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A COMPARISION OF DIFFERENT POSTOPERATIVE ANALGESIA TECHNIQUES AND THEIR EFFECT ON POSTOPERATIVE PULMONARY FUNCTION IN PATIENTS UNDERGOING LAPROSCOPIC CHOLECYSTECTOMY

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ABSTRACT

INTRODUCTION: Postoperative pain relief can be achieved by a variety of techniques including peripheral nerve block, parenteral NSAIDS, epidural analgesia, neuraxial local analgesics. The transverse abdominis plane block is a local anaesthetic block used to provide analgesia to the anterior and lateral abdominal wall.

METHODS: The prospective randomised study carried out in 90 patients belonging to ASA 1, 2 posted for LSCS and divided into 3 groups,30 patients each. All patients receive TAPP block at the end of surgery. Group B received TAPP block with 18 ml 0.25% bupivacaine 18ml with 2ml NS. Group BM received 0.25% bupivacaine with 1.5ml (150mg) of magnesium sulfate and 0.5ml of NS. Group BD received 20ml of bupivacaine with dexmedetomidine 0.5 mcg/kg with 2ml NS.

RESULTS: Combination of 0.25% bupivacaine and 150mg magnesium sulfate and combination of 0.25% bupivacaine and 0.5mcg/kg dexmedetomidine provides longer duration of analgesia compared to 0.25% bupivacaine alone.

CONCLUSION: Maximum duration of analgesia observed with combination of 0.25% bupivacaine and magnesium sulfate 150mg.Thus TAPP block when used as a part of multimodal regime provided superior analgesia up to 48 hours and reduced the need of opioid analgesia following LSCS under spinal anaesthesia.

KEYWORDS : Transverse abdominis plane block, Bupivacaine, Magnesium sulfate, dexmedetomidine.

INTRODUCTION

Laparoscopic cholecystectomy has become the main treatment of symptomatic cholelithiasis and it has been performed as a day case procedure for a decade. The most important benefit of such procedure is less discomfort, shorter hospitalization and earlier return to normal activity.[11]The site and size of surgical incision and severity of postoperative pain with restricted diaphragmatic movement are the most important factors known to impair pulmonary function after conventional open cholecystectomy. Post operative alteration in pulmonary function is clinically important in otherwise healthy individuals because the reduction in Functional Residual Capacity and its relation to closing capacity can lead to atelectasis and hypoxemia.[12]The inadequate relief of postoperative pain has adverse physiologic effects that can contribute to significant morbidity and mortality, resulting in delay of patient recovery and return to daily activities. The combination of techniques that have parietal, diaphragmatic and visceral components may reduce pain after laparoscopy.

The purpose of this randomized prospective clinical trial was To observe the effects of pneumoperitoneum on pulmonary function (FEV1, FVC and FEF 25%-75%) on the 1st and 3rd post operative day and to assess improvement in by using either wound infiltration of local anaesthetic or wound infiltration along with intraperitoneal instillation of local anaesthetic technique.

AIMS AND OBJECTIVES

The aims and objectives of this study are:

To compare the different modalities of post operative analgesia techniques and their efficacy in relieving post operative pain in Laparoscopic Cholecystectomy by using Visual Analogue Scale and to observe the effects of pneumoperitoneum on pulmonary function on the 1st and 3rd post operative day and to assess improvement in pulmonary function by using either wound infiltration of local anaesthetic or wound infiltration along with intraperitoneal instillation of local anaesthetic technique and to observe the side effects of drugs if any.

MATERIALS AND METHODS

After approval from Institutional Ethical Committee, 45 patients of ASA Grade I and II in age group 18 - 60 years with H/O symptomatic cholelithiasis posted for elective laparoscopic cholecystectomy under general anaesthesia were included in the study. Thorough pre-anaesthetic evaluation was carried out on the previous day and patients were explained regarding the procedure. Informed consent was taken. Preoperative Pulse Rate, Blood Pressure, Respiratory Rate and SpO_2 were recorded and considered as baseline.

