Rectus sheath catheters provide equivalent analgesia to epidurals following laparotomy for colorectal surgery

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ABSTRACT

INTRODUCTION Rectus sheath catheters (RSCs) are increasingly being used to provide postoperative analgesia following laparotomy for colorectal surgery. Little is known about their efficacy in comparison with epidural infusion analgesia (EIA). They are potentially better as they avoid the recognised complications associated with EIA. This study compares these two methods of analgesia. Outcomes include average pain scores, time to mobilisation and length of stay.

METHODS This was a 33-month single centre observational study including all patients undergoing elective open or laparoscopic-converted-to-open colorectal resection for both benign and malignant disease. Patients received either EIA or RSCs. Data were collected prospectively and analysed retrospectively.

RESULTS A total of 95 patients were identified. Indications for surgery, operation and complications were recorded. The mean time to mobilisation was significantly shorter in patients who had RSCs compared with EIA patients (2.4 vs 3.5 days, $p < 0.05$). There was no difference in postoperative pain scores or length of stay.

CONCLUSIONS RSCs provide equivalent analgesia to EIA and avoid the recognised potential complications of EIA. They are associated with a shorter time to mobilisation. Their use should be adopted more widely.

KEYWORDS

Analgesia – Epidural – Rectus sheath catheter – Laparotomy – Colorectal surgery

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In recent years, rectus sheath catheters (RSCs) have been used increasingly for postoperative analgesia after laparotomy. Described by Schleich in 1899 for providing relaxation of the anterior abdominal wall in adults,¹ rectus sheath blocks anaesthetise the lower thoracic nerves.² They have been used to provide effective pain relief for umbilical hernia repair in paediatric surgery.³ The use of RSCs in abdominal gynaecological procedures has also been described.⁴ However, there is limited published evidence supporting their effectiveness in open colorectal surgery.

Colorectal operations are among the most frequently performed major abdominal surgical procedures. Despite the growing popularity of laparoscopic surgery, a significant number of open colorectal resections are still performed in the UK.⁵ For over 20 years, epidural infusion analgesia (EIA) has provided superior analgesia compared with systemic analgesia after open colorectal surgery.^{6,7} In addition, EIA can effectively suppress surgical stress, reduce the incidence of postoperative pneumonia and shorten postoperative ileus.^{6,7} On the other hand, it is associated with complications such as hypotension and bradycardia as well as rare

but potentially devastating complications such as epidural haematoma and abscess.^{6,8}

In a retrospective study published in 2013, Godden *et al* demonstrated that as an alternative, RSCs provide effective postoperative pain relief equivalent to EIA in open colorectal cancer surgery.⁹ Complications, which were relatively infrequent compared with EIA, included visceral injury and local anaesthetic toxicity.^{2,9}

The aim of this study was to evaluate the effectiveness of RSCs on postoperative pain relief, time to mobilisation and length of stay compared with EIA in a large cohort of patients undergoing elective open or laparoscopic-converted-to-open colorectal resection for both benign and malignant disease. The complications associated with both methods of analgesia observed during the study were also recorded.

Methods

This observational study was conducted at our institution over a 33-month period from January 2011 to October 2013. Data were collected prospectively and analysed retrospectively. All

patients undergoing elective open or laparoscopic-converted-to-open colorectal resection for both benign and malignant disease were included. All operations were performed or directly supervised by one of five consultant colorectal surgeons. Patients received either EIA or RSCs. The decision to place an epidural catheter was made exclusively by the anaesthetic team. All patients who did not receive EIA were given RSCs.

