RESEARCH ARTICLE

Intraoperative epidural analgesia practices and their outcomes in major abdominal surgeries at a tertiary care hospital in Karachi

Amber Gulamani, Azhar Rehman, Mohsin Nazir, Zainab Shabbir

Abstract

Objective: To investigate the association involving site, concentrations and dosing of local anaesthetics used intraoperatively on postoperative pain scores, motor block and need for rescue analgesia.

Method: The observational study was conducted from June 1, 2020, to May 31, 2021, at the Aga Khan University Hospital, Karachi, and comprised patients planned for major abdominal surgeries with epidurals as primary analgesic modality. They were followed prospectively from placement of epidurals to 24h postoperatively. Data was collected from anaesthesia chart and pain management notes. Data was analysed using SPSS 19.

Results: Of the 170 patients, 96(56.4%) were females and 74(43.5%) were males. The overall mean age was 54.1±12.6 years and mean body mass index was 26.7±5.5Kg/m2. More than half of the patients 110(64.7%) had thoracic epidural, while 60(35.3%) had lumber epidural. Requirement of opioid co-analgesia intraoperatively was significantly high with higher compared to lower concentration of local anaesthetics (p=0.004). The difference in frequencies of motor block was significantly associated with catheter length (p=0.006).

Conclusions: Intraoperative management of epidurals is an essential but overlooked component of perioperative pain management. Guidelines should be formulated for intraoperative epidural analgesic regimens to improve postoperative outcomes.

Key Words: Epidural management, Pain management, Local anaesthetics, Intraoperative period, Thoracic epidural, Practice trends.

(JPMA 73: 1587; 2023) **DOI: 10.47391/JPMA.6434**

Submission completion date: 29-03-2022— **Acceptance date:** 06-04-2023

Introduction

Pain management in patients undergoing open abdominal surgeries is challenging and has a profound impact on their overall recovery and quality of life post-surgery. The concept of preventive analgesia has proven to be the most effective strategy in managing postoperative pain. It employs multimodal anti-nociceptive interventions, starting preoperatively and given for an increased duration, including the postoperative period, to prevent the development of central sensitisation.[1] Since intraoperative period involves multiple nociceptive stimuli that include surgical incision, intraoperative tissue injury and resultant inflammatory response, it can contribute to peripheral and central sensitisation.[1] Hence, analgesic modality employed should encompass the entire perioperative period for effective pain management.

Epidural analgesia is a time-honoured and widely practised technique for analgesia in major open abdominal surgeries in many centres across the world. It not only provides excellent postoperative pain control, but also improves overall surgical outcomes compared to opioid-based analgesic regimens.[2-4] A meta-analysis including 125 trials and 9,044 patients examined the effect of adding epidural analgesia to a general anaesthetic compared with standard opioid-based analgesia reported 25-40% reduced risk in postoperative mortality with major beneficial effects on cardiovascular and pulmonary complications.[4] It also decreases postoperative opioid requirements and development of chronic postsurgical pain, promotes early return of bowel movements, reduces the incidence of postoperative nausea, vomiting (PONV), decreases the risk of cardiopulmonary complications, accentuates surgical stress response and shortens hospital stay.[2-7] These benefits have also earned epidural analgesia a special place in pain management for enhanced recovery after surgery (ERAS) programmes.[8,9]

Majority of the studies have investigated the effect of postoperative epidural infusions on pain and other outcomes with little emphasis on intraoperative regimen. According to an audit report, only 57% of the epidurals placed before the induction of anaesthesia, were actually

Department of Anaesthesiology, Aga Khan University Hospital, Karachi, Pakistan.

Correspondence: Amber Gulamani. Email: ambergulamani@hotmail.com

ORCID ID.0000-0002-3164-5763

used during the procedure, with many of them only running for half of the procedure.[10] Delayed or omitted epidural infusion initiation results in additional requirement of intravenous (IV) opioid analgesics to treat breakthrough postoperative pain, which is associated with an increased incidence of opioid-related side effects.[11] Also, patients receiving intraoperative epidural infusions are reported to have better pain control and shorter length of post-anaesthesia care unit (PACU) stay.[12]

There is no standard guideline regarding the specific time to start epidural infusion during or after the surgery, or concentration and volume of local anaesthetics (LAs) that should be used as bolus or intraoperative epidural infusions.[12] Hence, management of intraoperative epidural dosing regimen is usually left to the discretion of primary anaesthetist.

