A COMPARATIVE STUDY BETWEEN THORACIC EPIDURAL ANAESTHESIA AND INTERCOSTAL NERVE BLOCK IN OPEN CHOLECYSTECTOMY UNDER GENERAL ANAESTHESIA IN RESPECT OF PERIOPERATIVE HAEMODYNAMIC RESPONSE AND ANALGESIA

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ABSTRACT

BACKGROUND

Open cholecystectomy is associated with major intraoperative haemodynamic alteration related to pain and increased perioperative opioid analgesic requirement.

Aims- Among the different multimodal analgesic technique, this study compares the effectiveness of thoracic epidural anaesthesia with intercostal nerve block in respect of perioperative haemodynamic response and analgesia.

Settings and Design- Prospective, randomised, single blind comparative clinical study.

MATERIALS AND METHODS

100 patients undergoing open cholecystectomy were randomly divided into one of the two groups containing 50 patients each. Group E received Thoracic Epidural Anaesthesia (T7 - T8) with Inj. Bupivacaine (0.25%) (1 mL/segment). Group I received intercostal nerve block (3rd - 6th ICS) with Inj. Bupivacaine (0.25%) (4 mL/space).

RESULTS

A greater perioperative haemodynamic stability and lesser perioperative analgesic requirement was noted in Group E in comparison to Group I. Hypotension was the only side effect noted in some patients of Group E.

CONCLUSION

Thoracic Epidural Anaesthesia is far more superior to Intercostal nerve block in respect to perioperative haemodynamic stability and analgesia. Initial hypotension is the only side effect seen in some patients with Thoracic Epidural Anaesthesia.

KEYWORDS

Thoracic Epidural, Intercostal Nerve Block, Open Cholecystectomy, Perioperative Haemodynamic Response, Perioperative Analgesia, Bupivacaine.

HOW TO CITE THIS ARTICLE: Roy A, Piplai G. A comparative study between thoracic epidural anaesthesia and intercostal nerve block in open cholecystectomy under general anaesthesia in respect of perioperative haemodynamic response and analgesia. J. Evolution Med. Dent. Sci. 2017;6(23):1920-1923, DOI: 10.14260/Jemds/2017/421

BACKGROUND

Open cholecystectomy still remains a more frequently performed procedure, but one of the major side effects is substantial impairment of pulmonary function after large subcostal upper abdominal incision. Marked diaphragmatic dysfunction occurs postoperatively caused by both reflex diaphragmatic changes and incisional pain. Inadequately relieved pain is deleterious and can lead to number of complications in the postoperative period like reduction of vital capacity and functional residual capacity to 20% - 40% of the preoperative value and may not return to normal until 2 - 3 days after surgery.

Perioperative analgesia has traditionally been provided by opioid analgesics. However, extensive use of opioids is associated with a variety of perioperative side effects such as ventilator depression (as already said), drowsiness, sedation, postoperative nausea and vomiting, pruritus, urinary retention, ileus that can delay hospital discharge.

Intraoperative use of large bolus doses or continuous infusion of potent opioid analgesic may actually increase postoperative pain as a result of their rapid elimination and/or development of acute tolerance.

As a result of better understanding of the mechanism and physiology of acute pain and nociceptors, the goal of a stress free anaesthesia with a minimal postoperative discomfort is sustainable. No single therapy can achieve this goal. Principles of multimodal strategy refer to simultaneous use of multiple analgesic methods or drugs, which decreases opioid consumption in the perioperative period. A multimodal approach deploys interventions such as local anaesthesia, an NSAID or an opioid so as to achieve combination analgesic effect. Neuraxial block like epidural anaesthesia can also be added to it. Therefore, anaesthesiologist and surgeon are increasingly turning to non-opioid analgesic technique as adjuvants for managing pain during the perioperative period.

Based on this idea of multimodal analgesia Dahl JB,¹ Rosenberg J, Dirkes WE et al in 1990 studied prevention of postoperative pain by balanced analgesia. Followed by this in 1991 Dahl JB,² Kehlet H did research work on non-steroidal anti-inflammatory drugs: rationale for use in severe post-operative pain. Further in 1983, a study was conducted on the effect of incisional infiltration of bupivacaine hydrochloride upon pulmonary functions, atelectasis and narcotic need following elective cholecystectomy by Patel JM,³ Lanzafame RJ, Williams JS, et al. In 1995 Abdulatif M⁴, al-Ghamdi A, Giamfi YA, el-Sanabary M, al-Metwally R. Studied

Financial or Other, Competing Interest: None.

