

Thoracic Epidural Local Anesthetics Are Ineffective in Alleviating Post-thoracotomy Ipsilateral Shoulder Pain

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Objective: This study was conducted to estimate the incidence and clinical predictors of post-thoracotomy shoulder pain and to determine the effectiveness of thoracic epidural block in alleviating this pain.

Design: A prospective clinical trial.

Setting: University teaching hospital.

Participants and Interventions: Thirty-two adult patients undergoing elective thoracic surgery consented to participate in the study. All operations were open thoracotomies done by the same team of surgeons and anesthesiologists. A thoracic (T6) epidural catheter was placed before induction of general anesthesia. Each patient received 7 mL of lidocaine 2% epidurally and repeated doses of 5 mL of lidocaine 2% every half hour during the operation. Postoperatively, the occurrence of incision or ipsilateral shoulder pain was observed and treated with a maximal dose of 5 mL of lidocaine 2%. If ineffective, indomethacin suppository (nonsteroidal anti-inflammatory drug [NSAID]) was given. Variables such as patient's age, sex, American Society of Anesthesiologists physical status, type, site and duration of surgery, duration of

anesthesia, the resection of main bronchus, and the use of thoracostomy tubes were recorded.

Measurements and Main Results: Postoperatively, 10 patients (31%) had shoulder pain, 4 patients (12.5%) complained of incision pain, and 2 (6.3%) complained of both incision and shoulder pain. A bolus of 5 mL of lidocaine 2% in the epidural catheter relieved incision pain in all the patients, but was ineffective for shoulder pain. Indomethacin suppository was effective in these patients. No correlation was found between any variable and the occurrence of shoulder pain.

Conclusions: It is concluded that post-thoracotomy shoulder pain is a common problem, and the previously mentioned variables did not predict its appearance. Thoracic epidural block is effective in the treatment of incision but not shoulder pain. The NSAID indomethacin suppository was found to be effective for that problem.

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INCISION FOR THORACOTOMY is known to be one of the most painful stimuli, and the use of thoracic epidural for postoperative pain management is a standard of care.¹ Although the epidural is highly effective for the incision pain, some patients recovering from thoracic surgery complain of independent shoulder pain during the acute postoperative period that may last up to 24 hours. The cause of this pain is unknown, although some explanations have been proposed for this phenomenon. Burgess et al² suggested that the pain results from transection of a major bronchus. Other possible causes include lateral decubitus position, pleural irritation generated by the thoracostomy tube, or referred pain from the diaphragm.³ Although post-thoracotomy shoulder pain is a common problem, there are few clinical trials concerning its treatment.^{4,5} This study was performed to estimate the incidence of post-thoracotomy shoulder pain, to find its clinical predictors, and to evaluate the effectiveness of thoracic epidural block and nonsteroidal anti-inflammatory (NSAID) as a treatment.

PATIENTS AND METHODS

After approval of the local ethics committee, a prospective study of 32 patients was conducted. Patients were scheduled for elective open thoracic surgery with combined epidural-general anesthesia and consented to participate in the study. Exclusion criteria included contraindications for epidural block (patient's refusal, infection at the injection

site, septicemia, coagulopathy, or hypotension⁶), chronic use of analgesics, or preoperative shoulder pathology. All patients were premedicated with 10 mg of diazepam and 10 mg of metoclopramide orally 1 hour before surgery. On arrival at the operating room, an intravenous catheter was placed for fluid and drug administration. Noninvasive blood pressure, pulse rate, and electrocardiogram were continuously monitored in each patient. A thoracic epidural catheter (T6) was placed before the induction of general anesthesia. The paramedian approach was selected in 15 patients and a midline approach in 17 patients, upon the anesthesiologist's discretion. A Tuohy needle was used, and the epidural space was identified by the loss-of-resistance technique. A test dose of 3 mL of lidocaine 2% with epinephrine 1:200,000 was used and then a bolus dose of 7 mL of lidocaine 2% was administered via the epidural catheter. Before the induction of general anesthesia, it was confirmed that the epidural block had succeeded. Sensory block between T3 and T7 was assessed by pinprick. There were no failed epidurals in this group of patients. Every half hour after the first dose, 5 mL of lidocaine 2% was administered epidurally to all patients. General anesthesia was identical for all the patients by using intravenous thiopental (4-5 mg/kg) and fentanyl (0.001-0.002 mg/kg) followed by vecuronium (0.1 mg/kg). Then a double-lumen tube (Robertshaw; left) was introduced to facilitate 1-lung ventilation during the operation. Inhalation anesthetic (isoflurane 0.7%-1.0%) was used for maintenance of anesthesia. All patients were placed in the standard horizontal lateral decubitus position. Padded rolls were placed under the patient's dependent axilla, and the arms and legs were flexed and supported by a soft surface pillow. All operations were standard open lateral thoracotomies done by the same team of surgeons with the same incision. After pneumonectomy, the patients had no thoracostomy tube. Other operations included the insertion of 1 or 2 tubes. All the patients were extubated while in the operating room at the end of the surgery. Then the patient was transferred to the postanesthesia care unit (PACU), where he/she stayed for 2 hours. The visual analog scale (VAS) was used to estimate the severity of pain on arriving in the PACU and every 15 minutes afterwards for 2 hours. If VAS was ≥ 3 at the incision site or shoulder, the patient received 5 mL of lidocaine 2% via the epidural catheter and was observed for the effect. A patient who was not relieved by this dose received 100 mg of indomethacin by suppository.

