

# A Prospective Randomized Study on the Efficacy of Interpleural Analgesia in Reducing Post Operative Pain and Parenteral Analgesic Requirement in Patients Undergoing Upper Abdominal Surgery

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## Abstract

**Introduction:** Administration of local anesthetics into the pleural space provides rapid onset and long duration of analgesia upper abdomen surgeries without respiratory depression as seen with opioids. In this study we attempt to find the efficacy of interpleural analgesia in reducing post operative pain and parenteral analgesic requirement in patients undergoing upper abdominal surgery. **Aim:** To analyze the efficacy of interpleural analgesia in reducing post operative pain and parenteral analgesic requirement in patients undergoing upper abdominal surgery. **Materials and Methods:** After ethics committee approval and written informed consent 36 patients undergoing elective upper abdominal surgeries were selected randomly based on computer generated random numbers. General anaesthesia administered as per routine in our hospital. When the surgery was over the patients divided into two treatment groups of 18 patients. 1. Pleural analgesia (bupivacaine) combined with Parenteral analgesics (Pentazocine). Forty milliliters of Injection bupivacaine 0.25% via intrapleural catheter. 2. Parenteral analgesics alone. (Pentazocine). **Results:** Consumption of pentazocine were higher in control group than in pleural group, for Day 1 ( $P < 0.001$ ), Day 2 ( $P < 0.01$ ) and Day 1 + 2 ( $P < 0.001$ ) Mean pain scores were significantly reduced 30 min after IP instillation of bupivacaine 0.25 % compared to control group. **Conclusion:** It is concluded from this study that intermittent interpleural analgesia with bupivacaine was more effective than intermittent intramuscular administration of pentazocine alone.

**Keywords:** Intrapleural Analgesia; Pentazocine; Bupivacaine; Upper Abdominal Surgeries.

## Introduction

Surgical incision involving the upper abdomen decreases the diaphragmatic function resulting in reduced pulmonary compliance, muscle splinting, inability to breathe deeply or cough forcefully and in some cases may even cause hypoxemia and hypercarbia. The administration of local anesthetics into the pleural space provides rapid onset and long duration of analgesia without respiratory depression as seen with parenteral opioids. This study is chosen to investigate the efficacy of interpleural analgesia in treating postoperative pain in upper abdominal surgeries in comparison with parenteral opioids.

## Aim of the Study

This study intends to prospectively analyze the efficacy of interpleural analgesia in reducing post operative pain and parenteral analgesic requirement in patients undergoing upper abdominal surgery.

## Patients and Methods

After approval from local ethics committee and written informed consent 36 patients undergoing elective upper abdominal surgeries like open cholecystectomy, nephrectomy, pyelolithotomy and pyeloplasty at Government General Hospital, Chennai were enrolled in the study. The inclusion

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criteria were age 19 to 65 years ASA physical status 1 & 2 with no contraindications for the technique and drugs. These include pleural injury, pleural adhesion, fibrosis or effusion, COPD, local infection, bleeding diathesis and allergy to study drugs. The linear visual analog scales (VAS) were explained to the patients prior to the study.

Patients were premedicated with Inj glycopyrrolate 0.2mg and Inj fentanyl 100 micrograms IV just before induction. Patients were induced with Inj propofol 2mg /Kg, Inj Suxamethonium 100mg IV and intubated one minute later with appropriate size endotracheal tube orally. The anaesthesia was maintained with nitrous oxide -oxygen mixture 3:2, muscle relaxant Inj Vecuronium, Volatile agents.

When the surgery was over the patients were randomly assigned to two treatment groups of 18 patients in each.

1. Pleural analgesia (bupivacaine) combined with Parenteral analgesics (Pentazocine).
2. Parenteral analgesics alone. (Pentazocine)

In patient assigned in pleural group the catheter was inserted unilaterally on the side of incision. The patients were positioned laterally with operative site up and pleural catheter was inserted at the sixth intercostals space in the posterior axillary line just before anaesthesia was discontinued during spontaneous ventilation. Intercostal drainage tube was kept ready throughout the study period to manage any untoward pneumothorax occurrence..

Under aseptic precautions the 17G Tuohy needle loaded with 5ml syringe containing normal saline introduced in the sixth intercostal space and then walked off the superior edge of the rib . The loss of resistance to saline technique was used to identify the entry in to the pleural cavity. The catheter was then advanced posterosuperiorly past the tip of the needle and fixed in position close to the paravertebral space and the needle is withdrawn. Forty milliliters of Injection bupivacaine 0.25%, was injected through catheter after negative aspiration for blood. Patient was turned supine and after reversal extubated.

In patients in control group no analgesics were given before extubation.