Pulmonary Function tests were carried out using Schiller Spirovit SP-1 spirometer, with the patient in sitting position, according to the guidelines of American Thoracic Society. These parameters were selected because spirometry is the most useful, cost effective and commonly used test for pulmonary function. Screening spirometry yields vital capacity, FVC and FEV1. From these values, two basic types of pulmonary dysfunction can be identified and quantitated: obstructive defects and restrictive defects. FEF 25% - 75% can be used to support the diagnosis of an obstructive defect.[2]

After giving premedication, general Anaesthesia was induced with Inj. Fentanyl 2 µg/kg and Inj. Sodium Thiopentone 4-7 mg/kg, Inj. Succinylcholine 1-2 mg/kg was given to facilitate endotracheal intubation. Anaesthesia was maintained with $O_2 + N_2O$ + Isoflurane. Inj. Vecuronium was used for muscle relaxation. The lungs of all patients were ventilated mechanically with tidal volume 8-10 ml/kg and ventilatory frequency was adjusted to maintain EtCO2 between 30 to 40 cm H_2O.

Intraoperatively vitals were monitored. Laparoscopic Cholecystectomy was performed in a standardized manner using two 5 mm and one 10 mm working ports and one 10 mm camera sheath.

The patients were randomly divided into 3 groups of 15 patients each.

In Group I, No Local Anaesthetic was used (Control Group) In Group II, All wounds were infiltrated with 0.25% Bupivacaine (total 2 mg/kg) containing 1 in 2,00,000 Adrenaline solution at the end of surgery, before wound closure. In Group III, In addition to wound infiltration with Bupivacaine/Adrenaline, 0.15% Lignocaine (4 mg per kg) in Normal Saline solution was instilled intraperitoneally through 10 mm port at the end of surgery Lignocaine was chosen by us, as we were concerned about the possible toxicity of intraperitoneal Bupivacaine: 2 mg/kg was already infiltrated in the wounds and dosage higher than 2 mg/kg could be dangerous. Inj. Diclofenac 75 mg i.m. was given half an hour before completion of surgery in all patients. Reversal was done using Inj. Glycopyrrolate 6-10 µg/kg i.v. and Inj Neostigmine 0.05mg/kg i.v.

Pulmonary Function Tests were performed on the day before surgery and on the 1st postoperative day and 3rd postoperative day, when patient was at rest and VAS was less than 4. The parameters recorded were **FEV1**, **FVC** and **FEF 25%-75%**. These are the basic parameters of pulmonary function tests for the assessment of lung function.
Post operative pain was recorded using Visual Analogue Scale (on a scale of 0 to 10) 1 hour, 3hours, 6 hours, 12 hours, 18 hours and 24 hours after surgery. VAS was recorded for abdominal pain and shoulder pain.

OBSERVATIONS AND RESULTS

After approval from Institutional Ethical Committee, 45 patients of ASA Grade I and II in age Group 18- 60 years posted for elective Laparoscopic Cholecystectomy were included in the study.

The patients were randomly divided into 3 Groups of 15 patients each as described above. There was no statistically significant difference between the 3 Groups in terms of age, weight, gender and duration of surgery.

No significant changes in pulse rate was observed perioperatively in all 3 Groups. No significant change in Systolic Blood Pressure was observed perioperatively in all 3 Groups. No significant change in Diastolic Blood Pressure was observed perioperatively in all 3 Groups. The oxygen saturation remained 100% in all 3 Groups throughout surgery.

The intraoperative vitals (Pulse Rate, Blood Pressure and SpO_2) were comparable in all 3 Groups.

COMPARISON OF VAS SCORE - ABDOMINAL PAIN

Groups compared	p value					
	1 hr	3 hrs	6 hrs	12 hrs	18 hrs	24 hrs
Group I vs Group II	0.001	0.002	0.001	0.114	0.004	0.058
Group I vs Group III	p<0.0001	0.001	p<0.0001	0.037	0.001	0.026
Group II vs Group III	0.959	0.977	0.970	0.867	0.903	0.939

ABDOMINAL PAIN

All patients in Group I (100%), 5 patients in Group II (33.3%) and 3 patients in Group III (20%) were supplemented with Inj. Diclofenac Sodium at VAS ≥ 4 with mean dose 115 mg, 90 mg and 75 mg respectively.

