LAPAROSCOPIC CHOLECYSTECTOMY DONE UNDER GENERAL AND EPIDURAL ANAESTHESIA- A COMPARATIVE STUDY DONE IN A RURAL MEDICAL COLLEGE HOSPITAL IN KERALA
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ABSTRACT

BACKGROUND
Conventionally, anaesthesia of choice for Laparoscopic Cholecystectomy (LC) has been general anaesthesia, but epidural anaesthesia is also used successfully these days. In this study, we compare our experiences of 100 cases of laparoscopic cholecystectomy done under General Anaesthesia (GA) and epidural anaesthesia.

MATERIALS AND METHODS
Fifty cases of laparoscopic cholecystectomy under epidural anaesthesia in a rural medical college hospital over a period of 1 year were compared with the same number of cases under general anaesthesia in the same medical college.

RESULTS
Our study found that laparoscopic cholecystectomy could be done safely under epidural anaesthesia or supplemented with analgesics. This study provides preliminary evidence about the efficacy of epidural anaesthesia for performing LC and it may be more beneficial for high-risk patients with cardiopulmonary diseases. All the parameters, which include duration of surgery, preoperative, intraoperative and postoperative comforts conclude that LC under epidural is a better choice than general anaesthesia especially in rural areas where cost and hospital stay are very important.

CONCLUSION
Epidural anaesthesia is a safe alternative to general anaesthesia in laparoscopic cholecystectomy with advantages of less postoperative complications, less cost and better analgesia.

KEYWORDS
Laparoscopic Cholecystectomy, Epidural Anaesthesia, General Anaesthesia, Rural Hospital.

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BACKGROUND
Laparoscopic Cholecystectomy (LC) is the standard procedure for gallstone diseases. General anaesthesia has traditionally been used to perform LC with pneumoperitoneum. But now, due to developments in the field of anaesthesia and surgery, regional anaesthesia (spinal/epidural/comboide spinal epidural) has been reported as an important technique for performing LC.

Initially, it was reported only for cases who were otherwise high-risk candidates for general anaesthesia.¹,² More recently, few studies have reported using regional anaesthesia as a routine technique for otherwise healthy patients also.³,⁴ In our country, patient's paying capacity and hospital stay are also important factors to be considered in the treatment plan.

Regional anaesthesia has lower postoperative mortality and fewer complications than G.A. So, spinal or spinoepidural anaesthesia seems more suitable for minimally invasive laparoscopic surgery. Segmental thoracic epidural anaesthesia in L.C. has some benefits over lumbar spinal anaesthesia like avoidance of urinary retention and benefits of a daytime surgery setting. In a patient with comorbidities like cardiac disease and COPD, slower onset of sympathetic block and minimised muscle weakness are desirable and it is better achieved with epidural anaesthesia.

So, we designed a comparative study to assess if epidural anaesthesia instead of general anaesthesia could be used as a routine in clinical practice.

MATERIALS AND METHODS
This study was conducted after getting clearance from the Institutional Ethics Committee. Two groups of patients who underwent LC were made based on retrospective data, which included 50 patients who underwent LC under GA and 50 patients who underwent LC under epidural from a medical college hospital. A questionnaire was designed, which included indication for the LC taking into consideration, the surgeon's perspective and patient's perspective. The cases done under epidural anaesthesia
included high-risk cases with chronic pulmonary diseases and cardiac diseases. Study also included patients with no major cardiac or pulmonary comorbidities.

Exclusion criteria of the LCs in the first group were pregnancy and American Society of Anesthesiologist’s (ASA) grade for physical status 4, 5, and 6 and in the second group pregnancy. Consecutive newly-diagnosed cases of cholelithiasis who reported to the Department of Surgery and who met the following criteria were enrolled in the study, which include American Society of Anesthesiologist’s (ASA) physical status 1, 2 or 3 and with the age between 18 and 80 years of age.

Exclusion criteria were acute inflammatory process (cholecystitis, pancreatitis or cholangitis), suspected/confirmed common bile duct stones, anxiety prone patient/diagnosed psychological morbidity, bleeding diathesis, jaundice and local spinal deformity, which precluded safe spinal anaesthesia. There was no cut off criteria for Body Mass Index (BMI) per se as an exclusion criterion.

Similarly, history of previous open upper abdominal surgery too was not taken as strict criteria for exclusion.

The standard protocol of first group included routine blood investigations including LFT, x-ray chest and ECG preoperatively, anxiolytic and H2 antagonists were given previous night. General anaesthesia was given using IV induction with propofol and atracurium. Nasogastric tube was avoided in all cases. No catheterisation was done. Four port laparoscopy was used as standard method.

In the second group, patients after investigations and assessment of respiratory and cardiac status were given epidural anaesthesia with a catheter in situ at thoracic level. The drugs were given so that a level of T4 was obtained. Before the epidural patient were given glycopyrrolate and midazolam 1 mg IV were given. After port insertion, 75 mg bupivacaine diluted to 150 mL saline was irrigated to the diaphragmatic area.

