Rectus Sheath Block Efficacy for Patients Who Underwent Emergency Midline Laparotomy at a Resource Limited Setting in Northcentral Ethiopia, 2019.

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Abstract

Background Midline laparotomy is associated with severe postoperative pain. Literature showed controversial results regarding the efficacy of the rectus sheath block.

Objective To assess the effectiveness of rectus sheath block efficacy for patients who underwent emergency midline laparotomy at a resource limited setting in Northcentral Ethiopia, from February 01 to March 30, 2019.

Methods This is a prospective cohort study that recruits 60 patients who underwent emergency midline laparotomy. Independent t-test and Manny Whitney tests were used for numeric data while Chi-Square or Fisher exact test was used for categorical variables. P-values < 0.05 were considered as statistically significant.

Results The median (interquartile range) of the numeric rating scale score at the recovery was 3(3-4) for an exposed group and 4.5(3-4.5) for an unexposed group with a p-value of 0.039. Postoperative numeric rating scale scores at 3 rd , 6 th , 12 th , and 24 th hours were statistically significantly lower in the exposed group. Postoperative tramadol consumption in 24 hours was significantly lower with a p-value of 0.0001 for the rectus sheath group.

Conclusions For surgeries done through midline laparotomy, adding bilateral rectus sheath block (BRSB) at the end of the operation might be an effective postoperative analgesia option.

Introduction

Laparotomies that necessitate midline incisions were commonly accompanied by postoperative pain, typically associated with neuroendocrine stress response [1, 2].

Postoperative analgesia enhances early mobilization and decreases the incidence of postoperative chest infection and deep venous thrombosis [3, 4].

Administration of multimodal analgesics could limit the excessive use of systemic opioid analgesia and its side effects [3–7]. Good postoperative pain management reduces the wound healing process [8].

Postoperative pain management minimizes the feeling of discomfort and makes the treatment more economic, however, there is no ideal method available for this [9, 10].

Schleich firstly described RSB in 1899 aiming at the deposition of local anesthetic (LA) in the virtual space between the posterior wall of the rectus abdominis muscle and its sheath [11]. The anesthetic injected into this space is proposed to spread freely up and down and to block the terminal branches of the intercostals nerves before they leave the rectus sheath [12].

The central portion of the anterior abdominal wall is innervated by the ventral branches of the thoracolumbar nerves, 6th thoracic nerve to 1st lumbar nerve (T6-L1); these ventral branches lie between the rectus abdominis muscle (deep) and the posterior rectus sheath (ventral) and enter the rectus muscle near the midline [13–16].

The RSB can be performed using a blind technique, with the patient lying supine, a point is identified 2–3 cm from midline then passing a short-beveled 5 cm needle through the anterior rectus sheath (a definitive “pop” should be felt as it passes through) and through the rectus abdominis muscle and the needle is advanced further until a firm resistance of the posterior wall is felt. After negative aspiration for blood, 15–20 ml of local anesthetic is deposited on the posterior wall of the rectus sheath. The procedure is repeated on the opposite side of the midline [17–20].

The aim of this study is to assess the postoperative analgesic efficacy of the rectus sheath block for emergency midline laparotomy.

Methods

Study setting, design, period and population

A Hospital-based prospective cohort study was conducted at Debre Tabor Hospital, in North-central Ethiopia from February 01 to March 30, 2019. The Hospital gives medical, surgical, pediatrics, gynecologic, and obstetrics services. Patients who have undergone emergency midline laparotomy at study setting were the source population while selected patients who underwent emergency midline laparotomy during the study period were the study population. Patients with psychiatric problems, age less than 18, patients who took strong opioids, and patient refusal were excluded.

Sample size determination

The sample size was calculated using the formula for continuous outcomes and means.

$$n = \frac{(S1^2 + S2^2)\,(\alpha 1/2 + \beta)^2}{(X1 - X2)^2}$$

Where n = the sample size in each of the groups; X1 = Sample mean in control group; X2 = Sample mean in treatment group; X1 − X2 = the difference the investigator wishes to detect; S^2 = variance; α = conventional multiplier for alpha = 0.05, which is 1.96; β = conventional multiplier for power = 0.80, which is 0.842.