RSCs (Mediplus, High Wycombe, UK) are placed intraoperatively, prior to closure of the laparotomy wound. A Tuohy needle is placed through the layers of the anterior abdominal wall, just lateral to the midline wound, until the tip lies within the rectus sheath. This depth is judged by feel and as such, it is essential for the surgeon to palpate the needle from within the abdomen. The catheter is fed through the needle into the rectus sheath. If sited correctly, it will feed in with little resistance. Once placement is achieved, the needle can be withdrawn, leaving the catheter in place. In our experience, the catheter should be secured at this stage with a simple dressing as it can become easily dislodged during abdominal wall closure. The catheter is then used to infiltrate the rectus sheath with 20ml of 0.25% bupivacaine. The process is repeated contralaterally.

Postoperatively, the catheters are flushed with 20ml of 0.25% levobupivacaine on each side six-hourly. This regimen continues for 1–3 days, depending on patient comfort. As pain improves, the frequency of the boluses decreases (usually around day 3), before discontinuation and subsequent removal of the catheters by day 5 at the latest. The catheters may be removed at an earlier stage if they are no longer required or any of the potential complications develop. These may include bleeding, infection around the site of the catheters, blockage and leakage of local anaesthetic during administration.

Alternatively, the RSCs can be placed by the anaesthetic team prior to surgery. Performed under ultrasonography guidance, this allows visualisation of the fascial layers of the abdominal wall and rectus sheath, enabling accurate placement of the catheters. With the Tuohy needle placed, the catheters are sited in a similar fashion to that described above.

Epidural catheters were placed in the standard fashion, with postoperative infusion and monitoring prescribed as per local protocol.

Alongside either of these analgesia modalities, patients also received regular paracetamol, tramadol and oral morphine. In each group, a subset of patients was also given patient controlled analgesia (PCA), with a morphine infusion. All patients followed our enhanced recovery after surgery guidance including provision of pre and postoperative high calorie drinks, early mobilisation, and removal of urinary catheters and intravenous infusions as soon as appropriate.

Indication for surgery, type of operation, day 1 mode pain score (ie the patients were asked to score their pain based on what they experienced for most of that day; 0 = no pain, 3 = severe pain), time to mobilisation (number of postoperative days until patient walks unaided) and length of stay were recorded. Postoperative complications arising from surgery (eg anastomotic leak), recovery (eg chest

infection) or the method of analgesia (eg epidural haematoma) were also recorded.

Statistical analysis

Results were analysed statistically using the Student's t-test or Fisher's one-tailed test. A *p*-value of <0.05 was deemed statistically significant.

Results

A total of 95 patients were included prospectively in the 33-month study period. Demographics, type of operation and complications are described in Table 1. The majority (73%) of operations were performed for colorectal cancer. Overall, the most common operation was right hemicolectomy

Table 1 Patient characteristics, type of operation and complications for rectus sheath catheter (RSC) and epidural anaesthesia groups

	RSCs (n=73)	Epidural (n=22)
Male patients	38	17
Indication		
Cancer	49	20
Benign disease	24	2
Conversion to open surgery	20	3
Operation		
Right hemicolectomy	24	3
Left hemicolectomy	6	1
Sigmoid colectomy	5	3
Subtotal colectomy	1	1
Panproctocolectomy	1	1
Proctectomy	1	2
Hartmann's procedure	4	0
Anterior resection	15	4
Low anterior resection	8	4
Ileocaecal resection	3	0
Abdominoperineal excision of rectum	5	3
Complications*		
Ileus	9	3
Chest infection	2	0
Wound infection	2	0
Wound dehiscence	2	0
Anastomotic leak	1	1
Pulmonary embolus	1	0
Urinary retention	0	1
Death	0	1
*no statistically significant difference		

Table 2 Comparison of rectus sheath catheters (RSCs) and epidural anaesthesia

	RSCs (n=73)	Epidural (n=22)	p-value
Patient controlled anaesthesia (morphine)	32	4	0.02
Mean day 1 mode pain score	0.53	0.59	0.39
Mean time to mobilisation in days	2.4	3.5	0.02
Mean length of stay in days	8.7	9.2	0.43

(28%), followed by anterior resection of the rectum (20%). Included in this cohort are small number of proctectomies ($n=3$), ileocaecal resections ($n=3$) and subtotal colectomies ($n=2$). In both groups, the most frequently occurring complication was paralytic ileus, affecting 15% overall. One patient in each group had an anastomotic leak but this was not a statistically significant difference. There was one death in the cohort from respiratory failure due to pneumonia, in a patient with chronic obstructive pulmonary disease who had received an epidural infusion. There were no complications directly attributable to RSCs or EIA.