Submission 26-12-2016, Peer Review 08-03-2017,

Acceptance 14-03-2017, Published 20-03-2017.

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DOI: 10.14260/Jemds/2017/421

whether pre-emptive interpleural block reduce perioperative anaesthetic and analgesic requirements? Again in 2006 Bablekos GD,⁵ Michaelides SA, Roussou T and Charalabopoulos KA studied the changes in breathing control and mechanics after laparoscopic vs. open cholecystectomy.

In our study, the primary objective is to compare the perioperative haemodynamic response and analgesic effect of single shot thoracic epidural anaesthesia versus intercostal nerve block in patients undergoing open cholecystectomy under general anaesthesia.

MATERIALS AND METHODS

The study protocol was approved by the Ethical Committee of Calcutta National Medical College, Kolkata and informed consent was obtained from every patient. Hundred ASA I-II patients of either sex, aged 18 - 45 years, undergoing open cholecystectomy were randomly assigned to one of the two groups containing fifty patients each. Patients having history of cardiovascular, cerebrovascular and respiratory diseases, coagulation abnormality, uncontrolled hypertension or diabetes mellitus, hypovolaemia, hepatic or renal disorder, spinal abnormality, drug allergy, skin infection at site of injection were excluded from the study. On preoperative rounds, patients were explained regarding the procedure and were also taught to interpret the Visual Analogue Scale (VAS) (graded from 0= no pain to 10= maximum pain).

At previous night, oral Midazolam 7.5 mg was given. All patients were kept fasting for 8 hrs. In the OT table, standard monitors were attached and an intravenous line secured. Premedication with Inj. Ondansetron (0.1 mg/kg), Inj. Glycopyrrolate (0.01 mg/kg) and Inj. Fentanyl (2 mcg/kg) was given. After preoxygenation for 3 mins, induction of anaesthesia with Inj. Propofol (1 - 1.5 mg/kg) was done. This was followed by Orotracheal intubation (with tube 7 - 7.5 mm ID for women and 8 - 8.5 mm ID for men) after proper muscle relaxation with Inj. Succinylcholine (1 - 1.5 mg/kg). Tracheal cuff was inflated until no audible air leak. Maintenance of anaesthesia was done with N₂O:O₂@60:40 and Isoflurane 0.6 - 0.8%. Muscle relaxation was maintained by intermittent bolus doses of Inj. Vecuronium Bromide (0.1 mg/kg) as required shown by TOF watch. Patients were mechanically ventilated to keep ETCO₂ between 35 - 45 mmHg.

In Group E, a single shot Thoracic Epidural was given for each patient of this group using a median approach at the level T7-T8 with Inj. Bupivacaine (0.25%) (1 mL/segment) aiming to block sensory supply from T4-L2.

In Group I, Intercostal Nerve Block (right sided) was given at 3rd to 6th intercostal space along the mid-axillary line and also in the drain site, i.e. midpoint between ASIS and lower subcostal border with Inj. Bupivacaine (0.25%) (4 mL/space). After the completion of surgery oropharynx was gently suctioned with patient adequately anaesthetised, then anaesthetic agent was discontinued and residual neuromuscular blockade reversed using IV Inj. Neostigmine (0.05 mg/kg) and Inj. Glycopyrrolate (0.01 mg/kg) and finally trachea was extubated after observing the TOF watch. NIBP, HR, ETCO₂ and SPO₂ were recorded and compared between the two groups before and after induction of anaesthesia, just after intubation, after giving long acting muscle relaxant and every 10 mins interval during the surgery and post extubation.

Patients were transferred to the PACU and intensity of pain and vital parameters were assessed after 30 mins and at

half hourly interval for 1st 6 hrs. Diclofenac sodium (75 mg) was administered as IV analgesic if the recorded VAS score was 4 or more and was repeated every 8 hrs. if required. Tramadol 100 mg IV was used as a rescue analgesic if the patient continued to have pain after diclofenac administration. The time for first analgesic request and total diclofenac consumed in 1st 6 hrs. were recorded. The patients were monitored for any side effects like nausea, vomiting, perioral numbness, hypotension (SBP > 20% decrease from baseline), bradycardia (HR < 60 beats/min) and drug allergy during this period.

