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Rectus sheath block in the emergency general surgery laparotomy; A review of the available literature

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Abstract

Aim: *The aim of this article was to review the evidence concerning the efficacy and safety of rectus sheath block in emergency general surgery laparotomy.*

Method: *Literature searches were performed using Cochrane Library, Medline, EMBASE and CINAHL databases. All published articles were included across levels of evidence. The outcomes measures looked at included; pain scores, opioid consumption, length of hospital stay and complications.*

Results: *The articles included one randomised controlled trial (RCT), one case-control series, two published abstracts and a single case report. The level of evidence varied across the studies and there is conflicting evidence regarding reduction in post-operative pain scores.*

Conclusion:There is a very limited volume of high methodological quality evidence to support rectus sheath block in adult emergency surgery patients. Few complications were reported suggesting the procedure is safe.

Keywords: Laparoscopic surgery, Emergency, Rectus sheath block

Introduction

Laparoscopic surgery has led to a wide range of procedures being performed via smaller incisions. For some procedures, however, it remains necessary to deliver a specimen or perform an operation through an abdominal incision. A vertical midline laparotomy gives access to the abdomen and pelvis and enables most procedures to be completed, particularly in an emergency.

Surgery causes cellular damage and triggers an inflammatory response, releasing endogenous chemical mediators that activate and sensitise nociceptors. Whilst this inherent, protective pain mechanism is essential, failure to adequately control iatrogenic pain may hamper recovery and affect outcome [1]. Stimulation of the sympathetic nervous system leads to tachycardia and hypertension with altered regional blood flow. This increases myocardial oxygen consumption and can lead to myocardial ischaemia in individuals with pre-existing disease, present in many older adults. Limited mobility due to pain can lead to venous stasis and combined with a post-surgical, pro-thrombotic state, may precipitate deep vein thrombosis and embolism. Such an event will require a period of anti-coagulation with associated potential morbidity and increased cost, or indeed prove fatal. Abdominal or thoracic pain can inhibit deep inspiration through diaphragmatic splinting with a weakened cough leading to atelectasis, reduced functional lung volumes and retention of sputum with hypoxaemia and respiratory tract infections. Delayed gastric emptying and decreased intestinal motility can occur in response to surgery, pain, or as a side-effect of opioid analgesics. This can prolong inpatient stay and have potentially detrimental effects on recovery [2]. Severe post-operative pain and the cell-mediated neurohumoral stress response to surgery can cause increased morbidity and mortality [3]. An individual's recovery from surgery can be negatively affected by anxiety, sleep deprivation and fatigue arising from poor acute pain management [4-6].

The rectus sheath block (RSB) targets the most ventral branches of the T6–T11 spinal nerve roots and are often used with midline incisions [7]. The technique has long been described and is understood to increase the dermatomal blockade in comparison to a transversus abdominis plane (TAP) block [8]. Within the last decade there has been refinement of local anaesthetic truncal blocks for analgesia in abdominal surgery. Rectus sheath block with indwelling local anaesthetic catheters has become more frequent in abdominal surgery via a midline laparotomy. Whilst there is conflicting evidence to support the use of transversus abdominis plane (TAP) blocks in elective surgery, [9-15] there is limited evidence of high methodological quality in support of rectus sheath blocks [16-18].

Patients requiring emergency laparotomy are frequently physiologically stressed, with intravascular depletion requiring inotropic support and sometimes even organ dysfunction. Such a scenario is not normally associated with elective surgery. Such a cohort of patients requiring open, emergency surgery should have analgesic management strategies in keeping with evidence of high methodological quality. This article aims to review the evidence regarding the efficacy and safety of rectus sheath block as an option in open emergency surgery.

Materials and Methods

Literature searches were performed using the Cochrane Library, Medline, EMBASE and CINAHL databases. Search terms included; rectus sheath, rectus sheath block, analgesia, anaesthesia, emergency surgery, laparotomy and iatrogenic. All published articles were included across levels of evidence. Article references were explored to yield further material. The literature review was limited to English language. Articles were excluded if related to solely elective surgery, paediatric surgery, pregnancy, appendicectomy or hernia repair. The search strategy and database results are displayed in Figure 1.