In both groups, the mean day 1 mode pain scores were less than 1 (Table 2, Fig 1). The mean length of stay was also similar between the two groups, at 8.7 days for those who had RSCs and 9.2 days for those who had EIA. There was a significant difference ($p<0.05$) in mean time to mobilisation; those who had RSCs mobilised after 2.4 days compared with 3.5 days for the epidural group. Significantly

more patients in the RSC group received PCA than in the EIA group.

Discussion

This single centre observational study comparing RSCs with EIA in the postoperative period following elective open colorectal surgery is the first known study with prospective data collection. Our results demonstrate a comparable analgesic effect of local anaesthetic infusions via RSCs when compared with epidural anaesthesia.

Time to mobilisation was significantly shorter in the group receiving RSCs. Furthermore, this group of patients avoided the complications associated with epidural anaesthesia. We hypothesise an explanation for this longer time to full mobility is that those patients who receive EIA may feel confined to their bed, both by the motor and sensory effects produced by the epidural itself, and the physical attachment to the infusion pump. For this reason, in many cases, mobilisation can only be achieved when the requirement for analgesia can be met by oral analgesia, allowing discontinuation of the epidural infusion. By contrast, those with RSCs are free to mobilise while still having regular local anaesthetic boluses.

In our study, no patients in either group developed complications directly as a result of the analgesia modality. However, the possible complications of both RSCs and EIA are recognised. Potential morbidity is greater from EIA when considering complications such as an epidural haematoma or hypotension. In addition, we feel that RSCs are simpler to place than EIA.

Regarding complications of postoperative recovery in general, there was no significant difference between the groups. It is recognised that pain and immobility can predispose patients to some of the complications that have been investigated in the present study. In particular, chest infection can result from pain preventing adequate inspiration and pulmonary embolus from prolonged immobility. It is not possible to say whether the earlier mobilisation of patients receiving RSCs in our study prevented these complications; a larger cohort is required for this. There was one death in our cohort, in a patient with a background of chronic obstructive pulmonary disease who received EIA. She developed postoperative pneumonia and died of respiratory failure. Regarding this patient specifically, EIA was placed prior to surgery at the anaesthetist's discretion and she underwent a left hemicolectomy. Her day 1 mode pain score was 0; we do not think her pneumonia resulted from inadequate analgesia.

We recognise the similarity in wound infection and dehiscence rates between the two modalities of analgesia. There may be a risk of impaired wound healing associated with RSCs, due to their placement so near the healing wound and regular irrigation of the rectus sheath with local anaesthetic, although this was not observed in the study.

Similar studies comparing RSCs with EIA include a non-randomised retrospective case notes review, which found that RSCs provided an equivalent analgesic effect to

epidural anaesthesia.⁹ A group based in New Zealand (Aung *et al*) compared RSCs with EIA (with/without opiate PCA in each group), and concluded that RSCs provided a safe and effective modality of postoperative analgesia.¹⁰ Their prospective study comprised 54 patients and they found that a postoperative pain score of 0 was achieved in 66.7% of patients with RSCs and 41.7% with EIA. However, their protocol involved a continuous infusion of anaesthetic via the RSCs (compared with six-hourly boluses) and their study group included all elective/emergency laparotomies, not just colorectal procedures.

