

Bupivacaine with Dexamethasone and Epinephrine Infiltration at the sutured muscle wound versus at Midline Preperitoneal in Open Laparotomies

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Abstract

Background: Pain following open laparotomies is typically localized in the mid abdominal incision.

The infiltration of local anesthetic into the preperitoneal space at laparotomy wound and over muscle sutures before skin closing both under direct vision. This study aims to compare the effectiveness of preperitoneal infiltration through an abdominal incision guided by direct vision versus over muscle sutures before skin closure.

Methods: Forty-four patients were randomly allocated to receive 20 ml of 0.25 mg bupivacaine mixed, 8 mg/mL epinephrine and 8 mg dexamethasone in the preperitoneal space (PPS) and over sutured muscle wound (SMW) before skin closure. Both through direct vision. Patients were evaluated for 72hours post-operatively, recording abdominal pain using the standard 10-cm numerical analogue scale (NAS), the time to first analgesic requirement, and the incidence of postoperative nausea and vomiting (PONV).

Results: Post-operative pain was significantly lower in the infiltration over the sutured muscle wound group at 12h and 24h post-surgery ($p < 0.05$). The time to first analgesic requirement was significantly longer in the infiltration over the sutured muscle wound group compared to the preperitoneal incisional group ($p < 0.001$). Although not statistically significant, PONV was less frequent in the infiltration over the sutured muscle wound group.

Conclusion: The results indicate the superiority of infiltration over the sutured muscle wound over preperitoneal space in managing postoperative pain following open laparotomies. The study also reports that local infiltration of the surgical

wound with bupivacaine, dexamethasone and epinephrine combination was effective in the postoperative pain control of the laparotomy wounds.

Keywords: preperitoneal space (PPS); sutured muscle wound (SMW); laparotomy; postoperative pain

Introduction

In the postoperative period, around 80% of individuals suffer from pain with almost all describing pain as moderate to severe [1]. Postoperative pain may lead to an increase in post-surgical hospitalization stay, insomnia, discomfort and stress [2]. Immediately following open laparotomy, patients are unable to take oral medications.

Laparotomies are characterized by their longer duration, slower recovery, and longer hospital stays, with open laparotomies being one of the most common procedures in our country. However, postoperative pain can affect these outcomes. Balanced anesthesia can increase pain threshold but may not provide full analgesia post-operation. Therefore, adding a local anesthetic technique is pivotal.

Various local analgesic techniques for postoperative open laparotomy pain include simple surgical site infiltration, transverse abdominal plane (TAP) block, and intraperitoneal infiltration. A simple technique known as preperitoneal space (PPS) local anesthetic infiltration may improve analgesic outcomes during the postoperative period. This study evaluates the effectiveness of PPS and over the sutured muscle wound (SMW) both by direct visualization through the abdominal incision in patients undergoing open laparotomies. Infiltration of the surgical wound with local anesthetics can decrease postoperative pain by inhibiting transmission of noxious impulses at the

site. local infiltration of the surgical wounds, bupivacaine has been reported to have significant effects on wound healing. Epinephrine delays systematic absorption of bupivacaine and prolongs its effects.

Materials and Methods

This study was conducted in accordance with the guidelines and regulations of our Private Hospital (Yemeni French Hospital) and approved by the ethics committee of 21st September university. Informed consent was obtained from all patients.

Forty-four patients, aged 19.9-65 years, majority ASA 1 or 2, with no history of local anesthetic allergy or chronic pain, were included in the study. Patients were pre-medicated with 8 mg ondansetron IV and received balanced anesthesia with 100 µg fentanyl, 2 mg/kg propofol, 0.5 mg atracurium, and maintenance with isoflurane at 1.2 MAC. Surgeries were performed by one colorectal surgeon.

Patients were randomly allocated to receive 20 ml of 0.25 mg bupivacaine mixed with 8 mg dexamethasone and 8 mg/mL epinephrine in the preperitoneal space at the incision edges, guided by direct vision (preperitoneal space group) or by infiltration over the sutured muscle wound through an abdominal incision before skin closure (sutured muscle wound group). All patients received 1 g paracetamol intraoperatively.

For both the preperitoneal space method and over the sutured muscle wound, a 150 mm needle was used. For PPS, the plane between the transverse abdominal muscle and the peritoneum was located, and infiltration was performed and inserted under vision gently about 0.5 cm above the peritoneum, and the local anesthetic was injected. The site was inspected to see the presence of an internal bulge (Doyle's bulge) confirmed the procedure's correctness.

Patients were evaluated for 72 hours post-operatively, recording abdominal pain using the NAS at 12h, 24h, 36h, 48h, and 72h. The time to first analgesic requirement and the incidence of post-operative nausea and vomiting (PONV) within 72 hours postoperatively were also recorded.

Sample Size Calculation: Sample size calculation was based on the difference in postoperative pain incidence between groups with preperitoneal bupivacaine infiltration and a over the sutured muscle wound group. Using G Power program version 3.1.9.4, with a 27% expected difference, a 2-tailed test, α error = 0.05, and power = 80%, the total calculated sample size required was 44 per group.

Statistical Analysis: Data were analyzed using SPSS version 23.0 (SPSS Inc., Chicago, IL, USA). Quantitative data were presented as mean \pm standard deviation or median with inter-quartile range (IQR) based on normality. Qualitative variables were presented as numbers and percentages. Normality was assessed using Kolmogorov-Smirnov and Shapiro-Wilk test.