Statistical Analysis

The information collected regarding all the selected cases were recorded in the master chart. For non-parametric data analysis; chi-square test was used. For parametric data independent sample's t-test was used for data analysis and for repeated measurement Kruskal-Wallis repeated measures ANOVA is used. A p value < 0.05 will be regarded as significant and p < 0.01 was considered highly significant.

RESULT

Group E

Received preoperative single shot thoracic epidural anaesthesia.

Group I

Received preoperative Intercostal Nerve Block.

	Group E	Group I	P value
Age (yrs.)	29.4 ± 6.32	30.14 ± 6.94	0.579
Sex (M/F)	15/35	28/22	---
Weight (Kgs)	51.56 ± 7.23	52.56 ± 7.93	0.512

Table A. Comparison of Demographic Profile between Two Groups

Mean Blood Pressure

Mean & SD	Group E	Group I	P value
MBP AP	84.45 ± 9.72	94.14 ± 8.9	0.448
MBP 30	88.79 ± 4.80	103.46 ± 9.29	0.000
MBP 50	87.62 ± 5.87	105.04 ± 7.73	0.005
MBP AE	95.07 ± 4.01	109.88 ± 7.91	0.000

Table B. Mean, Standard Deviation and P-value Chart of recorded Systolic Blood Pressure

Pulse Rate

Pulse Rate	Group E	Group I
PR AP	97.06 ± 3.22	92.14 ± 4.07
PR 30	78.04 ± 7.38	95.00 ± 4.61
PR 50	80.88 ± 10.42	96.54 ± 3.32
PR AE	84.90 ± 6.43	100.78 ± 6.86

Table C. Mean, Standard Deviation and P-value Chart of recorded Pulse Rate

Intraoperative Opioid Analgesic Consumption

	Opioid Used	Opioid Not Used	Chi-Square Test
Group E	0	50	Df= 1
Group I	26	24	P < 0.05

Table D. Comparison of Intraoperative Opioid Analgesic Consumption in Two Groups

Visual Analogue Scale (VAS Score)

Vas Score (at diff. times)	Group E	Group I
VAS_30 mins	0	2.12 ± 0.773
VAS_1 hr.	0	2.86 ± 0.969
VAS_2 hrs.	0	3.54 ± 1.034
VAS_3 hrs.	0.28 ± 0.454	4.18 ± 0.941
VAS_4 hrs.	0.54 ± 0.676	4.26 ± 0.876
VAS_5 hrs.	0.94 ± 0.682	4.54 ± 0.930
VAS_6 hrs.	1.60 ± 0.670	4.76 ± 1.021

Table E. Comparison of Visual Analogue Score (VAS) in Two Groups

(P value for all the above observations < 0.05)

Duration of Analgesia

	Group E	Group I	P value
Duration of analgesia (hrs.)	10.28 ± 1.773	5.18 ± 1.380	< 0.05
Diclofenac consumption in 24 hrs.	0	25.50 ± 35.889	< 0.05

Table F. Comparison of Duration of Analgesia and Diclofenac Consumption in Two Groups**Adverse Effects**

Adverse Effects	Group E	Group I	Statistical Significance
Hypotension	7	0	NS
Bradycardia	0	0	NS
Nausea & Vomiting	0	0	NS
Post-operative Motor Block	0	0	NS
Drug allergy	0	0	NS

Table G. Distribution of Adverse Effects in Two Groups**DISCUSSION**

Perioperative pain and nausea are the most common complication of open cholecystectomy. Both particularly pain causes perioperative haemodynamic instability, prolong recovery and discharge times and contribute to unanticipated admission after ambulatory surgery. Pain also contribute to nausea and vomiting, which after cholecystectomy can cause inflammation or local irritation around the gallbladder bed, liver, diaphragm and/or peritoneum further exacerbating pain. Referred pain may radiate to the epigastrium or right shoulder. The intensity of pain is most severe during the first 2 - 3 hrs. after operation.

Several investigators have proposed that preempting painful stimuli by administering a long-acting analgesic preoperatively could prevent or reduce postoperative pain. Successful prophylaxis would result not only from residual effects during recovery, but also from inhibition of noxious stimuli which would minimise hyperexcitability in the central nervous system. Others have suggested concurrent administration of several long-acting analgesics preoperatively, based on the hypotheses that pain resulting from cholecystectomy has multiple aetiologies which multimodal therapy could address, and that intervention at different levels in the central nervous system would facilitate a synergism between classes of drugs that would permit the use of lower effective doses of each drug, thereby also reducing associated side effects.