The current study was planned to investigate the effect of different concentrations, volumes and methods of LAs used intraoperatively for epidural analgesia on postoperative pain scores and other outcomes.

Patients and Methods

The observational study was conducted from June 1, 2020, to May 31, 2021, at the Aga Khan University Hospital, Karachi, and comprised patients planned for major abdominal surgeries with epidurals as primary analgesic modality. Patients who were shifted to intensive care unit (ICU) with tracheal intubation post-surgery, had communication impairment or epidural lasting <24h were excluded. Waiver was obtained from the institutional ethics review committee due to the observational nature of the study.

All patients received general anaesthesia (GA) with epidural. The epidural was administered to the patients for intraoperative and postoperative pain management. As a routine, management of epidural analgesia intraoperatively was left at the discretion of the primary anaesthetist, and all the patients were followed up postoperatively by the acute pain service team, including pain consultant, trainee and pain nurse, till the removal of epidural catheter.

Data was collected from anaesthesia chart and pain management notes. Intraoperative parameters, including epidural site, loading drug, dose, concentration, boluses, or infusions, and need, if any, for rescue opioid analgesia was noted. Parameters in the recovery room, at 2hr, 6hr, 10hr, 14hr, 20hr, 24hr, were recorded including postoperative pain scores, motor block and PACU stay. Motor block was assessed using the modified Bromage scale [13] in PACU.

Data was analysed using SPSS 19. Demographic characteristics and use of different LA parameters were analysed using parametric tests, like independent sample t test, and analysis of variance (ANOVA) and non-parametric tests, like Mann-Whiney U test, Kruskal-Wallis H test, chi-square test, or Fisher's exact test, as per quantitative and qualitative point estimations. Data was expressed as mean ± standard deviation, Median and interquartile range (IQR), or as frequencies and percentages, as appropriate. Parametric assumptions were justified by histogram and Kolmogorov-Smirnov test. $P<0.05$ was taken as significant.

Results

Of the 170 patients, 96(56.4%) were females and 74(43.5%) were males. The overall mean age was 54.1±12.6 years and mean body mass index was 26.7±5.5kg/m^2. Mean length of catheter left in the epidural space was 5.3±0.7cm and mean loading dose of local anaesthetic was 10.4±4.2ml. Mean duration of surgery was 235.02±97.1 minutes, mean time of PACU stay was 153.1±84.2 minutes and mean epidural discontinuation time 54.5±14.6 hours. Patient baseline characteristics and management strategies were noted (Tables 1-2). Bupivacaine and ropivacaine LAs were used intraoperatively, while only bupivacaine was used for epidural infusion postoperatively in all patients (Figure).

More than half of the patients 110(64.7%) had thoracic epidural, while 60(35.3%) had lumber epidural. Among thoracic epidurals, 25(22.7%) were placed in obese patients with BMI >=30kg/m2 and 85(77.2%) were placed

Table-1: Baseline characteristic (n=170).

Baseline Characteristics	Frequency (%)
Body mass index (BMI)	
<30 Kg/m2	124 (73.0)
>= 30 Kg/m2	46 (27.0)
Gender	
Male	74 (43.5)
Female	96 (56.4)
American Society of Anaesthesiology (ASA)	
II	115 (67.6)
III	55 (32.3)
Hypertension	75 (44.1)
Diabetes Mellitus	49 (28.8)
Ischaemic Heart Disease	9 (5.3)
Type of Surgery	
Gynaecological	59 (34.7)
Upper Gastrointestinal	44 (25.8)
Colorectal	43 (25.3)
Urological	22 (13.0)
Retroperitoneal	2 (1.2)