In Group I, 5 patients required **rescue analgesia** at 3 hours, 7 patients at 6 hours, 5 patients at 12 hours and 6 patients at 18 hours. Out of which 8 patients required 2 doses of **rescue analgesia**. (average 6.2 hours)

In Group II and Group III, all patients were painfree upto 6 hours. At 6 hours postoperatively 2 patients in Group II and 1 patient in Group III demanded **rescue analgesic** while at 12 hours, 3 patients in Group II and 1 patient in Group III were supplemented with analgesia.

Single patient in Groups II and III demanded **analgesia** at 18 hours. All patients were painfree at 24 hours postoperatively.

Only 1 patient in Group II required 2 **rescue analgesic** doses (average 9.6 hours) but in Group III none of the patients needed more than 1 dose of **rescue analgesic** (average 12 hours).

The difference in **abdominal pain** between Group I and Group II was statistically significant except at 12 hours postoperatively and 24 hours postoperatively. The lack of significant difference at 12 hours can be attributed to the fact that 7 patients from Group I received Inj. Diclofenac at 6 hours postoperative while only 2 patients in Group II received Inj. Diclofenac at 6 hours postoperatively.

The difference in VAS for **abdominal pain** between Group I vs Group III was statistically significant throughout the study period ($p<0.05$). Thus, patients who received wound infiltration of Bupivacaine along with intraperitoneal Lignocaine instillation had significantly lesser pain in the postoperative period.

The difference in VAS for **abdominal pain** between Group II vs Group III was not statistically significant throughout study period ($p>0.05$).

Thus, both interventions, wound infiltration with Bupivacaine alone and wound infiltration with Bupivacaine along with intraperitoneal Lignocaine provided satisfactory postoperative analgesia.The incidence of **shoulder pain** was 60% in Group I compared to only 13.3 % in Group II and Group III.

The difference in the Visual Analogue Score for **shoulder pain** between the 3 Groups was statistically significant at 6 hours and 12 hours interval post operatively. The **shoulder pain** was significantly lesser in Group II and Group III compared to Group I at 12 hours and 6 hours interval postoperatively. The difference in **shoulder pain** was not statistically significant between Group II and Group III. The **duration of surgery** had no influence on **postoperative abdominal pain** and **shoulder pain**.

CHANGES IN PULMONARY FUNCTION

(FEV1, FVC, FEF 25%-75%)
GROUP I There was a significant reduction in pulmonary function observed on 1st postoperative day compared to preoperative finding but on 3rd postoperative day, when patient became comfortable, there was improvement in all 3 parameters.

GROUP II There was a significant reduction in pulmonary function observed on 1st postoperative day compared to preoperative finding but on 3rd postoperative day, when patient became comfortable, there was improvement in all 3 parameters.

GROUP III There was a significant impairment in reduction in pulmonary function observed on 1st postoperative day compared to preoperative finding but on 3rd postoperative day, when patient became comfortable, there was improvement in all 3 parameters.

Results of **preoperative Pulmonary Function Tests (FEV1, FVC** and **FEF 25%-75%)** in all 3 Groups were comparable.

The patterns of postoperative alterations were qualitatively similar but quantitatively lesser in Group II and Group III as compared to Group I. There was lesser reduction in **FEV1, FVC** and **FEF 25%-75%** in Group II (52.09%, 51.52% and 52.38% respectively) as compared to Group I (63.10%, 58.46% and 62.67% respectively) on 1st postoperative day. Thus patients in Group II showed lesser impairment of **pulmonary function** 1 day postoperatively than Group I. However, the difference was not statistically significant ($p>0.05$).

But on the 3rd day postoperatively improvement in **FEV1** and **FEF 25%-75%** was observed in Group II (21.86% and 25.23% respectively) compared to Group I (23.78% and 27.75% respectively). The difference in **FVC** observed was smaller in Group I (21.92%) than Group II (24.42%). However, the differences were not statistically significant ($p>0.05$).