From the literature the mean VAS score, X1 = 1.83 in control group, X2 = 1.16 in treatment group and S1 = 0.74, S2 = 1.20 [21].

Substituting for these variables yield:

$$n = \frac{(1.20)^2 + (0.74)^2 \times (1.96+0.842)^2}{(1.16 - 1.83)^2}$$

n = 31, using a 1:1 ratio between groups a total of 62 patients were required. By adding 5% contingency the total required patients were 66.

Sampling techniques and procedures

Patients who underwent emergency midline laparotomy were recruited into the study by using a systematic random sampling technique. Within 95 patients estimated to undergo emergency midline abdominal laparotomy during the study period, 66 participants were included. The first participant was selected by the lottery method, then 2 patients for every 3 consecutive patients were included until the required sample size was met.

Operational Definition

Midline Laparotomy

abdominal cavity operation through a midline incision of the abdomen, from xiphisternum to symphysis pubis.

Baseline vital sign

vital sign before the induction of anesthesia.

Data collection procedures and tools

Data was collected by using a prepared questionnaire starting from intraoperative to 24 hours postoperatively. The severity of pain by using NRS, time for the first analgesic request (in hours), 24 hours analgesics consumption and incidence of postoperative nausea and vomiting were collected by two anesthetists. Data was gathered at five-time points: at 0 (immediately at recovery), 3, 6, 12, and 24 hours postoperatively.

Data quality control

Prior to the actual data collection pretest was done on 10% of the sample size to see the effectiveness of the data collecting tool and questionnaire. Collected data were checked for completeness, accuracy, and clarity.

Data processing and analysis

Data will be checked manually for completeness, coded and entered into SPSS version 23 computer program. Descriptive statistics were used to summarize data. Chi-square or Fisher exact test was used for

discrete variables and a student's t-test was used for comparing numerical variables of normally distributed data or Manny Whitney was used for skewed data. A P-value of less than 0.05 was considered as statistically significant.

Ethics approval and consent to participate

Ethical clearance was obtained from the Research ethical committee of the College of health science, Debre Tabor University. Confidentiality and the patient's right to withdraw from the study is maintained throughout the study period.

Results

Demographic and Perioperative Characteristics

Data were collected from sixty patients with a response rate of 91%. Six patients from both groups were lost to follow up. Demographic data such as age, sex, and ASA status were comparable between the groups (Table 1).

Table 1
Demographic characteristics of patients who underwent emergency midline laparotomy in North-central Ethiopia.

Variables	Exposed group (n = 30)	Unexposed group (n = 30)
Age (mean ± Standard deviation)	46 ± 13	44 ± 15
Sex (F/M)	14/16	21/9
ASA status, n (%)	21(70%)	25(84%)
ASA 1	9(30%)	5(16)
ASA 2		

Preoperative vital signs

Preoperative vital signs expressed in the median and interquartile range were comparable between two groups (Table 2).

Table 2
Preoperative vital signs of patients who underwent emergency midline laparotomy in North-central Ethiopia.

Variable	Exposed group (n = 30)	Unexposed group (n = 30)	P-value
Base line heart rate	80(69.7–83.2)	80(68–90)	1.000
Base line systolic blood pressure	121(110–130)	124(111–135)	0.605
Base line diastolic blood pressure	75(70–80)	76(70–80)	0.429

Perioperative characteristics of patients

Types of induction agents, muscle relaxants, pre-medications, analgesics, and diagnosis were expressed in frequency and percentage (Table 3).

Table 3
Perioperative characteristics of patients who underwent emergency midline laparotomy in North-central Ethiopia.

Variables	Exposed group (n = 30)	Unexposed group (n = 30)
Types of induction agent	24(40%)	7(11.7%)
Ketamine		
Propofol	5(8.33%)	7(11.7%)
Thiopentone	0(0%)	2(3.3%)
Ketofol	6(10%)	9(15%)
Diagnosis	8(13.3)	5(8.3%)
Sigmoid volvulus		
Blunt abdominal injury	6(10%)	7(11.7%)
Perforated appendicitis	8(13.3)	11(18.3)
Small bowel obstruction	5(8.3%)	5(8.3%)
Other	30(50%)	2(3.3%)
Analgesia	15(25%)	2(3.3%)
Tramadol		
Pethidine	9(15%)	21(35%)
Diclofenac	6(10%)	7(11.7%)
Types of induction	30(50%)	22(36.7%)
Suxamethonium	0(0%)	8(13.3%)
Vecuronium		

Postoperative vital signs

The postoperative vital signs were taken immediately at the arrival of the recovery room, 6th, 12th, and 24th hours postoperatively were statistically significant differences between groups (Table 4).