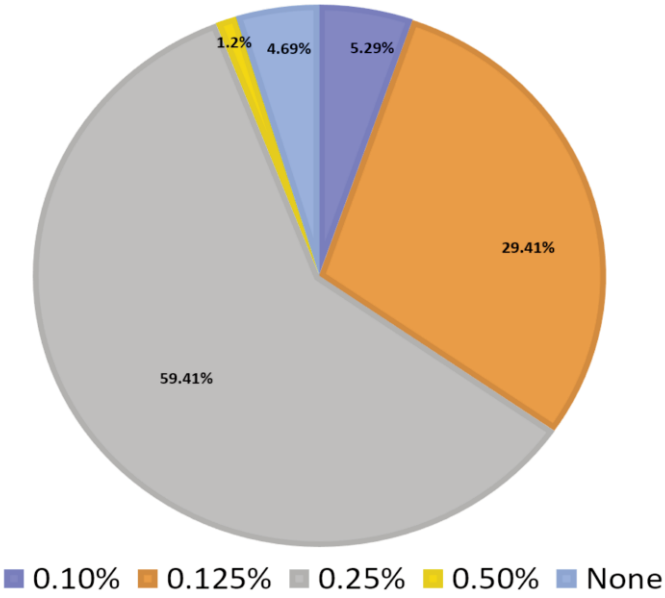

Figure: Loading dose concentration of local anaesthetics (LAs).

in non-obese patients with BMI <30kg/m2. Among lumber epidurals, 21(35%) were placed in obese and 39(65%) in non-obese patients. Epidurals were frequently inserted in sitting and awake position; 107(97.2%) thoracic epidurals, and 56(93.3%) lumber epidurals. Pain score on arrival in PACU between thoracic and lumber groups was nonsignificant (p=0.56). Motor block was more frequently observed in patients with lumber epidural 28 (46.6%) than thoracic epidural 37(33.6) (p=0.09).

Of the total 170 patients, 24(14.1%) did not receive intraoperative epidural LA infusion, 113(66.4%) received 0.125% bupivacaine, 20(11.7%) received 0.1% bupivacaine, 12(7.1%) received 0.25% bupivacaine and 1(0.6%) received 0.5% bupivacaine infusion. Among patients who received 0.125% bupivacaine, 37(32.7%) had no pain to mild pain, 66(58.4%) had moderate pain and 10(8.8%) had severe pain. Patients who received 0.1% LA infusion, 8(40%) had no pain to mild pain, 8(40%) had moderate pain and 4(20%) developed severe pain. The differences in the frequency of pain in relation to the 4 categories of intraoperative LA infusion were nonsignificant (p=0.68).

Motor block assessment showed that 7(58.3%) patients who received 0.25% LA infusion developed motor block, while 45(39.8%) in the 0.125% and 8(40%) who in the 0.1% group experienced motor block in PACU (p=0.074).

Overall, in 101(59.4%) patients, the length of catheter in

Table-2: Variation in epidural management practices (n=170).

Variation in Epidural Management	Frequency (%)
Epidural site of insertion	
Thoracic	110 (64.7)
Lumbar	60 (35.3)
Epidural Needle used (Gauge)	
16 (Gauge)	158 (93.0)
18 (Gauge)	12 (7.1)
Position of Patient during epidural insertion	
Sitting & awake	163 (95.8)
Lateral & awake	2 (1.2)
Lateral & asleep	5 (3.0)
Length of catheter in epidural space	
More than & equal to 5 Cm	151 (88.8)
Less than 5 Cm	19 (11.2)
Local Anaesthesia Used for epidural loading	
None	8 (4.7)
Bupivacaine	129 (75.8)
Ropivacaine	33 (19.4)
Concentration of epidural loading dose (%)	
no loading dose	8 (4.7)
0.5% Bupivacaine/Ropivacaine	2 (1.2)
0.25% Bupivacaine/Ropivacaine	101 (59.4)
0.125% Bupivacaine/Ropivacaine	50 (29.4)
0.1% Bupivacaine/Ropivacaine	9 (5.3)
Concentration of Intraoperative epidural infusion (%)	
No intraoperative infusion started	24 (14.1)
0.5% Bupivacaine	1 (0.6)
0.25% Bupivacaine	12 (7.1)
0.125% Bupivacaine	113 (66.4)
0.1% Bupivacaine	20 (11.7)
Intraoperative Use of Opioid	
None	101 (59.4)
Morphine	48 (28.2)
Nalbuphine	19 (11.2)
Tramadol	2 (1.2)
Pain Score on PACU arrival	
Mild pain (VAS 1-3)	56 (33.0)
Moderate pain (VAS 4-6)	98 (57.6)
Severe Pain (VAS 7-10	16 (9.4)
Patients with breakthrough pain in 24 hours postop	52 (30.6)
Interventions for breakthrough pain (n=52)	
Epidural Bolus	37 (71.1)
Opioid Bolus	5 (9.6)
Epidural & opioid Bolus	4 (7.6)
Epidural stopped & Opioid infusion started	4 (7.7)
Epidural Bolus & Opioid PCIA	2 (3.8)
Patients with Motor Block on PACU arrival	65 (38.2)
Patients with Motor Block in 24 hour postop.	27 (15.8)
Intervention(s) for Motor Block (n=27)	
Switch to lower concentration of LA	19 (70.3)
Re-position the patient & Epidural hold	6 (22.2)
None	2 (7.4)