Thus, wound infiltration with Bupivacaine resulted into lesser impairment in **postoperative pulmonary function** as compared to the control Group. However the difference was not statistically significant ($p>0.05$). It led to a significant reduction in **postoperative pain** and **analgesic requirement** compared to the control Group.

On the 1st postoperative day changes in **FEV1, FVC** and **FEF 25%-75%** were smaller in Group III (43.92%, 44.61% and 44.44% respectively) as compared to Group I (63.10%, 58.46% and 62.67% respectively). There was significantly lesser reduction in **FEV1 and FVC** in Group III as compared to Group I ($p<0.05$). The change in **FEF 25%-75%** was not statistically significant ($p>0.05$).

The changes in **FEV1, FVC** and **FEF 25%-75%** were lesser on 3rd day postoperatively in Group III (10.74%, 15.38% and 12.03% respectively) compared to Group I (23.78%, 21.92% and 27.75% respectively). However, the changes observed in **FEV1** was significant compared to **FVC and FEF 25%-75%.**

Thus, wound infiltration of Bupivacaine along with intraperitoneal instillation of Lignocaine resulted in significantly less impairment in **FEV1** and **FVC** on 1st postoperative day and **FEV1** on 3 postoperative day compared to control Group ($p<0.05$). It also provided a significant reduction in **postoperative pain** and **analgesic requirement**.

DISCUSSION

Laparoscopy involves insufflation of the abdomen by gas or other fluid so that endoscope can view the intra abdominal contents without being

in direct contact with the viscera or tissues.[1]The changes in pulmonary function that occur postoperatively are primarily restrictive, with proportional decreases in all lung volumes and no change in airway resistance. **In 2003 Lepner U, Goroshima J and Samarutel J** compared the efficacy of different local anaesthetic drugs and routes of administration for post operative analgesia after Laparoscopic Cholecystectomy to determine whether wound infiltration with local anaesthetic leads to lesser postoperative pain and reduced analgesic requirement and if an additional intraperitoneal instillation of local anaesthetic is effective in reduction of overall pain. **In 1996, Karayiannakis A J, Makri GG and their co workers** compared the pulmonary function tests after laparoscopic cholecystectomy with open cholecystectomy and with the pre operative values. Postoperatively, a significant reduction in **Total Lung Capacity, Functional Residual Capacity, FEV1, Forced Vital Capacity** and **Mid Expiratory Flow** occurred both after laparoscopic cholecystectomy and open cholecystectomy. The reduction in **FRC, FEV1, FVC and FEF 25-75%** were lesser after laparoscopic cholecystectomy (7%, 22%, 19%, 23% respectively) than after open cholecystectomy (21%, 38%, 32%, 34% respectively). In our study, reduction in postoperative **FEV1** was 63.6%, 52.1% and 43.9% in Groups I, II and III respectively. The reduction in **FVC** was 58.5%, 51.5% and 44.6% and in Postoperative **FEF 25%-75%** was 63.2%, 52.9% and 44.9% of the preoperative values in Group I, II and III respectively. This could be because they used Inj. Morphine for intraoperative and postoperative analgesia while we used Inj. Fentanyl for intraoperative analgesia and Inj. Diclofenac for postoperative analgesia. The results from their study indicated that considerable impairment of pulmonary function occured after laparoscopic cholecystectomy. The patterns of postoperative alterations were qualitatively similar but quantitatively lesser than those after open cholecystectomy.[12] **In 1998, Cunniffe Geraldine M, Oliver J and their colleagues** studied the effect of Intraoperative Bupivacaine Irrigation for Management of Shoulder tip pain following Laparoscopy. Many patients complain of shoulder tip pain following laparoscopic surgery. This pain contributes to patient morbidity by increasing analgesic requirement postoperatively. They carried out this study to assess whether Bupivacaine solution instilled under both domes of diaphragm could attenuate shoulder tip pain following general surgical laparoscopic procedures or not.**In 1999, Bisgaard Thue, Klarskov Birte and their co workers** studied the effects of multi regional local anaesthetic infiltration during Laparoscopic Cholecystectomy in patients receiving prophylactic multi modal analgesia. Early postoperative pain is the most common complaint after elective laparoscopic cholecystectomy. They conducted this study to examine the effects on postoperative pain and nausea after a combined somato visceral multi regional local anaesthetic blockade. 58 patients were randomised to receive a total of 286 mg (66ml) Ropivacaine or 66 ml saline via periportal and intraperitoneal infiltration. During the first 3 postoperative hours, the use of morphine and anti emetics was registered and **pain** and **nausea** were rated hourly. **Daily pain intensity, pain localisation** and **supplemental analgesic consumption** were registered the first postoperative week.

