaine; Bupi: Bupivacaine; QL: quadratus lumborum; PCA: patient-controlled analgesia.

3.5. *Wound infiltration (Trocar-site infiltration and intraperitoneal infiltration of local anaesthetic)*

Duffield et al. [22] reported, throughout an RCT (level 1b), the outcomes of 86 patients were randomly assigned to intraperitoneal infiltration and placebo group. Wound infiltration reduced VAS scores at rest and effort postoperatively at 24 h, 48 h and seven days ($P < 0.01$). It also reduced opioid consumption during the first 24 h postoperatively but without a significant difference (72.9 ± 9.3 mg versus 91.4 ± 9.6 mg, $P = 0.09$). However, there was no significant difference concerning the other outcomes between the two groups.

The wound infiltration technique was also compared to thoracic epidural analgesia following colonic resection in one RCT (level 2a) conducted by Boulind et al. [24]. Mean VAS scores on the first day of discharge were 1.9 ± 3.1 on the wound infiltration group (WIG) and 0.7 ± 0.7 on the epidural group ($P > 0.05$). Total morphine consumption was 12 mg in the WIG arm versus 9 mg. There was no significant difference in hospital stay length with a median of 4 [3–5] days and postoperative complications.

Wound infiltration reduced postoperative pain but without improving recovery of bowel function. However, it could be proposed as an alternative to thoracic epidural analgesia (grade of recommendation C).

3.6. *Quadratus lumborum block*

One RCT study (Level 1b) compared QL-block to lidocaine IV infusion following colonic resection was published in 2018 by Dewinter et al. [25]. Infusion of lidocaine has been found to improve postoperative analgesia and recovery. That is why QL-block was compared to it. The amount of opioid consumption was similar between the two groups (37.5 ± 28.4 mg versus 40.2 ± 25 mg, $P = 0.15$), and the mean VAS scores did not differ at any time at rest and effort. Concerning the postoperative rehabilitation, there was no difference between the groups: incidence of vomiting and nausea ($p = 0.58$), length of hospital stay (4 [3–5] versus 4 [4,5], $P = 0.73$) and time to recovery of intestinal function.

Quadratus lumborum block provided similar postoperative analgesia and recovery following laparoscopic colonic resection compared to lidocaine IV infusion. It could be an effective analgesic technique (grade of recommendation C).

4. Discussion

This systematic review proved that thoracic epidural analgesia improved postoperative analgesia and bowel function following laparoscopic colectomy but with a long length of hospital stay. Transversus abdominis plane block was as effective as thoracic epidural analgesia concerning pain control but with better postoperative recovery and lower length of hospital stay. Moreover, Lidocaine intravenous infusion improved postoperative pain management and recovery. Although, quadratus lumborum block provided similar postoperative analgesia and recovery compared to lidocaine infusion. Finally, wound infiltration reduced postoperative pain without improving recovery of bowel function and could be proposed as an alternative to thoracic epidural analgesia.

There is no doubt that the laparoscopic approach ensured greater postoperative recovery even in difficult cases [50–52]. For patients undergoing elective laparoscopic colonic surgery, enhanced recovery after surgery (ERAS) protocols are the standard of care to improve recovery and decrease the postoperative length of hospital stay and morbidity. Adequate pain management based on reduced opioid use is one of the cornerstones of these protocols [30]. Therefore, several regional and neuraxial techniques have been proposed and used as an adjuvant to systemic analgesic to improve pain control. In this review, we examined different methods regarding their impact on postoperative analgesia and recovery.

Thoracic epidural analgesia (TEA) has been considered the gold standard [53]. A Cochrane review published in 2016 showed that an epidural containing a local anaesthetic, with or without an opioid, decreased postoperative pain, accelerated the return to gastrointestinal transit and did not affect the incidence of nausea and vomiting following abdominal surgery [54]. In addition, Popping et al. [55] showed that

Table 3
Summarizes studies' findings and evidence levels.

