

**OPEN INTRAOPERATIVE RETROPLEURAL PERINEURAL INJECTION OF
BUPIVACAINE FOR POST OPERATIVE PAIN MANAGEMENT IN THORACIC
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ABSTRACT

Total 27 cases of pulmonary and pleural pathology were selected and were subjected to surgery by open thoracotomy method, which requires greater exposure for approach to the pathology. It is therefore achieved by a large incision on the thorax maybe by intercostal approach or by rib resection. A drug was selected and after the completion of the procedure was injected retropleurally perineurally, along the site of the incision taking care not to inject in the blood vessel. After completion of the surgery, injection bupivacaine was administered as per the procedure laid down and the patient was assessed for the effect of the analgesia. After surgery, patient was shifted to the intensive care unit for pain management and it is observed that the patient has complete analgesia and promotes deep respiration and limits the blood loss and the air entry improved. Follow up was done by a continuous monitoring for pain. The patient was shifted to the ward after all the parameters stabilised. So, bupivacaine is a drug which requires a smaller dose and delivers maximum effect. Patient was discharged on the tenth day depending upon their recovery without any functional incapacitation.

KEYWORDS: Bupivacaine, Perineural injection, Thoracotomy.**BACKGROUND**

Open Thoracic surgery leads to severe post-operative pain which is quite intense and therefore it needs adequate dose of drug or even more analgesics. So now a days, epidural analgesia has been the gold standard.^[1] Apart from its less duration of analgesia it has also been associated with an unwanted episodes like hypotension and urinary retention.

Recently, availability of lysosomal bupivacaine formation stimulated us to use multi variable intercostal nerve block (iv) to be injected during open thoracotomy.^[2] More stress is put on how is the patient's reaction in comparison to other analgesics.^[3]

Complications occurred with epidural anaesthesia as reported by R.G. Davies i.e. urinary retention OR 0.23, nausea, vomiting OR 0.47, hypotension OR 0.23.^[6]

Pain relief depends on area of its origin. For large tumours the surgeon needs long incision for extensive

retraction of the ribs of the chest. While doing so, following effects can occur.^[4]

- 1) In rigid chest, on forceable retraction for want of space can lead to fracture of the ribs.
- 2) The intercostal muscles are torn or cut.
- 3) Costochondral junction and costovertebral region is also extensively stretched which leads to myotendinous injury to the chest wall.
- 4) In addition, poor pain control leads to pneumonitis, pneumonia, extensive itching, nausea, rarely septic complications.

In this study, the author has a vast experience of operating difficult thoracotomy cases. The author has performed thoracotomy in various government and private medical colleges for cases like decortication, lobectomy, pneumonectomy, and various surgical tumours since 1977. Thus, this study is being presented to show the efficacy of bupivacaine when used intra-operatively which aids in post-operative analgesia.

Bupivacaine is a long acting anaesthetic agent and is injected in various sites including regional block, abdomen or fracture thoracic rib and nerve block.

Special precautions

Bupivacaine is known to block conduction arising from periphery.^[5]

It can cause:

- Hepatic dysfunction, Shock, Heart disease.
- Person using bupivacaine should go through Department of Health Research Govt of India (DHR).
- Pharmacological laboratory for cardiac medicine.

Dose of Bupivacaine

- Half-life of bupivacaine is 3-5 hours(adult) and 8.1 hours in neonates.
- IV lipid injection can be effective in treating cardiac toxicity due to bupivacaine overdose.
- Bupivacaine is unsuitable for intravenous anaesthesia.

The maximum cumulative safe dose for adult and children is 0.25% solution of bupivacaine.^[9] Smaller doses can be administered regularly in the elderly, epileptic and acutely ill patients. Children below 12 year should not be given bupivacaine. The effect of bupivacaine is operating surgeon dependent. Maximum permissible dose is 3 mg/kg body weight and the duration of action is 7.5 to 8 hours (reference- American society of anaesthesiology).

Anaesthetic Procedure	Concentration
Intercostal Infiltration Bupivacaine	0.5 %, 20mL SOLUTION- 100 mg
Intercostal Infiltration Bupivacaine	0.25%, 40 mL solution- 40mg

Mechanism of action

Bupivacaine binds to the intracellular voltage gated sodium channels and blocks sodium influx into the nerve cells which prevents depolarization and blocks the generation and conduction of nerve impulses.^[7]

Analgesic effect of Bupivacaine

Analgesic effect is due to binding of prostaglandins to E2 receptor which inhibits prostaglandins.^[8] 95% of these binds to plasma which crosses the placental barrier and the other areas of perfusion include liver, lung and the brain.