PACU: Post-anaesthesia care unit, VAS: Visual analogue scale, PCIA: Patient-controlled intravenous analgesia.

epidural space was ≤5cm and in 69(40.5%) patients, it was >5cm. Motor block was observed in 30(17.6%) patients with catheter length ≤5cm compared to 35(50.7%) with length >5cm (p=0.006).

Intraoperative opioids, including morphine, nalbuphine and tramadol, were used as co-analgesics in 69(40.5%) of the total 170 patients. Requirement of opioid co-analgesia was much more with high LA concentration compared to those with low concentration (p=0.004).

Discussion

The current study explored the differences in intraoperative management of epidural analgesia for major abdominal surgeries among anaesthetists at a tertiary care hospital. There is no standard guideline on the subject and the literature is not conclusive about the ideal practice.[14] The Royal College of Anaesthetists have recently published an updated version of "Best Practice in the Management of Epidural Analgesia in the Hospital Setting", but it only covers the organisational aspects of epidural analgesia.[15]

Majority of the epidurals were placed in the sitting position, likely because this is the usual teaching practice at the study site. In a recent survey of German anaesthetists, most participants also preferred the sitting position over lateral decubitus.[14] However, the ideal position for epidural puncture has not yet been thoroughly investigated in literature. Nishi et al. compared the sitting and lateral decubitus positions for the placement of epidural catheters, and found an increased risk for vasovagal syncope in the sitting position, whereas the lateral decubitus position was more technically challenging.[16]

To achieve optimum analgesia, epidural catheter should be inserted at an appropriate level for the surgery. The New York School of Regional Anaesthesia (NYSORA) recommends placing epidurals at the midthoracic level with segmental block extending from T5 to T8 for most upper abdominal procedures and, at the low thoracic level with sensory block extending to T7 for lower abdominal procedures, like colonic surgeries.[17] Placing epidurals at thoracic levels pose minimal risk of lower extremity motor deficits due to lumbar and sacral nerve root sparing.[17] Yet, the current study found that one-third of patients had lumbar epidurals for lower abdominal surgeries. This difference in practice could be because of lack of updated knowledge or fear of trauma to the spinal cord since most of the epidurals are placed by the residents under the supervision of the consultants.

Postoperative pain was comparable in patients receiving different concentrations of local anaesthetics, but frequency of postoperative motor block was significantly higher in patients who received higher LA concentration intraoperatively. The finding implies that intraoperative epidural regimens with low-dose LAs can provide optimum analgesia and prevent motor block in the immediate postoperative period. ERAS recommends use of dilute concentration of local anaesthetics in combination with opioids in postoperative period, but lacks information on intraoperative epidural dosing.[9]

Mehta s et al. have shown that when ropivacaine was used postoperatively, it was associated with significantly lower incidence of postoperative motor block compared to bupivacaine.[18] Unfortunately, ropivacaine solution is not available for postoperative infusion in most hospitals in Pakistan.

