ORIGINAL ARTICLE

# Attenuation of Hemodynamic Responses During Open Cholecystectomy with Interpleural Block in Controlled Hypertensive Patients

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**Abstract**

Sixty Controlled hypertensive patients undergoing elective open cholecystectomy under general anesthesia with and without inter pleural block were studied with regard to attenuation of intraoperative hemodynamic responses associated with surgical handling of gall bladder and duration of post-operative analgesia. They were divided into two groups. Group I comprising of 30 patients received inter pleural blockade with 0.4 ml/kg of 0.5% bupivacaine after induction of anesthesia but prior to surgical incision. Group II comprising of 30 patients did not receive inter pleural block. Intra-operative parameters that are heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and O2 saturation were noticed at the interval of 5 minutes starting from the induction till the end of surgery. Pre-induction heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure were comparable in both the groups. After administration of interpleural block after induction of general anesthesia in group I patients, heart rate, systolic, diastolic & mean arterial pressure were in acceptable range as compared to group II patients. Mean duration of analgesia in group I patients was 3.7±0.5 hours whereas patients in group II asked for analgesia immediately after emergence from anesthesia. No adverse effect like pneumothorax or systemic toxicity of bupivacaine occurred.

**Key Words**

Hemodynamics, Hypertensive, Open cholecystecetomy, Intrapleural block

## Introduction

Surgery evokes a series of well characterized changes in hormonal secretion and substrate mobilization commonly referred to as stress response to surgery (1). There is abundant evidence that both innocuous and noxious stimulation of peripheral somatic and visceral sensory afferent nerve endings can elicit reflex responses as occurs during surgery. Many of these, but specially those arising from visceral C fibers evoke powerful stimulation of sympathetic nervous activity which results in hemodynamic changes normally detected during anesthesia i.e. tachycardia, hypertension, sweating and skin pallor (2). Similarly a variation in hemodynamic parameters is observed when gall bladder is manipulated & is under traction during open cholecystectomy. These changes are more marked in an already stressed hypertensive patients and can be responsible for various cardiovascular and CNS insults perioperatively. Deliberate preventions and attenuation of these hemodynamic changes may reduce perioperative mortality and morbidity (3).Various measures have been used to attenuate the hemodynamic responses associated with surgical stimulus:

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- Deepening level of anesthesia with higher concentration of inhalational and intravenous anesthetics
- High dose of opioids.
- Antihypertensive therapy
- Regional or local neural blockade (intercostal, paravertebral & interpleural blockade.

Interpleural regional analgesia is the percutaneous introduction of the local anesthetics into the thoracic cage between parietal & visceral pleura. A unilateral analgesia is obtained by a rapid onset, but not sufficient enough for surgical procedure. No significant hemodynamic adverse effect is reported & ventilatory function is rather improved. Preoperative interpleural block reduced the hemodynamic response to surgery and intra operative anesthetic and analgesic requirements (4).

The objective of the present study was to determine the efficiency of interpleural block in attenuating the hemodynamic responses associated with surgical stimulus to the gall bladder & to ascertain the duration of postoperative pain relief in controlled hypertensive patients undergoing open cholecystectomy under general anesthesia.

**Maaterial and Methods**

After approval by hospital ethics committee, Place of STUDY, Year of Study, and written informed consent from the patients, a prospective study was conducted in 60 controlled hypertensive adults of either sex (ASA II-III) scheduled for elective open cholecystectomy (subcostal incision). Patients with a history of respiratory disease, traumatic or spontaneous hemothorax, pleuritis, bleeding disorder, and history of aspirin ingestion in previous week, chest deformity or allergy to local anesthetics were excluded from the study. The patients were randomly assigned to two groups of 30 patients each. Group I received inter pleural block on right side with 0.4 ml /kg of O.5% bupivacaine after induction of anesthesia but prior to surgical incision. Group II did not receive inter pleural block.