Metabolism

It is metabolised in liver via conjugation with glucuronic acid and excreted through urine.^[10]

Side effect

Side effects are
Dizziness
Restlessness

Hypersensitivity
Prolonged blocks
Hypertension
Arrhythmias
Bradycardia
Cardiac arrest
Respiratory failure

Patient selection

Patients were scrutinised and the patients with these criteria were not selected for the study-

1. Patient is a known /suspected hypersensitivity to bupivacaine.
2. Concomitant anticoagulant or abnormal bleeding tendency.
3. Severe anaemia or heart disease/ liver disease.
4. Patients who were dehydrated or hypovolemic.

MATERIAL AND METHODS

Since the drug requirement is less and there being a number of complications, the drug needs to be injected cautiously at an appropriate place by a learned person, without injecting into the blood vessel⁽¹¹⁾. Therefore, it is to be injected perineurally, precisely near the costovertebral junction, retro-pleurally without injuring the blood vessel.

Procedure

Needle of 20 G is taken with 10cc syringe filled with 0.5% bupivacaine and needle is bent at 45 degree with the bevel facing the surgeon. We aspirate and assure that there is no blood in syringe and we push 1 ml each of 0.5 % bupivacaine retropleurally around the intercostal nerve at costovertebral junction one intercostal space above and one intercostal space below with a 10 ml syringe (2.5 % solution- a total of 20 ml is injected along the nerve with normal saline). A bleb is raised which runs along the nerve and the syringe is taken out. Remaining solution can be injected around the chest intercostal drainage underwater seal tube, at 4mg/kg body weight. In addition, these patients were also put on epidural analgesia if required, in case this injection fails, a possibility which is very rare as the injection is administered under vision.



Fig. 1: Syringe filled with the drug and the needle is bent at 45 degrees.



Fig. 2: Perineural injection around the intercostal nerve is being given so as to raise a bleb retropleurally.

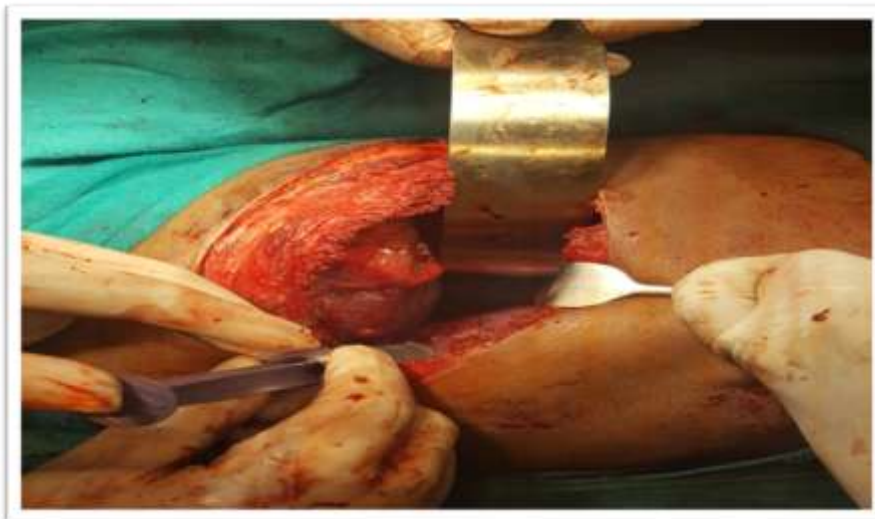


Fig. 3: Thorax is opened, nerves are being located and injected retropleurally. Photo from personal operation by the author.



Fig. 4: Open Thoracotomy.

