Ultrasonography guided rectus sheath catheters versus epidural analgesia for open colorectal cancer surgery in a single centre

AR Godden, MJ Marshall, AS Grice, IR Daniels

Royal Devon and Exeter Hospital NHS Foundation Trust, UK

ABSTRACT

INTRODUCTION Epidural anaesthesia (EA) has been the accepted standard for postoperative analgesia in open abdominal surgery. However, it is not without significant risk. This study aimed to audit the effect of EA and ultrasonography placed rectus sheath catheters (RSCs) on analgesia as well as the incidence of postoperative complications following open colorectal cancer surgery.

METHODS A three-year retrospective case note review was undertaken of all patients undergoing open colorectal cancer surgery at the Royal Devon and Exeter Hospital NHS Foundation Trust who received either EA or RSC for postoperative analgesia under the care of the senior authors. A single surgeon and single anaesthetist were practitioners.

RESULTS The case notes of 120 patients were reviewed retrospectively: 85 patients had EA and 24 RSC while 11 patients were excluded from the study. The EA group experienced a significantly higher incidence of hypotension (systolic blood pressure <130mmHg) than the RSC group on the first postoperative day ($p=0.0001$). There was no significant difference in pain score or opiate sparing properties 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). The RSC group had a higher incidence of ileus than the EA group (4/24 vs 2/85, $p=0.026$). However, the numbers were too small to draw a reliable conclusion.

CONCLUSIONS The use of ultrasonography guided RSCs has demonstrated effective postoperative analgesia equivalent to EA with the potential benefits of a reduced incidence of hypotension. A prospective randomised trial is now underway to compare RSC and EA in open abdominal and pelvic surgery.

KEYWORDS

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

Accepted 12 August 2013

CORRESPONDENCE TO

Ian Daniels, Consultant Colorectal Surgeon, Royal Devon and Exeter Hospital, Barrack Road, Exeter, Devon EX2 5DW, UK
E: iandaniels@me.com

In the UK, laparoscopic colorectal surgery is increasing. Nevertheless, a substantial proportion of surgery remains open.¹ The accepted ‘gold standard’ technique for postoperative analgesia following open colorectal surgery is epidural analgesia (EA).² The use of EA provides effective analgesia, and has the benefits of reducing systemic opiate requirements, ileus and pulmonary complications.^{3,4} Epidurals have reported complications that range from superficial wound site infection to paraplegia.^{5–8}

The introduction of local nerve blocks in place of EA in open colorectal surgery has shown promising results.^{9,10} The use of regional blocks has been shown to provide effective postoperative analgesia and demonstrates opiate sparing properties. Furthermore, it has been shown to be safe and avoids the risk for potentially devastating complications of EA. Associated complications with the use of regional blocks

include insufficient block, local anaesthetic toxicity and visceral puncture. However, the safety margin can be improved by the use of ultrasonography to guide insertion.¹¹ A study looking at the opiate sparing effects of regional block (transverse abdominis plane) for right hemicolectomies has produced promising results.¹²

We aim to add to this body of evidence and expand on it by describing the analgesic effect of ultrasonography guided rectus sheath catheters (RSCs) compared with EA in open colorectal surgery. There has been concern regarding potential for EA to cause hypoperfusion at the site of colorectal anastomosis. Although arterial hypotension following EA is well described, the impact of this on the rate of anastomotic leak is underinvestigated.^{8,11,15} In light of this, we compared the incidence of postoperative arterial hypotension between EA and RSC.

Methods

A three-year retrospective case note review was undertaken of all patients undergoing open colorectal cancer surgery at the Royal Devon and Exeter Hospital NHS Foundation Trust between 2006 and 2009 who received either EA or RSC for postoperative analgesia. All surgery was performed open by a single consultant surgeon with a single consultant anaesthetist placing either an epidural or RSC. Exclusion criteria included incomplete information available from notes and technical inability to use the EA or RSC postoperatively. The decision for type of analgesia was not randomised but based on a joint decision between the patient, surgeon and anaesthetist. The initial resections were performed with EA but, as the technique of RSC was explored over time, this became the standard technique. The rationale behind this was to assess the feasibility of ultrasonography guided RSC placement, the safety and efficacy of the techniques, and the impact on nursing care postoperatively.

Regardless of the intervention used, further perioperative analgesia was given intravenously via patient controlled analgesia. In the recovery room, EA or RSC was used as the first line of analgesia, with intravenous analgesia prescribed as necessary. In the postoperative period, both groups were also prescribed regular paracetamol, with breakthrough analgesia comprising non-steroidal anti-inflammatory drugs (NSAIDs), tramadol or oral morphine.