The decision to use EIA was not randomised; it was left to the discretion of the anaesthetist and so there will inevitably be a selection bias. Patient factors affecting this decision may clearly affect our results. This cohort of patients may be more frail than their counterparts who were treated with RSCs. As such, this could be a confounding factor for the slower time to recovery and mobilisation in the postoperative period. Ultimately, the anaesthetist's decision in terms of which of the two methods of anaesthesia was most appropriate was based on patient factors and his or her own personal preference.

Further limitations of this study include the difference in patients receiving postoperative PCA. Significantly more patients in the RSC group received PCA than in the EIA group. This is to be expected. By their nature, RSCs will only provide anaesthesia to the lower thoracic nerves running within the rectus sheath; they provide no visceral pain relief. Unless the patient has had a minor abdominal procedure requiring a laparotomy, systemic opiate-based analgesia is required to provide adequate pain relief. The occasionally required adjunct of PCA should not discourage clinicians from using RSCs. It is well tolerated and regarded as a recognised adjunct when using RSCs (Aung *et al*).¹⁰

More research into postoperative analgesia is required in light of newer modalities (ie RSCs) and a two-year non-blinded randomised controlled trial enrolling 132 patients is already underway.¹¹ This group's primary outcome is a pain score on moving from a supine to a sitting position at 24 hours following laparotomy for major abdominal surgery. We await their results.

Conclusions

In our cohort, RSCs seemed to provide equivalent analgesia to EIA, without the potential risks associated with EIA. They had minimal complications and were well tolerated. As a result, we now use RSCs routinely with PCA as primary analgesia following laparotomy for open colorectal resection. A randomised controlled trial is underway to determine whether their use should be more widely adopted following laparotomy for colorectal surgery.

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References

- Schleich CL. *Schmerzlose Operationen*. 4th edn. Berlin: Springer; 1899. pp240–258.
- Phua DS, Phoo JW, Koay CK. The ultrasound-guided rectus sheath block as an anaesthetic in adult paraumbilical hernia repair. *Anaesth Intensive Care* 2009; **37**: 499–500.
- Willschke H, Bösenberg A, Marhofer P *et al*. Ultrasonography-guided rectus sheath block in paediatric anaesthesia – a new approach to an old technique. *Br J Anaesth* 2006; **97**: 244–249.
- Azemati S, Khosravi MB. An assessment of the value of rectus sheath block for postlaparoscopic pain in gynecologic surgery. *J Minim Invasive Gynecol* 2005; **12**: 12–15.
- Schwab KE, Dowson HM, Van Dellen J *et al*. The uptake of laparoscopic colorectal surgery in Great Britain and Ireland: a questionnaire survey of consultant members of the ACPGBI. *Colorectal Dis* 2009; **11**: 318–322.
- Marret E, Remy C, Bonnet F. Meta-analysis of epidural analgesia versus parenteral opioid analgesia after colorectal surgery. *Br J Surg* 2007; **94**: 665–673.
- Warschkow R, Steffen T, Lüthi A *et al*. Epidural analgesia in open resection of colorectal cancer: is there a clinical benefit? A retrospective study on 1,470 patients. *J Gastrointest Surg* 2011; **15**: 1,386–1,393.
- Unic-Stojanovic D, Babic S, Jovic M. Benefits, risks and complications of perioperative use of epidural anesthesia. *Med Arch* 2012; **66**: 340–343.
- Godden AR, Marshall MJ, Grice AS, Daniels IR. Ultrasonography guided rectus sheath catheters versus epidural analgesia for open colorectal cancer surgery in a single centre. *Ann R Coll Surg Engl* 2013; **95**: 591–594.
- Aung ET, Fluir P, Aiono S. Introduction of continuous regional analgesia via wound catheters in a peripheral hospital. *N Z Med J* 2010; **123**: 25–31.
- Wilkinson KM, Krige A, Brearley SG *et al*. Thoracic Epidural analgesia versus Rectus Sheath Catheters for open midline incisions in major abdominal surgery within an enhanced recovery programme (TERSC): study protocol for a randomised controlled trial. *Trials* 2014; **15**: 400.