**Epidural Anaesthesia Technique**

Patient was placed in right lateral position and under full aseptic precautions, an epidural catheter was placed at 10th thoracic spine interspace using 17-gauge Tuohy needle. Epidural space was identified by loss of resistance technique. Anaesthesia solution was made by adding 18 mL of 2 percent lidocaine plus epinephrine (1;2,00,00) and 2 mL of sodium bicarbonate 8.4 percent. 3 mL of the solution was given as a test dose and additional 7 mL was injected over a 1.5-minute period. Intraoperative anxiety was relieved by midazolam 1-2 mg referred shoulder pain with fentanyl 1-2 mcg/kg and hypotension with ephedrine 5-10 mg as IV boluses.

**Surgical Technique**

Laparoscopic cholecystectomy was performed according to the standard four-port standard technique. Certain salient features of the technique practiced for both the groups were—

After the second trocar, the subdiaphragmatic surface of the liver was bathed with 30 mL of a solution, which contained 10 mL each of 2% lignocaine and 0.5% bupivacaine dissolved in 10 mL of saline. The pneumoperitoneum was maintained with CO2 at 10-15 mmHg.

Nasogastric tube was not introduced routinely. It was done if the surgeon desired decompression of stomach. After gallbladder had been extracted, the gallbladder fossa in the liver was bathed with 20 mL of solution with 5 mL each of 2% lignocaine and 0.5% bupivacaine dissolved in 10 mL of saline.

The following criteria were established for conversion of the anaesthesia from SA to GA-

a. Patient anxiety.

b. Pain, which was not relieved by addition of Inj. Fentanyl 50 μg /kg.

c. Bleeding, which could not be controlled by routine manoeuvres.

d. Inadequate muscle relaxation with difficult dissection.

Laparoscopic cholecystectomy was done in the same standard way of duct first method. The relaxation of abdominal wall was assessed by the tone and also the pressure required distending the abdomen for the procedure.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Relaxation</th>
<th>Pressure Required to Distend the Abdomen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1</td>
<td>Good relaxation</td>
<td>10-12 mm of Hg</td>
</tr>
<tr>
<td>Grade 2</td>
<td>Moderate relaxation</td>
<td>12-15 mm of Hg</td>
</tr>
<tr>
<td>Grade 3</td>
<td>Poor relaxation</td>
<td>&gt;15 mm of Hg</td>
</tr>
</tbody>
</table>

In case, patient complains of shoulder pain, supplementation with IV fentanyl 50 micrograms was given as bolus and infusion with 50 micrograms in 1 hr. was given.

Intraoperative BP evaluation was done at 5 minutes, 15 minutes, 30 minutes and 45 minutes. Continuous intraoperative ABG monitoring was done and no significant changes were found in the same.

**OBSERVATIONS**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>General Anaesthesia (100)</th>
<th>Epidural Anaesthesia (100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (in years)</td>
<td>51±15</td>
<td>46±18</td>
</tr>
<tr>
<td>Sex M/F</td>
<td>15:35</td>
<td>15:35</td>
</tr>
</tbody>
</table>

**Table 2. Duration for GA and Epidural**

<table>
<thead>
<tr>
<th>Duration</th>
<th>GA</th>
<th>Epidural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaesthesia time</td>
<td>50±5 minutes</td>
<td>56±10 minutes</td>
</tr>
<tr>
<td>Pneumoperitoneum</td>
<td>15 mmHg</td>
<td>12 mmHg</td>
</tr>
<tr>
<td>Surgical procedure</td>
<td>40-50 minutes</td>
<td>50-60 minutes</td>
</tr>
</tbody>
</table>
This may result in regurgitation of gastric content thus necessitating the use of endotracheal intubation to prevent aspiration in such an eventuality.\textsuperscript{1,2} The increased intraabdominal pressure during pneumoperitoneum together with the head-up tilt used in upper abdominal laparoscopies is believed to decrease venous return to the heart.\textsuperscript{6,7}

Various studies in the past have shown that epidural anaesthesia is better than general anaesthesia for laparoscopic cholecystectomy.\textsuperscript{8,9} Spinal anaesthesia itself induces peripheral vasodilatation. Hence, there is a fear that laparoscopic procedure done under spinal anaesthesia may result in hypotension. Indeed, effects of CO\textsubscript{2} pneumoperitoneum on intraoperative haemodynamics under SA is not a well-studied scenario.

Referred shoulder pain due to diaphragmatic irritation from carbon dioxide pneumoperitoneum was a significant intraoperative problem. Twelve patients experienced shoulder pain and required intravenous fentanyl injection. Two patients could not tolerate the shoulder pain and were converted to GA. Shoulder pain maybe managed by using nitrous oxide, gentle surgical manipulation, nasogastric tube insertion for gastric decompression and irrigation of diaphragm with 2\% lidocaine solution. No significant changes were noted in respiratory parameters during epidural anaesthesia in any patients. One of the most important problems of LC under regional anaesthesia is inadequate relaxation of abdominal musculature, but this problem was not encountered in our patients.

Problems related to GA such as oral and teeth injury during laryngoscopy and a sore throat and stomach inflation as a result of mask ventilation could be avoided in a regional anaesthetic setting. For a successful completion of LC under regional anaesthesia, neuraxial blockade must be performed to cover T6 level or above.