Patients were prepared by overnight fasting and were premedicated with Alprazolam 0.25 mg orally at bed time. Antihypertensive medication was continued till morning of surgery. After recording the baseline parameters, anesthesia was induced with intravenous thiopentone sodium and intubation facilitated with vecuronium 0.08mg/kg. Tramazac 1 mg / kg was given for analgesia in each group. After induction, patients in group I received interpleural block with 0.4 mg/kg of 0.5% bupivacaine in 7th intercostal space in midaxillary line. An 18 gauge Tuohy needle was inserted in 7th space on right side immediately above the rib. A 10 ml glass syringe was connected to tuohy needle. Loss of resistance was elicited. The endotracheal tube was disconnected during insertion of the needle and injection of the study drug solution after negative aspiration. Bilateral air entry was ascertained to rule out pneumothorax. Anesthesia was maintained with halothane & nitrous oxide 67% in oxygen. Neuromuscular blockage was achieved by vecuronium. Intraoperative increase in blood pressure greater than 20% of base line was managed by increasing the concentration of halothane. If blood pressure was still not controlled satisfactorily; intermittent bolus dose of nitroglycerine in a dose of 1 µg/kg was used. At the end of surgery, residual neuromuscular block was reversed with neostigmine 0.05 mg / kg & glycopyrollate 0.4 mg. The following parameters were recorded by an anesthetist who was blinded to the group to which patients belonged every 5 minutes after induction of anesthesia till surgery: heart rate, blood pressure (systolic, diastolic & mean). ECG & O2 saturation were monitored continuously. The duration of surgery and gall bladder handling were recorded in both the groups. Concentration of halothane and number of doses of intermittent nitroglycerine required to keep the patient hemodynamically stable intra-operatively were recorded.

In the recovery room, heart rate, blood pressures were recoded every thirty minutes. Duration of analgesia was ascertained from the completion of surgery to when patients demanded for analgesia. Injection diclofenac sodium 1 mg / kg was given. Chest X-ray was done in the ward with in 24 hrs to exclude pneumothorax.

Statistical evaluation of results obtained was done using t-test.

*Table.1 Patient Characteristics ( Mean + SD )*

| | Group I | Group II |
|---|---|---|
| **Age (years)** | 54.3± 4.82 | 58.6± 5.2 |
| **Weight (kgs)** | 62.43± 3.62 | 64.36± 5.30 |
| **Sex (M/F)** | 2/28 | 2/28 |
| **Duration of surgery (min)** | 57.73± 2.42 | 59.23± 2.83 |
| **Duration of gall bladder handling (min)** | 30.36± 2.79 | 28.6± 3.02 |
| **Pre-induction heart rate (beats/min)** | 92.83± 4.58 | 90.26± 5.79 |
| **Pre-induction mean systolic blood pressure (mmHg)** | 148.13± 4.03 | 147.46± 5.35 |
| **Pre-induction mean diastolic blood pressure (mmHg)** | 92.86± 5.83 | 92.53± 2.62 |

*Table.2 Intraoperative Hemodynamic Variables ( Mean + SD )*

| | Group I | Group II | P Value |
|---|---|---|---|
| **Highest Mean Heart rate (beats/min)** | 89.60±4.78 | 101.93±10.61 | < 0.0001 |
| **Highest Mean Systolic Blood pressure (mm Hg)** | 139.2±6.81 | 163.26±10.37 | <0.0001 |
| **Highest Mean Diastolic blood pressure (mm Hg)** | 89.73±4.62 | 107.06±8.67 | <0.0001 |
| **Highest Mean Mean arterial pressure (mm Hg)** | 91.36±3.37 | 116.03±10.54 | <0.0001 |
| **Duration of Analgesia (hours)** | 3.7±0.5 | Nil | |

## Results

There were thirty patients in each group and the demographic profiles in both the groups were comparable.

There was no significant difference in antihypertensive medication profile in both the groups and the preoperative hemodynamic parameters were comparable. There was no significant difference in duration of gall bladder handling or duration of surgery in both the groups. (*Table I*) No significant difference was observed in heart rate, systolic blood pressure, diastolic blood pressure & mean blood pressure recorded after induction of anesthesia (prior to interpleural block) in the two groups.

Intra-operatively, significant difference in heart rate was observed in the two groups. In group I patients highest mean heart rate was 89.60±4.78 which was significantly lower than in group II 101.93±10.61; p<0.0001. In group I, the highest mean systolic blood pressure achieved was 139.2 ± 6.81 mm Hg and highest mean diastolic pressure was 89.73±4.62 which were significantly lower than that seen in group II 163.26 ± 10.37 (P<0.0001) and 107.06 ± 8.67 (P<0.0001) respectively. Similarly the highest mean arterial pressure was significantly lower in group I patients 91.36 ± 3.37 compared to group II patients 116.03 ±10.54 (p<0.0001). The duration of post operative analgesia was 3.7±0.5 hours in group I whereas in group II patients asked for analgesia immediately after emergence from anesthesia. (*Table-2*)