In the current study, 24 patients did not receive intraoperative LA infusion, which is likely because of haemodynamic instability. Patients who received concentration of 0.125% and 0.1% of LA had less requirement of opioid co-analgesia compared to those who received 0.25% or greater. Most likely explanation of this observation was that haemodynamic instability is directly related to the LA concentration, therefore, with high concentration of LA (0.25%-0.5%), less volume was given that did not provide adequate sensory level.

In the current study, motor block was observed more often when the length of epidural catheter in space was >5cm compared to the patients who had catheter ≤5cm in the epidural space. Afshan at el. found no difference in terms of complications, including motor block, when they left the catheter at 3cm, 5cm and 7cm; only the risk of catheter dislodgement was higher in the 3cm group.[19] Although, literature has shown that catheter malposition is associated with unilateral motor block,[20] the current study showed that none of the patients had unilateral block.

The current study has limitations as it was an observational study done at a single academic centre, which may not represent practices elsewhere in the world. There are no guidelines to standardise intraoperative epidural management practices and it is usually left to the discretion of the anaesthetist. Also, due to the unavailability of preservative-free opioid preparations at the study site, AKUH currently does not add opioids to LA mixtures for epidurals. This may affect the analgesic efficacy of the diluted LA mixture. The study evaluated the variation in practice of anaesthesiologists, but it was an audit without group comparison and/or hypothesis testing. Therefore, no assumption of sample

size calculation could be applied, and all patients with intraoperative epidurals over one-year duration were included to be able to maximise the representation of the target population. The study was not powered to control intraoperative confounding factors, like delay in the preparation of epidural infusion, or infusion on hold due to concerns for ongoing intraoperative blood loss or hypotension.

Conclusion

Placement of epidurals at appropriate site is crucial to achieving optimum analgesia with minimal risk of lower extremity motor deficits due to lumbar and sacral nerve root sparing. Loading should be done with dilute LA solution, preferably combined with an opioid to improve analgesic efficacy and to avoid motor block. Epidural catheter should be left in space at least 5cm. Finally, there is a need to develop guidelines to standardise intraoperative epidural management practices for better patient outcome.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: None.