Table 4
Postoperative vital signs expressed in median (interquartile range) of patients who underwent emergency midline laparotomy in North-central Ethiopia.

Variable	Exposed group (n = 30)	Unexposed group (n = 30)	P-value
SBP immediately at arrival of recovery room	124(119.5–129)	128(121.5–129)	0.009**
DBP immediately at arrival of recovery room	74(70-82.5)	70(70–80)	0.439
PR immediately at arrival of recovery room	89(83.3–92)	82(70-88.5)	0.789
SBP at 3rd hour postoperative	120(120–124)	120(119.5–128)	0.288
DBP at 3rd hour postoperatively	72(70–80)	70(70-78.5)	1.00
PR at 3rd hour postoperatively	80(78–85)	84.5(82–98)	0.111
SBP 6th hour postoperatively	116(110–124)	120(115-128.5)	0.010**
DBP 6th hour postoperatively	77(70–80)	73.5(70-78.5)	0.796
PR 6th hour postoperatively	81(77.5–82)	82(80-88.8)	0.438
SBP at 12th hour postoperatively	110(100–118)	120(115–127	0.0001**
DBP at 12th hour postoperatively	70(70–75)	75(70–80)	0.020**
PR at 12th hour postoperatively	80(71–80)	75(70–80)	0.110
SBP at 24th hour post operatively	115.5(100–120)	122.5(119.5–129)	0.006**
DBP at 24th hour post operatively	80(70–80)	79(69.8–80.3)	0.160
PR at 24th hour post operatively	80.5(74–85)	80(75–89)	0.796
First analgesic request (in hours)	8(7–9)	2(1-2.3)	0.001**
Hint**= statistically significant			

Comparison of Postoperative Pain Severity by Numeric Pain Rating scale

The median NRS score was lower in the RSB group at 0 (immediately at the arrival of recovery room), 3rd, 6th, and 12th hours postoperatively (p- values < 0.05) (Table 5).

Table 5
The median (IQR) Numeric Rating Scale score between the two groups of patients who underwent emergency midline laparotomy in North- central Ethiopia.

Variable	Exposed group (n = 30)	Unexposed group (n = 30)	P-value
NRS immediately at arrival of recovery room	3(3–4)	4.5(3-4.5)	0.039**
NRS at 3rd hour post operatively	3(3–4)	5(4–6)	0.0001**
NRS at 6th hour post operatively	3(3–4)	4(4–5)	0.030**
NRS at 12th hour post operatively	3(3–5)	4(4–6)	0.041**
NRS at 24th hour postoperatively	3(3–4)	5(3.8-6) 0.0001**	
Hint: **= statistically significant			

Comparison of Total Analgesics Consumption between Groups

There was a statistically significant difference in total tramadol and diclofenac consumption within 24 hours postoperatively (Table 6).

Table 6
Comparison of total analgesic consumption within 24 hours postoperatively between groups in North-central Ethiopia.

Variable	Exposed group (n = 30)	Unexposed group (n = 30)	P-value
Tramadol in mg (IV)	25(25–50)	150(100–200)	0.0001**
Diclofenac in mg (IM)	0(0–75)	75(75–75)	0.013**
Hint: **= statistically significant			

Incidence of postoperative Nausea and Vomiting

The incidence of postoperative nausea and vomiting over 24 hours was 13.3%. The proportion of nausea and vomiting was lower in the BRSB group (36.7%) compared to the control group (50%) with a p-value of 0.0001.

Discussion

The International Association for the Study of Pain defined pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage [22].

Currently, the important factor that could affect the duration and recovery from postoperative ileus might be decreasing the dose of narcotics [23].