## Discussion

Afferent nerve impulses arising from the site of physical trauma (5) and hypothalamic activities (6) have been reported to be responsible for neurohormonal perturbations. Preoperative neurohormonal responses typically arise after the start of surgical intervention, but in humans, increases in heart rates, blood pressure and plasma catecholamine & cortisol concentrations have also been recorded in relation to induction of anesthesia and

before skin incision. These changes are mild and relatively innocuous in the healthy normotensive patients, but can be marked and detrimental in the hypertensive patient (3). Hypertensive patients have an exaggerated response to many forms of stress, both in conscious state and during anesthesia. It is a well known acknowledged fact that patients with cardiac disease in general and hypertension in particular, have proved to be poor operative risk. The operative risk increases with the severity of the disease and the magnitude of the surgical procedure. Suitable preoperative treatment and appropriate perioperative management including a safe anesthetic technique can greatly reduce the risk.

Conventionally hypertension developing in the intraoperative period is managed by increasing the concentration of inhalation agents; use of calcium channel blockers, beta blockers, nitroglycerin, sodium nitroprusside or high doses of opioids. Use of inhalation agents like halothane sensitizes the myocardium to catecholamine. Increasing the concentration of isoflurane decreased the prestimulation arterial pressure and increased heart rate, but it did not show a concentration dependent suppression of hemodynamic response to noxious stimulation (2). The use of opioids to attenuate the catabolic hormonal response may result in unacceptable ventilatory depression several hours post operatively (7).

Regional or local neural blockade with local anesthetics alone or in combination with general anesthesia can be employed to suppress physiological responses to noxious stimulation totally or partially (2). Interpleural block, a recently devised method consists of injection of a local anesthetic into the pleural space. The areas covered by analgesia include thorax and upper part of abdomen. No hemodynamic adverse effects occur & ventilatory function is rather improved. The main mechanism of analgesia is probably a retrograde intercostal nerve blockade. Main indications of interpleural analgesia are cholecystectomy and thorax trauma patients. Adverse effects & hazards are uncommon and include mainly pneumothorax and toxic effects of local anesthetic overdose (8). In this study, it was observed that interpleural block with bupivacaine resulted in attenuation of hypertensive response to surgical stimulation of gallbladder. Preinduction heart rate, systolic, diastolic & mean arterial pressure was comparable in both the groups which increased significantly in both the groups after intubation. However, later in group I after administration of interpleural block, all patients had acceptable arterial blood pressure with halothane concentration of 0.5% & none of the patients required nitroglycerine bolus dose. In contrast almost all patients in group II suffered from hypertension and tachycardia especially after skin incision and during gallbladder traction which could not be managed with alteration of halothane concentration alone (mean halothane concentration 1.4) and required antihypertensive treatment with nitroglycerine. The efficacy of inter pleural catheter for perioperative pain management was studied by Shrestha BR *et al* (9) in 2003. They concluded that interpleural local anesthetic administration via catheter technique has been found excellent in various surgical procedures in upper abdomen in selected patients. It carries both the benefit of extending analgesia up to the post operative period via catheter and reducing pneumothorax in each individual. With proper technique risks can be minimized a lot. Their study was conducted on a 46 years old women who underwent cholecystectomy who was given preoperative block and who belonged to ASA-I, but in our study, controlled hypertensive patients belonging to ASA-II were studied and we concluded that interpleural block led to stable hemodynamics during surgery.

Similar results have been seen in other surgeries also. Crystal Z (10) in 1997 conducted a study to see analgesia in breast surgery with interpleural bupivacaine. A control group of 15 patients were given general anesthesia undergoing breast surgery. In 15 other patients, an inter pleural block was performed 20 minutes before induction of general anesthesia for per-emptive analgesia. They concluded that the combined technique was associated with significantly reduced preoperative opiate requirement with better emergence from anesthesia, fewer side effects, a prolonged pain free period and overall better