EA was sited between T8 and T11 depending on the dermatome innervating the planned incision. A loading dose of 8–10ml 0.25–0.5% bupivacaine with 50–100µg fentanyl was given and the analgesic response assessed accordingly. Intraoperative dosing was performed according to cardiovascular response to surgery, and an infusion of 0.125% bupivacaine and 4µg/ml fentanyl commenced in the recovery room. Local policy dictated continued epidural usage.

The RSCs were initially flushed with 10–20ml of 0.25% levobupivacaine 6-hourly for the first 72 hours following surgery. The prescription was then altered to 10–20ml levobupivacaine as required. On day 5, all levobupivacaine boluses were stopped to ascertain whether the patient could be managed on simple analgesia alone. If pain persisted, the catheters were used 6-hourly for a further 48 hours, at which point all catheters were removed.

The RSCs were inserted following induction of anaesthesia with a predefined method. The upper abdomen is prepared with 2% chlorhexidine and draped. A sheathed ultrasonography probe is used to identify the linea alba. The probe is then moved laterally to demonstrate the main body of the rectus abdominis. The posterior rectus sheath and transversalis fascia are visualised as 'tram lines' posterior to the rectus abdominis. Using a 16G Tuohy needle and hydrosection with 20ml of 0.25% levobupivacaine, the posterior rectus sheath is dissected from the rectus, thereby creating space for the RSC to be introduced. 4cm of catheter is left in this space and the rest is tunnelled laterally to avoid the surgical field. The same is repeated on the other side. With the introduction of the technique and following a learning curve, the catheters could be placed within the time range of an epidural.

During the postoperative period, blood pressure was measured 12-hourly and recorded on bedside charts by nursing staff on days 1–4. Pain score, use of additional analgesia and postoperative complications (wound, respiratory tract, anastomotic leak) were recorded. Pain was assessed using the visual analogue scale as dictated by trust policy.

A formal enhanced recovery process was not in place during this time although all patients were given supplemental nutritional shakes on a regular basis following surgery until they were able to tolerate diet.

Statistical analysis was carried out with a two-tailed Fisher's exact test for categorical data and an independent t-test for continuous data as appropriate.

Results

Overall, 120 patients were identified for the study but 11 patients were excluded: 4 had insufficient data and 7 experienced technical failure of EA ($n=4$) or RSC ($n=3$). Of the 109 patients included, 85 had EA and 24 had RSC. There was a male sex distribution of 45/85 and 18/24 respectively, and a median age of 64 years for both groups. All patients in this study underwent open surgery for colorectal cancer, with 94% being elective procedures. Patient demographics are displayed in Table 1.

Table 1 Patient demographics for rectus sheath catheter (RSC) and epidural anaesthesia (EA) groups

	RSC ($n=24$)	EA ($n=85$)
Median age (range) in years	64 (39–87)	64 (48–87)
Male-to-female ratio	18:6	45:40
Emergency surgery	1	6
Elective surgery	23	79
<i>Operation</i>		
Right hemicolectomy	8	25
Left hemicolectomy	3	8
Abdominoperineal excision of rectum	2	10
Anterior resection	9	24
Laparotomy and stoma formation	1	5
Proctectomy	1	0
Total colectomy/subtotal colectomy	0	3
Total mesorectal excision and Hartmann's procedure	0	10
<i>Complications</i>		
Anastomotic leak	4	5
Chest infection	9	27
Ileus*	19	2
Wound complication	14	15

* $p<0.05$

Figure 1 Postoperative pain scores on day 1 for rectus sheath catheter (RSC) and epidural anaesthesia (EA) groups

RSC and EA were well tolerated with good postoperative analgesia. There was no significant difference in pain score between the groups following surgery ($p=0.92$) (Fig 1). Additional analgesia was prescribed for both groups according to the World Health Organization analgesic ladder.¹⁴ There was significantly less use of NSAIDs in the RSC group ($p=0.0001$). However, intolerance to the medication was not recorded and the result can therefore not be analysed in context. There was no significant difference in opiate sparing effect of EA over RSC.

Patients with EA trended towards a lower systolic blood pressure (SBP) than patients with RSC. EA patients demonstrated a significantly higher incidence of SBP $<130\text{mmHg}$ on the first postoperative day ($p=0.03$).

All wounds were reviewed regularly by experienced nursing staff trained in the management of common colorectal postoperative wound complications. In the RSC group, there were three wound complications (one superficial wound infection and two wound dehiscences, both managed with negative pressure wound therapy [NPWT]). In the EA group, there were 11 wound complications (8 superficial wound dehiscences: 4 requiring NPWT and 4 infected wounds). There was no statistical difference in postoperative wound complications between the groups ($p=1.0$).

This incidence of postoperative ileus was significantly higher in the RSC group than in the EA group (4/24 vs 2/85, $p=0.026$). However, two of the patients in the RSC group had

a concurrent chest infection and the numbers are small so the significance of this is debatable. Patients who developed signs of respiratory tract infection following surgery were investigated clinically, biochemically and radiographically. In the RSC group, there were two respiratory tract infections requiring antibiotic treatment while in the EA group, there were 18 respiratory tract infections that required treatment with antibiotics. This difference was not statistically significant ($p=0.2$).