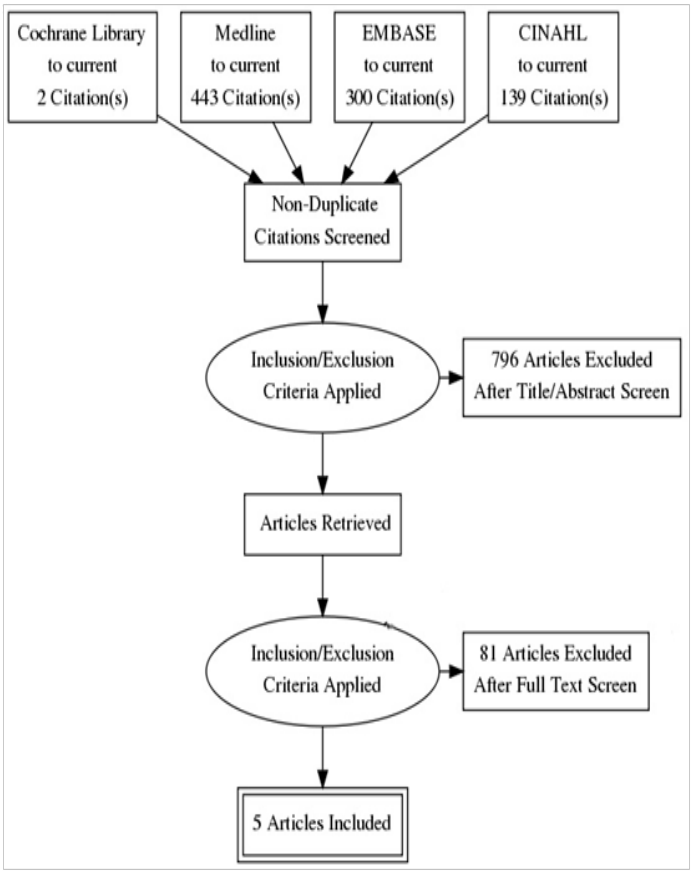

Figure 1. *Search Strategy and results.*

Results

Five published articles were reviewed after applying inclusion and exclusion criteria. Articles included one RCT, one case-control series, two published abstracts and a case report. The relevant features of these articles are demonstrated in Table 1.The articles are reviewed in detail below.

Shabana et al.[16]conducted RCT on 50 adult patients undergoing open abdominal surgery. The authors compared bolus RSB with bupivacaine (20ml 0.25%) to RSB with bupivacaine and morphine (20ml 0.25% and 2mg). Patients had rescue analgesia with an intravenous PCA. Surgery consisted of paraumbilical hernia repair (9) intestinal obstruction (14) and abdominal tumour resection (27). It is not clearly described if these were emergency procedures or elective. The groups were similar in demographic profiles. The study was powered to detect a 25% reduction in opioid requirement, with appropriate randomisation of patients and methods were used to facilitate a double-blind trial. No account was given of patient withdrawal. The authors reported a reduction in visual analogue scores (VAS) pain scores at rest at 6 (p=0.003), 12 (p=0.006) and 18 (p=0.036) hours respectively for the morphine containing RSB group.Similar findings were reported regarding VAS score on mobilisation at 6 (p=0.001), 12 (p=0.007) and 18 hours (p=0.04). Patients with morphine RSB required less opioids in the first 24-hour period and there were no complications in either group.There was no significant reduction in length of hospital stay (p=0.065). This trial was conducted with high methodological quality thereby decreasing the risk of bias. However, it is possible that some of these cases were elective and paraumbilical hernia repair is not comparable to midline laparotomy and bowel resection in terms of expected post-operative pain. The blocks were placed surgically via incisions lateral to the rectus.This is different technique from routine practice of open or ultrasound (US) guided and other studies have not supported the use of peripheral morphine administration in improving pain relief [22]. This trial represents level 1++ evidence regarding the potential benefit of a morphine and bupivacaine combination RSB, but is not comparing RSB to systemic analgesia or other regional anaesthetic techniques [23].