Features	No. of studies by Evidence level	Findings	Grade of recommendation
Thoracic epidural analgesia	1 level 1A study	Thoracic epidural analgesia improved postoperative analgesia and bowel function following laparoscopic colectomy but increased length of hospital stay	A
Transversus abdominis plane block	2 level 1B studies	Transversus abdominis plane block reduced postoperative opioid consumption and improved postoperative analgesia	B
	1 level 1B study	Transversus abdominis plane block was as effective as thoracic epidural analgesia concerning pain control but with better postoperative recovery and lower length of hospital stay	
Lidocaine IV infusion	3 level 1B studies	Lidocaine IV infusion improved postoperative pain management and recovery following laparoscopic colonic surgery	B
Wound Infiltration	1 level 1B study1 level 2A study	Wound infiltration reduced postoperative pain but without improving recovery of bowel function. Although it could be proposed as an alternative to thoracic epidural analgesia	C
Quadratus lumborum block	1 level 1B study	Quadratus lumborum block provided similar postoperative analgesia and recovery following laparoscopic colonic resection compared to lidocaine IV infusion, so it could be an effective analgesic technique	C

epidural analgesia reduced several cardiovascular and respiratory morbidities throughout their meta-analysis. However, controversies existed on the impact of TEA on hospital LOS, while a recent Cochrane meta-analysis [54] showed that TEA reduced hospital LOS after open abdominal surgery but not following laparoscopic surgery. In this review, we found that TEA increased postoperative hospital stay but improved analgesia and recovery. So, we suggested that TEA should be used in cases of pre-existing respiratory or cardiovascular diseases following laparoscopic colonic surgery.

Since the role of TEA has been questioned about laparoscopic colorectal surgery, interest in abdominal wall blocks, as a part of multimodal analgesia, increased. TAP block was first described in 2001 et has been the most widely studied [47]. It provides analgesic coverage to the anterior abdominal wall (from T10 to L1) by anaesthetizing the thoracolumbar nerves [56]. In 2010, a Cochrane Review showed that TAP block reduced opioid consumption during the first 48 h postoperatively following abdominal surgery; however, it was based on moderately sized studies with significant heterogeneity [57]. A recent systemic review and meta-analysis, published by Peltrini et al. [9], found that TAP block provided a reduction in pain scores and a significant decrease in morphine consumption on the first postoperative day without increasing complications. Another meta-analysis, including six RCTs, compared TAP block to epidural analgesia in colorectal surgery, showed that TAP block was equivalent to TEA in postoperative pain management and improved functional recovery, especially in laparoscopic surgery [29]. We found only three RCTs (two RCTs comparing TAP block versus placebo and one RCT comparing TAP block versus TEA) concerning laparoscopic elective colonic resection. We showed that TAP block could be an effective analgesic technique with better postoperative functional recovery and lower hospital length of stay than TEA. However, the major weakness of the TAP block was its short efficacy duration. This shortness of efficacy may be due to the drug half-life (usually 8–10 h) of the local anaesthetic (conventional bupivacaine and ropivacaine) [58]. Therefore, several methods have been proposed and studied to increase the duration of TAP block, including adding an adjuvant (dexamethasone or dextran) [59], using an infusion catheter [60] or liposomal bupivacaine [61].

In addition, the QL-block controls somatic pain of the upper and lower abdomen through local anaesthetic that covers thoracolumbar and thoracic paravertebral fascia [62]. Deng et al. [63] compared QL-block with TAP block after laparoscopic colorectal surgery and found that QL-block improved postoperative pain management, especially by reducing opioid consumption. These results were confirmed by another RCT published by Huang et al. [64]. Although, one major advantage of QL-block compared to TAP block is its analgesia duration ranging from 24 to 48 h [65]. We found only one RCT comparing QL-block with epidural analgesia concerning laparoscopic colectomy, resulting in similar postoperative analgesia and recovery.

The use of lidocaine IV infusion as an analgesic technique is well established. A Cochrane review including 45 trials proved that lidocaine infusion reduced postoperative pain during the first 24 h postoperatively [66]. For colorectal surgery, a recent meta-analysis including 10 RCTs (508 patients) showed that lidocaine infusion significantly reduced postoperative pain scores, hospital length of stay and time of excretion [10]. However, it was based on high-level heterogeneity studies and included open and laparoscopic colonic and rectal surgery. Regarding laparoscopic colectomy, we found throughout this systemic review that lidocaine infusion improved postoperative analgesia and reduced the length of hospital stay, so it could be considered an effective analgesic technique.