Our study showed that there is hypotension on inducing the pneumoperitoneum in many cases, which can be controlled with infusion of fluid and inotropic agents. Immediate drop of PO\textsubscript{2} noted maybe due to tenting effect of diaphragm and absorption of carbon dioxide, which produced a stage of carbemia. But, in 30 minutes study, the PO\textsubscript{2} level was stable and indicated adequate adaptation.

We did not use regular nasogastric aspiration in cases of epidural anaesthesia. Intraabdominal pressure was kept at 12 mm of Hg instead of 15 mm of Hg in the GA group. Theoretically, it can produce regurgitation of gastric content and aspiration, but in our series, we did not encounter this problem. There were 6 patients who complained of severe shoulder pain on inflating the peritoneum and they were treated with fentanyl.

Postoperative comfort with epidural anaesthesia was statistically significant and features of nausea or vomiting were seen minimally. The general anaesthesia patients had postoperative abdominal pain and pain during respiration. The mean pain free postoperative period for 6-12 hrs. is statistically significant in the latter group.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|}
\hline
\textbf{Symptoms and Complaints} & \textbf{GA} & \textbf{Epidural} \\
\hline
Abdominal discomfort & Nil & Nil \\
Shoulder pain & 4 & 6 \\
Abdominal stretch pain & Nil & 6 \\
Nausea vomiting & Nil & 1 \\
Hypotension & 2 & 5 \\
Bradycardia & 2 & 4 \\
Conversion rate & 2 & 4 \\
\hline
\end{tabular}
\caption{Table 3. Intraoperative Features}
\end{table}

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|}
\hline
\textbf{Postoperative Features} & \textbf{GA} & \textbf{Epidural} \\
\hline
Discharge time & 2-3 days & 36-48 hours \\
Cost & High & Low \\
Patient comfort scale pain & More & Less \\
free/shoulder pain & & \\
Headache & 2 & Nil \\
Sore throat & 6 & Nil \\
Nausea and vomiting & 4 & Nil \\
\hline
\end{tabular}
\caption{Table 4. Postoperative Features}
\end{table}

\section*{DISCUSSION}

The laparoscopic cholecystectomy is the routine procedure for the gallbladder disease. The surgery was done routinely under general anaesthesia. But, many patients have postoperative pain even though the incisions are small. CO\textsubscript{2} is generally used for creating pneumoperitoneum. Hypercarbia can occur because of systemic absorption of CO\textsubscript{2} in patients under GA. Adequate administration of O\textsubscript{2} by facial mask prevented respiratory acidosis in patients with spontaneous ventilation. In our series, blood gas analysis was not performed. It would be better to do blood gas analysis particularly for patients with limited respiratory reserve. It has been specified that epidural anaesthesia can be safely given for patients having severe respiratory problems. Management of GA is difficult in obese patients and special attention has to be paid to airway. Restricted temporomandibular joint movements and narrow neck make intubation and airway control difficult. Risk of increased aspiration is also there. Postoperative respiratory complications can be reduced with continuous epidural anaesthesia. Hence, options of regional anaesthesia like spinal and epidural are used in many centres.

We have divided the patients into 2 groups and one group with no comorbidities were given in GA and second group with comorbidities due to respiratory diseases and cardiovascular diseases were operated under epidural anaesthesia. This group also included patients without any comorbidities. The study suggested that there is definitive advantage of epidural over general anaesthesia in high-risk cases. The patients with COPD and CAD who were having high risk for general anaesthesia or unfit for GA tolerated the epidural anaesthesia well. Though regional anaesthesia for laparoscopic cholecystectomy has been shown to be safe and associated with better postoperative pain control, it has not become the anaesthesia procedure of choice. There may be multiple reasons for this. It is assumed that pneumoperitoneum induces rise in intraabdominal pressure.
Most of the patients regarded epidural anaesthesia as a comfortable procedure with lesser cost than those undergoing the same procedure under GA.

The cost for the total procedure is the most important factor in rural areas. The average cost for LC under general anaesthesia along with medicines and hospital stay compared to that of epidural anaesthesia is higher and hence epidural was found to be more cost effective.

Hospital stay was found to be only 1-2 days with regional anaesthesia whereas the hospital stay with GA was found to be 2 to 3 days.

**CONCLUSION**

Hence, in this study, it was found that laparoscopic cholecystectomy is safe in case of high-risk group of patients. The cost factor is very significant in case of rural services. Total hospital stay is less and postoperative comfort is more with epidural anaesthesia than general anaesthesia.

Our study concluded that laparoscopic cholecystectomy could be done safely under epidural anaesthesia or supplemented with analgesics. This study provides preliminary evidence about the efficacy of epidural anaesthesia for performing LC and it may be more beneficial for high-risk patients with cardiopulmonary diseases. All the parameters, which include duration of surgery, preoperative, intraoperative and postoperative comforts conclude that LC under epidural is a better choice than general anaesthesia, especially in rural areas where cost and hospital stay are very important.

**REFERENCES**