Godden et al. (2013) conducted a retrospective casenote review of 109 patients undergoing open colorectal surgery [17]. 85 patients had Epidural analgesia (EA)and 24 had RSB. 7 emergency patients were included, of which 1 had RSB. Bilateral US-guided blocks were sited with a bolus regimen of 0.25% levobupivacaine 6 hourly. The epidural group experienced a significantly higher incidence of hypotension on the first postoperative day (p=0.0001). There was no significant difference in pain score or opioid use between the groups (p=0.92). There was no significant difference in postoperative respiratory tract infection, anastomotic leak or wound complications between the groups (p=0.2, p=1.0 and p=0.5 respectively). Ileus was more common with rectus sheath anaesthesia than epidural (4/24 vs 2/85, p=0.026) respectively. However, the authors report that the numbers were too small to draw a reliable conclusion. The authors recognise the fact that this retrospective review is not a direct comparison and as such represents a 2- level of evidence [23]. Furthermore, they also reference their own local prospective trial that has not yet reported stating it is comparing EA to RSB, which, if emergency patients are included, will potentially provide high quality evidence that is currently lacking.

Malchow et al. [19] report the successful use of RSB infusion in a fit 38-year-old patient wishing to avoid epidural use because of poor experience previously and with previous opioid addiction. The block was placed awake post emergency adhesiolysis and remained in situ with good effect for 5 days without complication. This case report represents level 3 evidence [23].

Lili et al. [20] reported on a trial comparing single infusion RSB in conjunction with TAP blocks versus TAP alone in 60 elderly adults having emergency surgery. The operative details or demographics were not provided. The patients were reportedly randomised but no information was provided. No other information regarding analgesic protocol was offered, nor the duration of observation of patients, nor complications. No results were provided, just p values, with no confidence intervals. The outcomes favour the combined block compared to the control group in terms of pain scores, intraoperative opioid use, length of hospital stay and satisfaction. It is not possible to confer a level of evidence to this published abstract because so many important methodological details were not stated.

Van Der Walt et al. [21] report the use of RSB infusion in 12 patients undergoing emergency laparotomy. A morphine PCA was used concurrently but the patients were not randomised to

Author	Study Type	Urgency of cases	No. Participants	Operation	Comparison	Pain Score	Other Outcomes	Level of Evidence
Shabana et al. [16]	RCT	Emergency	50	Paraumbilical hernia repair, Tumour resection, Obstruction	RSB & RSB with morphine surgically placed	Reduction at 6(p=0.003), 12(p=0.006) and 18 hours (p=0.0036) in morphine group	Reduction in opioids, 0.7 ± 2 vs 6.3 ± 8.3mg 24 hours, p=0.002	1++
Godden et al. [17]	Retro-spective case-control	Elective (102) and emergency (7)	85 EA, 24 RSB, of which 1 RSB in emergency and 6 EA	Open colorectal surgery	EA	No difference (p=0.92)	Increased ileus (p=0.026), no difference in wound problem rate, leak rate or infection rate.	2-
Malchow et al. [19]	Case report	Emergency	1	Adhesiolysis	n/a	Satisfied	Avoided opioids	3
Lili et al. [20]	Published abstract	Emergency	60	Not described	TAP & RS vs No block	Reduction at 2, 6, 12 hr p<0.05	Lower Intraoperative sufentanil p<0.05, Lower LOS p<0.05, higher satisfaction p<0.05	n/a
Van Der Walt et al. [21]	Published abstract	Emergency	12	Unplanned laparotomy	n/a	Reduction	Reduction in opioid use	n/a

Table 1. *Articles appraised after selection criteria applied.*

treatment. Moderate pain was reported at a diminishing frequency in the cohort over time. Six patients used 4-18mg morphine over 24 hours while the remaining six required up to 110mg. Four patients used 12-18mg morphine over the next 24 hour and 8 required up to 65mg.There were no complications. A level of evidence cannot be ascribed to this published abstract.