One hour after extubation and every 6 hrs thereafter in both the groups pain was recorded using Visual analog scale (VAS). The patients were given pain relief medication on demand. In the control group patients were given Inj Pentazocine 30 mg intramuscularly. In the pleural group break through pain was treated similarly. Postoperatively,

one hour after pleural puncture chest radiograph was obtained for detection of a possible pneumothorax in pleural group. Pain was evaluated with a 10 cm VAS in both the groups. Patients were continuously monitored with ECG. Blood pressure and heart rate were recorded noninvasively every 5 minutes up to 30 minutes after the bolus in both groups. The total parenteral analgesic requirement in the initial 48 hrs postoperative period was recorded. The study was stopped after 48 hours because of concerns of the interpleural catheter displacement following mobilization of the patient and fear of catheter-related infection.

#### *Statistical Analysis*

Student t test was used to compare the pentazocine requirement and VAS scores between the pleural and control groups.

Data was analyzed with SPSS software.

Data are presented as means±SD. The P values were provided to indicate statistical significance. P < 0.05 was considered as significant.

#### **Results**

One patient was excluded from the study due to aspiration of blood in the pleural catheter. Demographic data were similar in both the groups. Mean age was 40.7yrs ± 11.30 (21 to 56 yrs) in pleural group and 44.6 yrs ± 11.9 (18 to 65 yrs) in control group. No episodes of hypotension or bradycardia were noted. Neither pneumothorax nor CNS (central nervous system) toxic reactions (tremor, perioral numbness, muscle twitches, metallic taste, and tinnitus convulsions) were noted. The catheter insertion using loss of resistance technique described above was easy to identify the pleural space and effective.

Consumption of pentazocine were higher in control group than in pleural group, for Day 1 (P < 0.001), Day 2 (P < 0.01) and Day 1 + 2 (P < 0.001) and was significant. It was found that difference was more significant on Day 1. Patients of control group received a mean dose of 114.9±20.7 mg of pentazocine in the first 48 hrs postoperatively in contrast to pleural group which received mean dose of 61.6±8.7 mgs.

Mean pain scores were significantly reduced 30 min after IP instillation of bupivacaine 0.25% compared to control group. The mean pain score of the pleural group is 2.96±0.72 and mean pain score

of the control group is  $6.04 \pm 1.30$  for 48 hrs. There was significant difference between the groups when comparing mean pain scores ( $P < 0.001$ ). When VAS scores were analyzed at each time point recorded showed significant difference between the groups

at any time of measurement. Visual analogue scale (VAS) pain score versus time in patients assigned to pleural bupivacaine (=) or control group (+). Data are presented as mean  $\pm$  SD.

**Table 1:** Patient characteristics

	Pleural Group (18)	Control Group (18)
Age(yr)	$40.7 \pm 11.3$	$44.2 \pm 11.9$
Sex(male/female)	5/12	10/8
Weight(Kg)	$55.4 \pm 5.9$	$57 \pm 6.8$

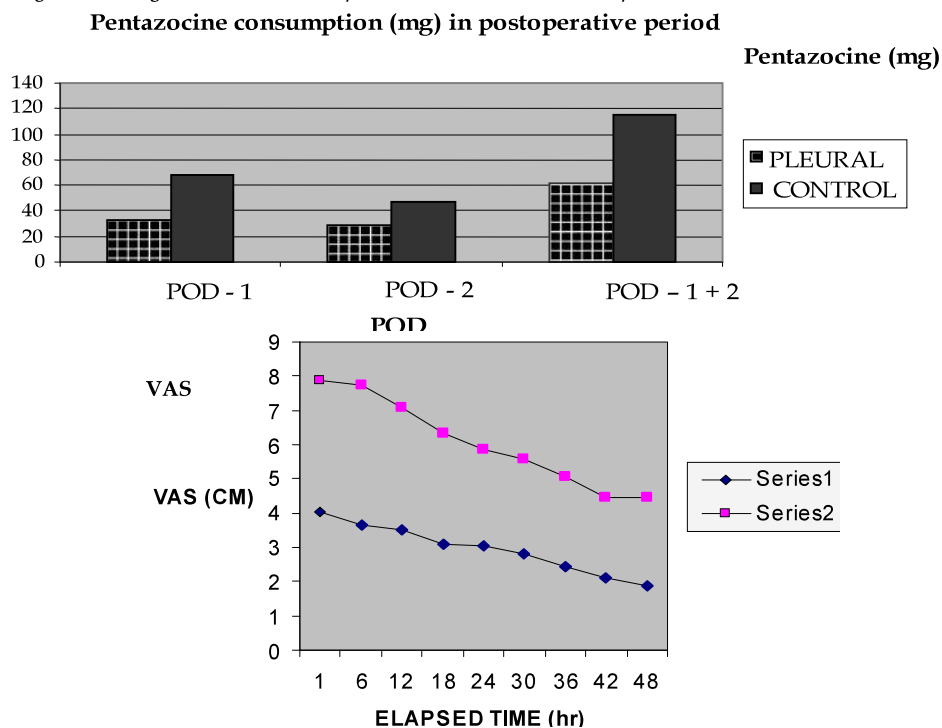
**Table 2:** Pentazocine consumption (mg) in the two groups recorded at Days 1 And 2 postoperatively and during whole study period (Day 1 + Day 2)