There were five postoperative anastomotic leaks (four in the EA group and one in the RSC group), all of which were due to a stapled anastomosis. There was no discernible statistical difference between the groups ($p=1.0$) although we appreciate numbers were too small to draw a reliable conclusion.

Discussion

Our results show that the use of RSCs for postoperative analgesia following open colorectal surgery is as effective as EA. No significant difference was found with regard to pain control or the requirement for additional analgesia between the two methods.

The use of EA demonstrated a trend towards lower postoperative blood pressure. However, the results were not significant until categorised into incidence of blood pressure less than or equal to 130mmHg . The association of epidural use and postoperative hypotension is consistent with current research.² The incidence of lower respiratory tract infection, postoperative wound complications and anastomotic leak was not significantly different between the groups.

The major weakness of this study was the lack of direct comparison as all cases were initially treated with EA and then, following introduction of the technique, RSC. With wider adoption in the hospital of the use of RSC and the perceived patient benefits including improved mobility, the technique was demonstrated to be both feasible and reproducible. The promising initial results from this review have led us to develop a prospective randomised trial comparing RSC and EA in open abdominal and pelvic surgery (Royal Devon and Exeter Hospital NHS Foundation Trust study number 1120550).

Conclusions

The use of ultrasonography guided RSCs has demonstrated effective postoperative analgesia equivalent to EA with the potential benefits of a reduced incidence of hypotension.

References

1. 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.

2. Rigg JRA, Jamrozik K, Myles PS *et al*. Epidural anaesthesia and analgesia and outcome of major surgery: a randomised trial. *Lancet* 2002; **359**: 1,276–1,282.

3. 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.

Table 2 Comparison of additional analgesia requirements for rectus sheath catheter and epidural anaesthesia groups		
	RSC	EA
Paracetamol	100%	100%
NSAID ($p<0.05$)	38%	100%
Tramadol	67%	68%
Oral morphine	21%	22%
Intravenous morphine	0%	1%
Fentanyl patch	4%	2%

RSC = rectus sheath catheter; EA = epidural anaesthesia; NSAID = non-steroidal anti-inflammatory drug

4. 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.
5. Royal College of Anaesthetists. *Best Practice in the Management of Epidural Analgesia in the Hospital Setting*. London: RCA; 2010.
6. Freise H, Van Aken HK. Risks and benefits of thoracic epidural anaesthesia. *Br J Anaesth* 2011; **107**: 859–868.
7. Pöpping DM, Zahn PK, Van Aken HK *et al*. Effectiveness and safety of postoperative pain management: a survey of 18 925 consecutive patients between 1998 and 2006 (2nd revision): a database analysis of prospectively raised data. *Br J Anaesth* 2008; **101**: 832–840.
8. Moraca RJ, Sheldon DG, Thirlby RC. The role of epidural anesthesia and analgesia in surgical practice. *Ann Surg* 2003; **238**: 663–673.
9. Charlton S, Cyna AM, Middleton P, Griffiths JD. Perioperative transversus abdominis plane (TAP) blocks for analgesia after abdominal surgery. *Cochrane Database Syst Rev* 2010; **12**: CD007705.
10. Siddiqui MR, Sajid MS, Uncles DR *et al*. A meta-analysis on the clinical effectiveness of transversus abdominis plane block. *J Clin Anesth* 2011; **23**: 7–14.
11. Kishore K, Agarwal A. Ultrasound-guided continuous transverse abdominis plane block for abdominal surgery. *J Anaesthesiol Clin Pharmacol* 2011; **27**: 336–338.
12. Brady RR, Ventham NT, Robert DM *et al*. Open transversus abdominis plane block and analgesic requirements in patients following right hemicolectomy. *Ann R Coll Surg Engl* 2012; **94**: 327–330.
13. Sala C, García-Granero E, Molina MJ *et al*. Effect of epidural anesthesia on colorectal anastomosis: a tonometric assessment. *Dis Colon Rectum* 1997; **40**: 958–961.
14. World Health Organization. *Cancer Pain Relief and Palliative Care*. Geneva: WHO; 1990.

Correspondence

Comments on papers published in the *Annals* are always welcome.

We prefer comments and other letters to the Editor to be submitted through our readers' pages (<http://www.rcseng.ac.uk/publications/readerspages>). This enables the comments to appear online without delay.

Readers' pages are checked regularly by *Annals* staff so that comment on published material can be brought to the attention of the author of the original work. Authors can of course visit readers' pages to look for such comments and can reply directly on these pages. Correspondence is reviewed by the Editor and most is subsequently published in the *Annals*.