Safety of rectus sheath blocks

A surgical insertion technique for RSB, at the time of laparotomy, should decrease the potential risk of visceral injury, which is not yet reported in the literature. Examples have been published of visceral injury in TAP blocks, but the incidence is low in the context of published patient numbers [24-26]. The use of ultrasound decreases peritoneal puncture in abdominal procedures [27].

Surgeons should be vigilant to avoid suturing the catheter in situ, which has been reported to require re-operation [28,29]. Wound dehiscence and infection have been associated with RSB use, but similar rates also occurred in control groups within the studies and in the context of low patient numbers [17,30,31]. The surgeon and anaesthetist should be aware that plasma local anaesthetic levels with RSB may not rise predictably and can rise above accepted maximal dose, however no adverse effect was reported [32,33].

Discussion

This review demonstrates the paucity of evidence supporting the use and efficacy of rectus sheath blocks in patients undergoing emergency laparotomy. Anecdotal experience suggests rectus sheath catheters have been used safely and efficaciously in emergency patients when an epidural or spinal anaesthetic was not possible.

Epidural and spinal anaesthesia are effective for abdominal surgery and may be the gold standard in elective surgery [34]. A Cochrane Library review found that epidural local anaesthetics provide better postoperative pain relief, improve oxygenation and reduce pulmonary complications compared with parenteral opioids [35]. However, there are very rare but serious sequelae of central neuraxial blockade [36,37].More pragmatically, epidural analgesia may not always be effective due to several factors including catheter malposition, displacement, technical or patient factors. Intolerable side effects may also be an indication for premature discontinuation. In a prospective audit evaluating epidural anaesthesia in 5628 patients, 22% had premature termination of epidural infusions: the most common causes were dislodgement (10%), inadequate analgesia (3.5%), and either sensory or motor deficit (2.2%). Most of these failures occurred on or after the second postoperative day, when patients may still have a high analgesic requirement [38]. The use of neuraxial anaesthesia in emergency cases may be contraindicated, limited by patient factors and time consuming in time-critical instances. It is necessary, therefore, to have an effective alternative to control post-operative pain and promote recovery whilst minimising adverse effects.

Other regional anaesthetic options include TAP and subcostal TAP blocks, either alone or in combination.Some authors have reported success in safe reduction of pain scores with such techniques in case series of emergency patients [39]. Much of the published data regarding TAP blocks however relates to elective surgery, including laparoscopic surgery and caesarean delivery, which are not the focus of this review.

Parenteral opioids may be used in conjunction with neuraxial anaesthetic techniques, or isolation.They provide adequate pain relief, but are commonly associated with nausea, vomiting, sedation, respiratory depression and rarely, death [40].

One emergency patient cohort that may need special consideration are those requiring a stoma. Delivery of the bowel to the skin often involves opening the rectus sheath, and therefore it is plausible that this may affect both the localised pain and retention of local anaesthetic within the fascial compartment. However, there is no current evidence to support or refute this hypothesis.

The National Emergency Laparotomy Audit (NELA) could have collected data on analgesic/anaesthetic choices and interventions and could thereby have provided the evidence required to drive future randomised trials [41]. There is a currently ongoing trial that is yet to report on a comparison between EA and RSB in elective patients, while a further three clinical trials are registered internationally to address the question in emergency patients, but

results are not available [42-45].

Conclusion

There is limited high methodological quality evidence in support of rectus sheath blocks in adult emergency surgery patients, despite apparent, efficacious and common use. More evidence is needed to validate the technique as a potential and equitable alternative to other regional blocks, systemic opioids, spinal or the 'gold standard' epidural anaesthesia which is precluded in a proportion of emergency patients.

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