Nevertheless, optimal dosing of lidocaine infusion is still unclear. The standard regimen proposed in the included trials by the Cochrane group was 2 mg/kg/h preceded by a bolus of 1.5 mg/kg/h. It is also unclear whether lidocaine infusion should be continued postoperatively or stopped at the end of the surgery [67]. In addition, continuous monitoring is mandatory during the postoperative period due to lidocaine toxicity related to its plasma concentration [68].

Moreover, wound infiltration was proposed as a potentially valuable technique for pain management following colorectal surgery. It is a local infiltration performed immediately after fascia closure by the surgeon [69]. In a non-randomized prospective trial, Park et al. [23] compared ultrasound TAP block versus wound infiltration and found that pain outcomes were comparable; however, it was less opioid consumption in the TAP block group. Therefore, and to minimize this opioid consumption, Pedrazzani et al. [69] associated TAP block with local wound infiltration. They found that this association reduced the use of opioids and improved pain scores following laparoscopic colorectal surgery.

Our systematic review should be interpreted given several limitations for some reasons. Only 12 studies were included, so we cannot decide for sure due to the small sample size. Besides, several postoperative data were not reported or missed. We have tried to standardize, but some outcomes were not measured or not well-defined. Despite the advances in managing postoperative pain following colonic resection, it is still unclear which technique is better. Reducing opioid consumption, length of hospital stay and improving functional recovery remains challenging for anesthesiologists and surgeons. With a level of evidence, we have tried to assess the co-analgesic techniques to improve

these outcomes. Some of them were effective in pain management and postoperative recovery. However, others are still controversial. This systematic review underlines that further randomized trials are necessary to clarify which analgesic technique is better.

5. Conclusions

According to the available data in the literature, thoracic epidural analgesia improved postoperative analgesia and bowel function following laparoscopic colectomy but increased length of hospital stay (grade of recommendation A), transversus abdominis plane block reduced postoperative opioid consumption and improved postoperative analgesia (grade of recommendation B), transversus abdominis plane block was as effective as thoracic epidural analgesia concerning pain control but with a better postoperative recovery and lower length of hospital stay (grade of recommendation B), lidocaine IV infusion improved postoperative pain management and recovery following laparoscopic colonic surgery (grade of recommendation B), Wound infiltration reduced postoperative pain but without improving recovery of bowel function (grade of recommendation C) and Quadratus lumborum block provided similar postoperative analgesia and recovery following laparoscopic colonic resection compared to lidocaine IV infusion (grade of recommendation C).

Provenance and peer review

Not commissioned, externally peer-reviewed.

Compliance with ethical standards

This research involved human participants. This was a retrospective analysis of published cases and did not require informed consent. Ethics approval and consent to participate were not included in this review.

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Availability of data and materials

All data generated or analyzed during this study are included in this published article.

Author contributions

Mohamed Aziz Daghmouri: This author helped in designing and implementation of the manuscript, analyzing the result, writing the manuscript and approving the final version.

Mohamed Ali Chaouch: This author helped in designing and implementation of the manuscript, analyzing the result, writing the manuscript and approving the final version.

Maroua Oueslati: This author helped in editing and improving the final version of the manuscript.

Lotfi Rebai: This author helped in editing and improving the final version of the manuscript.

Hani Oweira: This author helped in editing and improving the final version of the manuscript.

Trial registry number

Name of the registry: PROSPERO.

Unique Identifying number or registration ID: CRD42021279228.

Hyperlink to your specific registration (must be publicly accessible and will be checked): https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42021279228.

Consent

No Ethical Approval or consent is required as this research project is a systematic review of previous studies.

Guarantor

DAGHMOURI Mohamed Aziz.

Declaration of competing interest

The authors declare that they have no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2021.103124.

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