quality of post operative recovery. Similar results were seen in our study with attenuation hemodynamic responses and reduced analgesic requirement in post operative period. In our study the duration of post operative analgesia after interpleural block was 3.7±.5 hours. Average duration of post-operative analgesia with bupivacaine and adrenaline ranges between 5-8 hours but we have not used adrenaline as our study is conducted on hypertensive patients. That might has resulted in less duration of analgesia. Our results are consistent with results of Kastrissios *et al* (11) who compared the inter pleural bupivacine infusion with intravenous pethidine infusion after cholecystectomy and observed that former provided good post-operative pain relief following cholecystectomy. Similar results were obtained by Blake *et al* (12) following cholecystectomy & Frank ED *et al* (13) following cholecystectomy. Similar results are obtained by L. Weinberg *et al* (14) who compared the effect of interpleural block with intravenous morphine patient controlled analgesia in patients undergoing hepatic resection. Patients in the interpleural group were less sedated and none required treatment for respiratory depression as compared to patients in morphine group. They also had lower pain scores during movement in the first 24 hours. The exact mechanism of analgesia provided by interpleural block is not clear. It has been suggested that large solution diffuses from the pleural space through the parietal pleura and the innermost inter costal muscles to reach the inter costal space where blockade of intercostal nerves occur. The sympathetic chain which is separated from the pleural cavity only by the parietal pleura is also postulated to be the site of action (7). One of the potential adverse consequences of inter pleural block is the possible development of pneumothorax. An x-ray was done in group I patients in first 24 hours post operatively and none of the patients revealed pneumothorax. Morris C J *et al* (15) have performed interpleural blocks in more than 7000 patients, had 0% incidence of pneumothorax and consider it the ideal regional anesthetic technique for chest wall surgery. So, it is concluded that inter pleural block is simple and effective method to attenuate the adverse intra-operative hemodynamic changes associated with gall bladder manipulation in controlled hypertensive patients undergoing open cholecystectomy under general Anesthesia.

**References**


1. Hall GM, Desborough J P. Endocrine & Metabolic responses to surgery & injury- effect of anesthesia. International practice of anesthesia. First edition vol. 1 Prys -Roberts brown 1996; Vol 1.pp.1-11.
2. Prys-Roberts CA, Brown BR Jr. Philosophy of anesthesia: some definitions and a working hypothesis. International practice of anesthesia. 1st edition vol. 1. Prys -Roberts brown 1996.pp.9.
3. Kumar R, Prakash S, Gupta P, Gogia AR. Attenuation of hemodynamic responses during open cholecystectomy with interpleural block in controlled hypertensive patients. *J Anesthesia Clin pharmacol* 2005; 21(1): 39 -44.
4. Abdulatif M, al-Ghamdi A, Gyanji YA, *et al*. Can pre-emptive interpleural block reduce peri-operative anesthetic and analgesic requirements? *Reg Anesth* 1995; 20(4): 296-302.
5. Edgahl RH. Pituitary adrenal response following trauma to the isolated leg. Surgery 1959; 46(1): 1921.
6. Hume DM , Edgahl RH. The importance of brain in endocrine response to injury. Ann surg 1959; 150: 697 - 712.
7. Benjamin GC. Interpleural Regional Anesthesia. A*nesthesia & Analgesia* 1988; 67: 427 - 29.
8. Orliaguet G, Carli P. Interpleural analgesia. *Ann Fr Anesth Reannim* 1994; 13(2): 233 - 47.
9. Shreshtha BR, Tabadar S, Mahajan S, *et al*. Interpleural Catheter Technique for perioperative pain management. *Katmandu University Med J* 2003; 1(1): 46-47.
10. Crystal Z, Hatz Y. Analgesia in Breast surgery with inter pleural block. *Harefuat* 1997; 133 (10): 430 - 502.
11. Kastrissios H, Mogg G A, Triggs EJ, Higbie J W. Interpleural bupivacaine infusion compared with IV pethidine infusion after cholecystectomy. *Anesthesia Intensive Care* 1991; 19(4): 539 - 45.
12. Blake DW, Donnan G, Novella J. Interpleural administration of bupivacaine after cholecystectomy: a comparison with intercostal nerve block. *Anesth Intensive Care* 1989; 17(3): 269-74
13. Frank ED, Mc. Kay W, Rocco A, Crallo JP. Interpleural bupivacaine for post-operative analgesia following cholecystectomy: a randomized prospective study. *Reg Anesthesia* 1990; 15(1): 26-30.
14. Weinberg L, Scurrah N, Parker F, *et al*. Interpleural analgesia for attenuation of post operative pain after hepatic resection. *Anesthesia* 2010; 65: 721-8.
15. Morris CJ, Bunsell R. Interpleural blocks for chest wall surgery. *Anesthesia* 2014; 69(1): 85-6.