Only 1 previous study involving ambulatory open cholecystectomy has been reported in the literature. In the study by Basu⁶ et al 32 patients were included and 78% were

discharged in < 24 hrs. with pain and nausea as the principal factors that did not allow discharge. In this protocol, the analgesia included non-steroidal anti-inflammatories and opioids without specification of doses or administration frequency.

The factor preventing ambulatory discharge connecting all these studies is the primary complaint after surgery in all patients of the intense pain preventing early mobilisation, return of suitable intestinal movements and feeding without nausea.

Thus, different multimodal analgesic technique has been tried over time. In 1989, Woolf CJ⁷ did a research work on recent advances in the pathophysiology of acute pain. In 1991 Grace PA,⁸ Quereshi A and Coleman J et al studied how to reduce postoperative hospitalisation after laparoscopic cholecystectomy. In 1994 Bartholdy J,⁹ Sperling K and Ibsan M et al studied the role of preoperative infiltration of the surgical area enhances postoperative analgesia of a combined low-dose epidural bupivacaine and morphine regimen after upper abdominal surgery. In 2003 Vieira AM,¹⁰ Schnaider TB, Brandão AC and Campos Neto JP did a comparative study of intercostal and interpleural block for post-cholecystectomy analgesia. In 2011 Akoh JA,¹¹ Watson WA and Bourne TP studied day case laparoscopic cholecystectomy: Reducing the admission rate. Again in 2011 Kraft K,¹² Mariette C, Sauvanet A, Balon JM, Douard R, Fabre S, Guidat A, Hutten N, Johanet H, Laurent A, Muscari F, Pessaux P, Piermé JP, Piessen G, Raucoules-Aimé M, Rault A, Vons C; French Society of Gastrointestinal Surgery; Association for Hepatobiliary and Transplantation Surgery studied the indications for ambulatory gastrointestinal and endocrine surgery in adults. Finally, in 2014 Fuks D,¹³ Cosse C, Sabbagh C, Lignier D, Degraeve C, Regimbeau JM. Can we consider day-case laparoscopic cholecystectomy for acute calculous cholecystitis? Identification of potentially eligible patients.

In our study, we have compared the effect of preoperative single shot Thoracic Epidural Anaesthesia (Group E) and Intercostal Nerve Block (Group I) in maintenance Perioperative Haemodynamic Stability and Analgesia.

Thoracic Epidural Anaesthesia block the somatic pathway via the Thoracic Nerves (T4-T12), which supply the thoracic. In our study, significant difference in Haemodynamic

parameter was noted 30 mins. after Thoracic Epidural Anaesthesia or Intercostal Nerve Block in either of the two groups. Further, there was no Intraoperative opioid consumption in Thoracic Epidural group, while about more than half of the patients required opioid administration in the intercostal nerve block group.

The recorded post-operative 6 hrs. VAS score in patients receiving Thoracic Epidural Anaesthesia was less than 4 throughout the 6 hrs. period. While the VAS score of patients receiving Intercostal Nerve Block was more than 4 at 3 hrs. after the operation.

The first analgesic request after Thoracic Epidural Anaesthesia and Intercostal Nerve Block was 10.28 ± 1.773 hrs. and 5.18 ± 1.380 hrs. respectively.

Finally, the only adverse effect noted in 7 patients receiving Thoracic Epidural was Hypotension, while no such adverse effect was noted in the Intercostal Nerve Block Group.

CONCLUSION

Preoperative Thoracic Epidural Anaesthesia in patients undergoing Open Cholecystectomy under General Anaesthesia result in greater Perioperative Haemodynamic response and Analgesia in comparison to patients receiving Preoperative Intercostal Nerve Block.

Pleura, abdominal peritoneum plus the skin and the muscle of the upper abdomen. It also blocks the Sympathetic pathway via the splanchnic nerves, which supply the liver bed.

While the Intercostal Nerve block result in the blockage of the Intercostal Nerves (3rd - 6th), which arise from the anterior rami of the Thoracic Spinal nerve (T1-T11) and thus result in only somatic blockade.

Due to additional splanchnic nerve blockade, thoracic epidural anaesthesia result in greater perioperative haemodynamic stability and analgesia than intercostal nerve block.

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