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Data collected included patient's age, sex, American Society of Anesthesiologists (ASA) score, type, site and duration of surgery, duration of anesthesia, and number of thoracostomy tubes. The duration of surgery was defined as the time between skin incision and closure, and the duration of anesthesia was defined as the time spent in the operating room. The patient's complaints in the PACU, whether complaining of incision pain, shoulder pain, or both, were also recorded as was the treatment effect on the VAS score. The correlation of all the variables with shoulder pain was determined by Spearman's rank order correlation. Statistical significance was set at $p < 0.05$.

RESULTS

The demographic and clinical characteristics of the patients are summarized in Table 1. The surgical procedures were all open thoracotomies and included 10 lobectomies, 4 pneumonectomies, 11 wedge resections of the lung, and 7 pleurodesis procedures. The duration of anesthesia was 138 ± 25 minutes, and the duration of surgery was 89 ± 30 minutes (mean \pm standard deviation). In the PACU, 10 patients (31.3%) complained of shoulder pain (VAS score ≥ 6), 4 patients (12.5%) complained of incision pain, and 2 patients (6.3%) had both shoulder and incision pain. The shoulder pain was described similarly by all the patients, being located ipsilateral to the operated side, around the joint and diffuse. All 16 patients received an additional bolus dose of 5 mL of lidocaine 2% epidurally. Only incision pain was improved (VAS score ≤ 3). Shoulder pain persisted. One hundred milligrams of indomethacin was then administered rectally, and substantial pain relief was achieved in all 12 patients (VAS score ≤ 3) within 20 minutes. Distribution of patients who suffered shoulder pain according to the type of surgery is detailed in Table 2. No correlation was found between shoulder pain and any of the following parameters: patient's age, sex, ASA score, type or site of surgery, duration of surgery, duration of anesthesia, and the use of thoracostomy tubes.

DISCUSSION

The appropriate treatment for post-thoracotomy shoulder pain is debatable. One report suggests that stellate ganglion block might be a possible effective treatment.⁴ Another describes brachial plexus block⁵ or phrenic nerve infiltration³ as

Table 1. Patients Characteristics

Patients Characteristic	Number of Patients
Sex: female/male	11/21
ASA I	7
ASA II	15
ASA III	10
Age (years)	59 (± 17)*

Abbreviation: ASA, American Society of Anesthesiologists.

*Data are expressed as mean (\pm standard deviation).

Table 2. Number of Patients Complaining of Shoulder Pain, Divided by The type of Operation

Type of Operation	Number of Patients	Number of Patients Suffering Shoulder Pain (%)
Lobectomy	10	5 (50)
Pneumonectomy	4	1 (25)
Wedge resection	11	2 (18)
Pleurodesis	7	2 (28)

an option. In this study, a bolus dose of local anesthetic in the epidural catheter was ineffective for the shoulder pain, although highly effective for incision pain. Shoulder pain was relieved only after rectal administration of the NSAID indomethacin. This beneficial effect of NSAID has been previously reported⁷ and may indicate that an inflammatory process is involved. The question of the use of NSAID in dehydrated patients, as those who are undergoing thoracic surgery, is debated. Another option for the management of post-thoracotomy pain is the use of opioids. However, opioids are respiratory depressants and should be given with caution in patients after a lung operation that ends with reduced pulmonary reserve, especially in those patients who suffer from chronic obstructive pulmonary disease.^{8,9} Thus, an effective and safe solution for the management of post-thoracotomy shoulder pain is still lacking.

This study was unable to find a predictor for the pain. The results do not support the hypothesis that shoulder pain is a result of transection of a major bronchus.² Duration of the surgery was raised as a factor contributing to shoulder pain.¹⁰ The authors of that letter proposed that longer operations are associated with a higher incidence of non-incisional postoperative pain. The results of the present study do not substantiate such a connection. The possible association between lateral decubitus position and shoulder pain was previously described.¹¹ Because all patients in this study had their surgery in the lateral decubitus position, this possible association cannot be documented. There is a correlation between the surgical technique and postoperative pain.^{12,13} An extensive (open) surgery is more painful than video-assisted thoracic surgery. In this study, the technique was standard (open) and the operating team was the same in all cases. Therefore, the impact of surgery extent could not be derived. It is reasonable to assume that the previously mentioned factors may contribute to the post-thoracotomy shoulder pain, but their relative importance is yet unknown.

The major limitation of this study is the lack of comparison to a study group who received a different treatment; thus, the authors cannot state definitively the most effective management of post-thoracotomy shoulder pain. However, NSAIDs appeared to be quite effective. The literature in this field is very limited, providing partial solutions. Further clinical research is needed to clarify the pathophysiology and improve the management of post-thoracotomy shoulder pain.

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