Our study demonstrates that BRSB in patients undergoing emergency midline laparotomy resulted in statistically significant lower pain scores when compared with the unexposed group immediately at the recovery room with a median (IQR) NRS score of 1(1–1) versus 6(5–6) p-value 0.0001. The pain severity score in NRS was also lower in the BRSB group at 3rd, 6th, 12th hours postoperatively (p-value < 0.05). Twenty-four hours of analgesics consumption were reduced in the BRSB group (p-value < 0.05).

In line with our findings, studies showed that BRSB is effective in reducing the severity of postoperative pain score, analgesics consumption and increases time to first analgesic request [24–27]. While other studies failed to demonstrate BRSB effectiveness [28, 29].

Though there was a proportional difference among the groups for the incidence of postoperative nausea and vomiting, there was no statistically significant difference between the groups (p > 0.05) which had a comparable result with a study done by Elbahrawy and El-Deeb (p-value 0.037) [30].

Conclusion

Bilateral rectus sheath block might be an effective and long-lasting analgesic option for midline laparotomy.

Abbreviations

GA: General Anesthesia; LA: Local Anesthesia; LSA: Local Statistical Agency; NRS: Numeric Rating Scale; RSB: Rectus Sheath Block

Declarations

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No

Authors’ contributions

Teshome D. developed the proposal, analyzed the data and prepared the manuscript. Fenta E. Hunie M. and Girma S. revised the proposal, involved in data analysis and manuscript preparation. All authors approved the final manuscript for publication.

Ethics approval and consent to participate

See methods section.

Consent for Publications

Not applicable.

Conflict of Interest

The authors declare that there is no conflict of interests.

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Availability of data and materials

Data and materials will be shared upon reasonable request.

References

1. Rozen WM, Tran TM, Ashton MW, Barrington MJ, Ivanusic JJ, Taylor GI. Refining the course of the thoracolumbar nerves: a new understanding of the innervation of the anterior abdominal wall. *Clin Anat.* 2008; 21(4):325–33. doi: 10.1002/ca.20621.
2. Shabana M A, Dar M, Ghanem A M. surgically performed rectus sheath block – Effect of morphine added to bupivacaine versus bupivacaine only: A prospective randomized controlled double blinded trial. *Egyptian Journal of Anaesthesia*, 2013; 29: 401–405.
3. Wilkinson KM, Krige A, Brearley SG, Lane S, Scott M, Gordon AC, 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 randomized controlled trial. 2014; 15:400. doi: 10.1186/1745-6215-15-400.
4. Imani F. Postoperative pain management. Anesthesiol pain Med; 2011.
5. Block BM, Liu SS, Rowlingson AJ, Cowan AR, Cowan JA, Wu CL. Efficacy of postoperative epidural analgesia: a meta-analysis. 2003; 290(18):2455–63. doi: 10.1001/jama.290.18.2455.
6. Imani F, Faiz HR, Sedaghat M, Hajiashrafi M. Effects of adding ketamine to fentanyl plus acetaminophen on postoperative pain by patient controlled analgesia in abdominal surgery. *Anesth Pain Med.* 2014;4(1):12162. doi: 10.5812/aapm.12162.