Ropivacaine reduced **overall pain** the first two hours and **incisional pain** for the first three postoperative hours ($p<0.01$) but had no apparent effects on **intraabdominal or shoulder pain**. The number of patients requiring **rescue analgesic** was significantly lower in the Ropivacaine group (6 patients) as compared to the control group (14 patients) ($p<0.05$). This correlates with our study as all 15 patients required rescue analgesic in Group I compared to 5 patients in Group II and 3 patients in Group III. From their study they demonstrated that a combined somatovisceral Ropivacaine blockade reduced pain, nausea and analgesic requirement during the immediate postoperative period after laparoscopic cholecystectomy.[4]**In 2009, Ramos Gilson Cassem, Pereria Edisio and their colleagues** compared effect of anaesthetic-surgical time on the post operative pulmonary function tests (FVC and FEV1) after laparoscopic cholecystectomy with pre operative values. The objective of this study was to detect restrictive ventilatory defects, their severity and the recovery time of spirometry measurements in the postoperative period of laparoscopic cholecystectomy as compared to preoperative (baseline) values. 15 female patients undergoing elective laparoscopic cholecystectomy were studied. Patients in whom anaesthetic and surgical time was longer than 50 minutes were excluded from the study and a new patient was selected. Spirometric measurements were conducted pre operatively, 24 hours post operatively and thereafter every 2 days till until a test considered normal for the patient was obtained. F**VC and FEV1** values obtained on 1st post operative day were found to be significantly ($p<0.05$) lower than pre operative values. However the values obtained on 3rd post operative day were not significantly lower than pre operative values ($p>0.05$). This does not correlate with our study as values were significantly lesser on 1st postoperative day (**FVC and FEV1**) as well as 3rd postoperative day (**FEV1**) compared to preoperative values in our study ($p<0.05$). This could be because the average duration of surgery was longer in our study (91 minutes to 100 minutes) as compared to their study ($\leq$ 50 minutes). From their study they concluded that reduced anaesthetic and surgical time led to minimal alteration and faster recovery of pulmonary function in the postoperative period.[23] **In 2009, Liu Yu-Yin, Yeh Chun Nan, Wang Shang Yu and their co workers** studied the effect of pain relief after infusion of Ropivacaine at port sites at the end of surgery. This prospective and randomised controlled trial aimed to clarify the impact of infusion of local analgesia at the port site after laparoscopic cholecystectomy on pain relief. **In 2014, Vejdan Seyyed Amir, Khosravi Malihe and their co workers** compared the efficacy and side effects of local anesthetic drugs versus conventional analgesics in post-operative pain control.

CONCLUSION

The study was carried out, at SMIMER, in 45 patients of ASA Group I and II belonging to the age group 18 - 60 years undergoing laparoscopic cholecystectomy after approval from Institutional ethical committee. Pulmonary Function tests were carried out in sitting position by using Schiller Spirovit SP-1 spirometer.From our study, we concluded that careful wound infiltration with a Bupivacaine/Ad renaline mixture is a simple, safe, and well feasible technique which significantly reduces the post operative abdominal pain and analgesic consumption for 24 hours after laparoscopic cholecystectomy. An additional intraperitoneal instillation of local anaesthetic, along with wound infiltration resulted into reduction in intensity of abdominal and shoulder pain and improvement in pulmonary function . **In our opinion, wound infiltration along with intraperitoneal instillation of local anaesthetic can be a recommended technique to provide stable hemodynamic and satisfactory postoperative analgesia without much impairment in pulmonary function, in patients undergoing laparoscopic cholecystectomy.**

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