References

1. Huang CC, Sun WZ, Wong CS. Prevention of Chronic Postsurgical Pain: The Effect of Preventive and Multimodal Analgesia. Asian J Anesthesiol 2018;56:74-82. doi: 10.6859/aja.201809_56(3).0002.
2. Li Y, Dong H, Tan S, Qian Y, Jin W. Effects of thoracic epidural anesthesia/analgesia on the stress response, pain relief, hospital stay, and treatment costs of patients with esophageal carcinoma undergoing thoracic surgery: A single-center, randomized controlled trial. Medicine (Baltimore) 2019;98:e14362. doi: 10.1097/MD.0000000000014362.
3. Mallard C, Withers B, Bauer B, Sloan PA, Dineen S, Rebel A. Effects of intraoperative epidural anesthesia during hepatectomy on intraoperative and post-operative patient outcomes. Int J Clin Anesth Res 2018;2:023-30. Doi: 10.29328/journal.ijcar.1001008
4. Pöpping DM, Elia N, Van Aken HK, Marret E, Schug SA, Kranke P, et al. Impact of epidural analgesia on mortality and morbidity after surgery: systematic review and meta-analysis of randomized controlled trials. Ann Surg 2014;259:1056-67. doi: 10.1097/SLA.0000000000000237.
5. Guay J, Choi PT, Suresh S, Albert N, Kopp S, Pace NL. Neuraxial anesthesia for the prevention of postoperative mortality and major morbidity: an overview of cochrane systematic reviews. Anesth Analg 2014;119:716-25. doi: 10.1213/ANE.0000000000000339.
6. Jian W, Rejaei D, Shihab A, Alston TA, Wang J. The role of multimodal analgesia in preventing the development of chronic postsurgical pain and reducing postoperative opioid use. J Opioid Manag 2018;14:453-61. doi: 10.5055/jom.2018.0478.
7. Wang J, Yin Y, Zhu Y, Xu P, Sun Z, Miao C, et al. Thoracic epidural anaesthesia and analgesia ameliorates surgery-induced stress response and postoperative pain in patients undergoing radical oesophagectomy. J Int Med Res 2019;47:6160-70. doi: 10.1177/0300060519866943.
8. Moningi S, Patki A, Padhy N, Ramachandran G. Enhanced recovery after surgery: An anesthesiologist's perspective. J Anaesthesiol Clin Pharmacol 2019;35(Suppl 1):s5-13. doi: 10.4103/joacp.JOACP_238_16.
9. Gustafsson UO, Scott MJ, Hubner M, Nygren J, Demartines N, Francis N, et al. Guidelines for Perioperative Care in Elective Colorectal Surgery: Enhanced Recovery After Surgery (ERAS®) Society Recommendations: 2018. World J Surg 2019;43:659-95. doi: 10.1007/s00268-018-4844-y.
10. Shah AC, Nair BG, Spiekerman CF, Bollag LA. Process Optimization and Digital Quality Improvement to Enhance Timely Initiation of Epidural Infusions and Postoperative Pain Control. Anesth Analg 2019;128:953-61. doi: 10.1213/ANE.0000000000003742.
11. de Boer HD, Detriche O, Forget P. Opioid-related side effects: Postoperative ileus, urinary retention, nausea and vomiting, and shivering. A review of the literature. Best Pract Res Clin Anaesthesiol 2017;31:499-504. doi: 10.1016/j.bpa.2017.07.002.
12. Shah AC, Nair BG, Spiekerman CF, Bollag LA. Continuous intraoperative epidural infusions affect recovery room length of stay and analgesic requirements: a single-center observational study. J Anesth 2017;31:494-501. doi: 10.1007/s00540-017-2316-4.
13. Graham AC, McClure JH. Quantitative assessment of motor block in labouring women receiving epidural analgesia. Anaesthesia 2001;56:470-6. doi: 10.1046/j.1365-2044.2001.01524-6.x.
14. Schlesinger T, Weibel S, Steinfeldt T, Sitter M, Meybohm P, Kranke P. Intraoperative management of combined general anesthesia and thoracic epidural analgesia: A survey among German anesthetists. Acta Anaesthesiol Scand 2021;65:1490-96. doi: 10.1111/aas.13971.
15. Royal College of Anaesthetists. Best Practice in the Management of Epidural Analgesia in the Hospital Setting. [Online] 2020 [Cited 2022 May 16]. Available from URL: https://fpm.ac.uk/sites/fpm/files/documents/2020-09/Epidural-AUG-2020-FINAL.pdf.
16. Nishi M, Usukaura A, Kidani Y, Tsubokawa T, Yamamoto K. Which is a better position for insertion of a high thoracic epidural catheter: sitting or lateral decubitus? J Cardiothorac Vasc Anesth 2006;20:656-8. doi: 10.1053/j.jvca.2006.03.019.
17. Toledano RD, Van de Velde M. Epidural Anesthesia and Analgesia. [Online] 2020 [Cited 2022 May 16]. Available from URL: https://www.nysora.com/topics/regional-anesthesia-for-specific-surgical-procedures/abdomen/epidural-anesthesia-analgesia/.
18. Mehta S, Gajbhare MN, Kamble NP. Comparison of Epidural Analgesia Using 0.2% Bupivacaine and 0.2% Ropivacaine for the Management of Postoperative Pain in Major Orthopedic Surgery. Anesth Essays Res 2018;12:586-91. doi: 10.4103/aer.AER_62_18.
19. Afshan G, Chohan U, Khan FA, Chaudhry N, Khan ZE, Khan AA. Appropriate length of epidural catheter in the epidural space for postoperative analgesia: evaluation by epidurography. Anaesthesia 2011;66:913-8. doi: 10.1111/j.1365-2044.2011.06820.x.
20. McLeod GA, Cumming C. Thoracic epidural anaesthesia and analgesia. Continuing Education in Anaesthesia Critical Care & Pain 2004;4:16-9. Doi: 10.1093/bjaceaccp/mkh006.