7. Gharaei H, Imani F, Almasi F, Solimani M. The effect of ultrasoundguided tapb on pain management after total abdominal hysterectomy. *Korean J Pain.* 2013;26(4):374–8. doi: 10.3344/kjp.2013.26.4.374.
8. Karbasy SH, Derakhshan P. Effects of opium addiction on level of sensory block in spinal anesthesia with bupivacaine for lower abdomen and limb surgery: a case-control study. *Anesth Pain Med.*2014;4(5):21571. doi: 10.5812/aapm.21571.
9. Cousins MJ. Acute and postoperative pain. In: Wall PD, Melzack R, editors. Textbook of Pain. 3th. New York: Livingstone Inc; 1994. p. 357–85.
10. Pasero C, McCaffery M. Postoperative pain management in the elderly. Seattle: *IASP Press;* p. 45–68.
11. Aydınlı I. Geriatrikolgulardapostoperatifağrıtedavisi. T KlinikAnestReanim 2003; 1:47–58.
12. Schleich DL. Schmerzloseoperationen. 4th ed. Berlin: Springer Verlag; 1989. p. 240–58.
13. Manassero A, Bossolasco M, Meineri M, Ugues S, Liarou C, Bertolaccini L. Spread patterns and effectiveness for surgery after ultrasoundguided rectus sheath block in adult day-case patients scheduled for umbilical hernia repair. J *AnaesthesiolClin Pharm* 2015; 31(3):349–53.
14. Børglum J, Jensen K. Abdominal Surgery: Advances in the Use of Ultrasound-Guided Truncal Blocks for Perioperative Pain Management. Abdominal Surgery. Bispebjerg: licensee InTech; 2012: 69-74.
15. Kelvin How Yow Quek. Bilateral rectus sheath block as the single anaesthetic technique for an open infraumbilical hernia repair. Singapore Med Journal. 2014; 55(3): e39–e41.
16. McDonnell JG, O'Donnell B, Farrell T, et al. Transversus abdominis plane block: a cadaveric and radiological evaluation. *Reg Anesth Pain Med* 2007;32:399–404
17. Yarwood J, Berrill A. Nerve blocks of the anterior abdominal wall, Continuing Education in Anaesthesia Critical Care & Pain. *British journal of Anesthesia* 2010; 10(6): 182–186
18. Børglum J, Jensen K. Abdominal Surgery: Advances in the Use of Ultrasound-Guided Truncal Blocks for Perioperative Pain Management. Abdominal Surgery. Bispebjerg: licensee InTech; 2012: 69-74.
19. Kelvin How Yow Quek. Bilateral rectus sheath block as the single anaesthetic technique for an open infraumbilical hernia repair. *Singapore Med Journal.* 2014; 55(3): e39–e41.
20. Pain terms: a list with definitions and notes on usage: recommended by the IASP subcommittee on Taxonomy. *PAIN* 1979; 6;249
21. Okamoto K, Komasawa , Kido H, Efficacy of TransversusAbdominis and Rectus Sheath Blocks in combination with Continuous Intravenous Fentanyl for Postoperative Analgesia of Laparoscopic Colectomy: A Retrospective Study. Masui. 2017 Jan;66(1):73-75.
22. Bashandy GM, et al. Reducing postoperative opioid consumption by adding an ultrasound-guided rectus sheath block to multimodal analgesia for abdominal cancer surgery with midline incision. *Anesth Pain Med*. 2014.
23. Crosbie EJ, et al. Eur J The surgical rectus sheath block for post-operative analgesia: a modern approach to an established technique. *ObstetGynecolReprod Biol.*

24. Purdy M, et al. A prospective, randomized, open label, controlled study investigating the efficiency and safety of different methods of rectus sheath block analgesia following midline laparatomy. Medicine (Baltimore). 2018 Feb; 97(7):e9968. doi:10.1097/MD
25. Bashandy G M, Elkholy A H. Reducing postoperative opioid consumption by adding an ultrasoundguided rectus sheath block to multimodal analgesia for abdominal cancer surgery with midline incision. Anesth Pain Med. 2016; 10(3): 1-6.
26. Ibrahima M, Shamaa EH, Ads E. Efficacy of combined ultrasound guided anterior and posterior rectus sheath block for postoperative analgesia following umbilical hernia repair: Randomized, controlled trial. Egyptian Journal of Anaesthesia 2016; 32(4):519-26
27. Smith BE, Suchak M, Siggins D, Challands J. Rectus sheath block for diagnostic laparoscopy. Anesthesia 1988; 43:947- 948
28. Hany Mahmoud Yassin, Ahmed TohamyAbd Elmoneim, and Hatem El Moutaz. The Analgesic Efficiency of Ultrasound-Guided Rectus Sheath Analgesia Compared with Low Thoracic Epidural Analgesia After Elective Abdominal Surgery with a Midline Incision: A Prospective Randomized Controlled Trial. *Anesth Pain Med.* 2017 June; 7(3):e14244.
29. Padmanabhan J, Rohatigi A, Niaz A. Does rectus sheath infusion of bupivacaine reduce postoperative opioids requirement? Ann R Coll Surg Engl 2007; 89(3): 229-232
30. Elbahrawy K, El-Deeb A. Rectus sheath block for postoperative analgesia in patients with mesenteric vascular occlusion undergoing laparotomy. A randomized singleblinded study. Anesth Essays Res 2016;10:516-520