Group	Day1	Day 2	Day1+ 2
Pleural	$33.3 \pm 9.7$	$28.3 \pm 7.0$	$61.6 \pm 8.7$
Control	$68.3 \pm 13.8$	$46.6 \pm 21.1$	$114.9 \pm 20.7$
P Value	$< 0.001$	$< 0.01$	$< 0.001$

**Table 3:** Pain scores

Time	Interpleural Pain score	Control Pain score	P Value
1 Hour	$4.0 \pm 1.2$	$7.8 \pm 0.7$	$< 0.001$
6 Hour	$3.6 \pm 0.8$	$7.7 \pm 0.7$	$< 0.001$
12 Hour	$3.5 \pm 1.0$	$7.0 \pm 1.0$	$< 0.001$
18 Hour	$3.1 \pm 1.3$	$6.3 \pm 1.0$	$< 0.001$
24 Hour	$3.0 \pm 1.4$	$5.8 \pm 1.3$	$< 0.001$
30 Hour	$2.8 \pm 1.4$	$5.5 \pm 1.2$	$< 0.001$
36 Hour	$2.4 \pm 1.1$	$5.0 \pm 1.2$	$< 0.001$
42 Hour	$2.1 \pm 1.2$	$4.4 \pm 1.2$	$< 0.001$
48 Hour	$1.8 \pm 1.1$	$4.4 \pm 1.1$	$< 0.001$
Total(48 hrs)	$2.96 \pm 0.72$	$6.04 \pm 1.30$	$< 0.001$

*Bar Diagram Showing Pentazocine Consumption in Pleural & Control Group*



## Discussion

The Aim of postoperative pain management is to provide good subjective comfort and to contribute to early recovery and a good outcome after surgery.

In this prospective study we have investigated the efficacy of intermittent boluses of intrapleural bupivacaine compared to intramuscular pentazocine with regard to postoperative pain relief. Many clinicians avoid the closed chest technique for the placement of an interpleural catheter because of the high incidence of pneumothorax [3]. Using our technique, pneumothorax was not seen in our patients as determined by chest x-ray in the recovery room. We used a syringe filled with saline and a Touhy needle instead of a lubricated glass syringe to locate the interpleural space. This may eliminate false negatives caused by sticking between the piston and the syringe wall and thus prevent the needle from being accidentally advanced too far into the thoracic cavity. Our technique is equally effective as the balloon method and it was easy to identify the pleural space.

We used pentazocine for comparison with interpleural bupivacaine because it has less propensity for causing spasm of sphincter of Oddi.

The intramuscular route was chosen because of the simplicity of administration by nurses in the post operative ward.

Nevertheless, the use of interpleural local anesthetics is not devoid of side effects that include pneumothorax ( most common ), systemic toxicity of local anesthetics, pleural effusion, Horner's syndrome, pleural infections, catheter rupture, and temporary phrenic nerve palsy [16,17]. No such complications were recorded in our patients. Pneumothorax and phrenic nerve palsy were excluded in our patients by chest X-rays. Furthermore, the use of a diluted local anesthetic solution decreased the propensity for phrenic nerve palsy and toxic reactions.

Parenteral opioids are similarly associated with risks, especially ventilatory depression and cognitive impairment that may restrict early postoperative ambulation. There is significant opioid sparing benefit by the interpleural analgesia.

We have chosen 40 ml of 0.25% bupivacaine every 6 hrs because this dose is unlikely to be associated with toxic plasma concentration [18].

In fact, postoperative alpha 1-acid-glycoprotein increases, leading to an increase in protein binding

of local anesthetics and to a reduction of free-fraction, thus diminishing the risk of potential central nervous system toxicity [19]. Moreover, Scott [20] suggests that the absolute toxic plasma concentration may be more dependent on the rate of increase of the concentration than on any exact concentration of bupivacaine. Von Kleef et al also found no difference between the use of 0.5% and 0.25% bupivacaine for interpleural analgesia [21]. We used 0.25% bupivacaine which produced effective analgesia.

The quality of analgesia obtained in our study is consistent with that reported by others [2,3,4].

The results of this study demonstrate the effective analgesia obtained in the immediate postoperative period by the injection of interpleural bupivacaine after upper abdominal surgery.

## Conclusion

It is concluded from this study that intermittent interpleural analgesia with bupivacaine was more effective than intermittent intramuscular administration of pentazocine alone, in reducing the severity of pain after upper abdominal surgery up to 48 hours postoperatively and can be recommended for sufficient pain control.

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*Conflict of Interest:* Nil

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