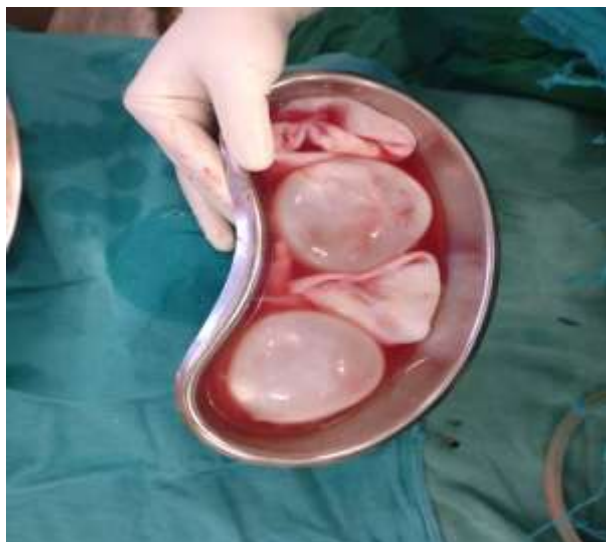


Fig. 5: Hydatid cysts from the right lung removed by open thoracotomy.

Contraindication

1. Patient is a known /suspected hypersensitivity to bupivacaine.
2. Concomitant anticoagulant or abnormal bleeding tendency.
3. Severe anaemia or heart disease/ hepatic dysfunction.
4. Spinal or epidural anaesthesia should never be administered to dehydrated and hypovolemic patient.

RESULT

A total of 27 patients undergoing thoracotomy conducted personally by the author and published in an international journal of surgery (EJBPS- YEAR 2017, VOLUME 4, ISSUE 8, 797- 799) [4], were included in this study. 60% of the patients were relieved of major pain by injecting bupivacaine, 10% needed tramadol, rest needed analgesia only for 24-48 hours (seen in personally operated cases). Patient became ambulatory and patient could be discharged at the earliest in bupivacaine injection case.

Result of this single dose bupivacaine in open thoracic analgesia perineural retro pleural injection gave excellent results with minimal complication/no complication.

DISCUSSION

While doing thoracotomy, it was noted that there is extensive opening of the chest wall to permit the operative procedure, and, while doing so, the intercostal muscles are sharply cut and the muscles at the costochondral junction are forcibly retracted due to excessive movement of the costovertebral and costochondral junction, which would lead to post thoracotomy pain. It was further observed that there are multiple sites of pain in the post-operative phase such as the costochondral and costovertebral junction, accidentally broken ribs, sites of fluid infusion, sites of venesection, infection site sepsis and thrombosed veins.

Bupivacaine is a long acting local anaesthetic agent. It blocks initiation and transmission of nerve impulse at the site of application by stabilising neuronal membrane and the compound is ultimately metabolised in the liver depending upon site of injection and concentration used.^[12] Anaesthesia usually lasts for 2-4 hours. It is unsuitable for intravenous regional anaesthesia or for local application.

Over dosage

Accidental intravenous injection is characterised by a systemic effect of dizziness, blurring of vision, restlessness, tremors and occasionally convulsions. They are rapidly followed by drowsiness, unconsciousness, respiratory failure, myocardial depression and hypertension resulting in hypoxia, acidosis, heart block and cardiac arrest. In such condition drugs like diazepam and thiopental sodium with maintenance of clear airway is required. Lipid emulsion can be effective in treating cardiac toxicity due to bupivacaine overdose.

Storage

Injection should be stored and protected from light but should not be allowed to be freeze.

CONCLUSION

Bupivacaine is a long acting analgesic which remains for a long time in the perineural space of intercostal nerves, thus improving the analgesia. This leads to increased chest compliance and adequate oxygenation⁽¹³⁾. The complications of epidural analgesia are in form of retention of urine and others. Bupivacaine has become the drug of choice for thoracic surgeries as it is used in small doses which gives maximum effect and the required analgesia, provided it is given in right doses by the right person in the procedure described above and with proper precautions⁽¹⁴⁾. Results are better by injection into perineural retro pleural thoracic nerve block. Post operatively, it produces analgesia, thus reducing the need of additional analgesics. Perineural retro pleural injection of Bupivacaine can be suitable as an alternative to thoracic epidural anaesthesia

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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Caution - Direct injection into the vein can have serious complication and must be avoided. Once the needle is pricked aspiration should be done to ensure that it has not entered the vessel.

Note - Study has been done to have a supplementary/major role in production of analgesia in post thoracotomy pain.

The project is still being continued by the author, to study the comparative effects of bupivacaine and other analgesics.

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