Data of 44 patients

Data of 44 patients	SMW (N=22patients)	PPS (N= 22 patients)	T-test	Chi ² test	P-value
Age: Mean \pm SD Range (years)	39 \pm 13.80 20-63	42 \pm 9.0 19.9-65	-0.854		0.398
Sex: Males Females	9 (40.9%) 13 (59.1%)	8 (36.3%) 14 (63.6%)		0.107	0.744
ASA1-3: 1 2 3	9 (40.9%) 9 (40.9%) 4 (18.2%)	8 (36.4%) 9 (40.9%) 5 (22.7%)		0.170	0.919
Procedure time: Mean \pm SD Range (hr)	2.50 \pm 1.10 1.5-3.9	2.60 \pm 1.20 1.4-3.80	-0.288		0.775
BMI mean \pm SD	24.50 \pm 2.67	23.80 \pm 2.55	0.889		0.379
NAS score: Preoperatively 12hr postoperative 24hr postoperative 36hr postoperative 48hrs postoperative 72hrs postoperative	1.15 \pm 0.75 3.05 \pm 0.89 2.20 \pm 0.83 2.10 \pm 0.76 4.00 \pm 0.79 4.63 \pm 1.16	1.63 \pm 0.95 3.98 \pm 1.32 2.80 \pm 0.70 2.71 \pm 0.81 4.65 \pm 1.78 4.53 \pm 1.59	-1.860 -2.740 -2.592 -2.576 -1.566 0.238		0.070 0.009 0.013 0.014 0.125 0.813

1st request of analgesia:				
Mean±SD	24.30±2.53	10.5±2.36	18.708	0.000
Range (hr)	16-26	8-12		
SMW= Sutured muscle wound, PPS= Preperitoneal space				

Results

Demographics: The demographic characteristics showed no significant differences between the groups regarding age, gender, and weight. Most patients were female 59.1% in the infiltration over the sutured muscle wound group and 63.3% in the preperitoneal incisional group). The time to infiltrate the preperitoneal space was not significantly different between the groups.

Postoperative Pain: Post-operative pain was significantly lower in the infiltration over the sutured muscle wound group at 12h and 24h ($p < 0.05$). There were no significant differences in NAS scores at 36h, 48h and 72h postoperatively.

Analgesic Requirement: The time to first analgesic requirement was significantly longer in the infiltration over the sutured muscle wound group compared to the preperitoneal space group ($p < 0.001$).

PONV: Although statistically insignificant, PONV was less frequent in the infiltration over the sutured muscle wound group than in the preperitoneal incisional group.

Discussion

Pain following open laparotomies is primarily in the abdominal incision, necessitating effective postoperative analgesia. Various studies have suggested that direct laparotomy-related pain is multifactorial, with contributions from the surgical site, visceral pain, and referred pain. Several modalities, such as NSAIDs, opioids, PCA, TAP block, QL block, and local anesthetic infiltration at incisional sites, are used for pain relief. However, these methods may not be available in low resources countries and often require skilled anesthesiologists and good facilities [3].

This study explored the potential for postoperative analgesia in laparotomies by either PPS infiltration or over the sutured muscle wound. Both could ensure precise and adequate local anesthesia delivery, resulting in superior pain control and reduced opioid consumption [4-6]. The delayed onset of pain and decreased PONV observed in the infiltration over the sutured muscle wound group suggest improved patient comfort and recovery [6]. The precise administration of the local anesthetic in the preperitoneal space likely contributes to these outcomes by providing both somatic and visceral pain relief [7].

The use of preperitoneal space showed promising results but was inferior to infiltration over the sutured muscle wound. Optimizing preperitoneal incisional-guided techniques at anterior axillary line with modern anterior axillary line machines and adequate operator training could enhance their effectiveness [7]. However, that the analgesia's exact mechanism is not entirely clear but may

involve somatic and visceral anti-nociceptive activity. Local anesthetics in the preperitoneal space act on specific pain receptors, providing targeted pain relief [7]. The use of epinephrine and dexamethasone as an adjuvant to bupivacaine could also contribute to prolonged analgesia due to their ability to prolong the duration of local anesthetics and anti-inflammatory properties [5,8].

Several studies have highlighted the benefits of PPS in various surgeries ultrasound guidance reduces the risk of local anesthetic systemic toxicity following peripheral nerve blockade [7-9]. Others demonstrated effective preperitoneal analgesia using a catheter on the peritoneum [10]. Similarly, Lindberg M et al. found that infiltration of local anesthetics reduced postoperative pain and enhanced recovery in colorectal surgeries [11]. These findings do not align with the results of our study in superiority of sutured muscle wound over preperitoneal space infiltration, emphasizing the efficacy of PPS needs further analysis in managing postoperative pain to be standardized.

The study's limitations include its single-center design and potential biases that were not addressed. The small sample size and the experience of a single operating surgeon may also limit the generalizability of the findings.

Conclusion

The results indicate that infiltration over the sutured muscle wound is superior in controlling post operative pain over preperitoneal space following open laparotomies. Also, it confirms that local infiltration of the laparotomy wound with bupivacaine, dexamethasone and epinephrine combination was effective in the postoperative pain control.

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