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Effect of Subdiaphragmatic and Gall Bladder Bed Administration of Bupivacaine on Post Operative Pain and Post Operative Pulmonary Functions in Laparoscopic Cholecystectomy

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***ABSTRACT**: Pain is an inevitable consequence of any operation and proper attention to the source of pain and its control is needed. The problem of inadequate postoperative pain relief has been recognized for many years and has been the subject of considerable research. In the present research we attempted to study the effect of subdiaphragmatic and Gall Bladder bed administration of bupivacaine on post operative pain and post operative pulmonary Functions in laparoscopic cholecystectomy.*

***MATERIAL AND METHODS**: Sixty patients who were admitted and subsequently underwent elective laparoscopic cholecystectomy were included in the present study after taking their informed consent over one year period. Patients were divided into three groups of twenty each. Group I received bupicavaine in both subdiaphragmatic and gallbladder bed region, Group II received bupivacaine in subdiaphragmatic and saline in gallbladder bed region while Group III received normal saline in both region. Postoperative pain scores along with pulmonary functions were assessed and compared with preoperative values. Data was analysed statistically.*

***RESULTS**: local instillation of bupivacaine significantly reduced pain scores in the early period after laparoscopic cholecystectomy ($p<0.05$). The present study also showed more marked fall in pulmonary functions postoperatively as compared to their preoperative values in Group III.*

***CONCLUSION**: Subdiapharagmatic and gall bladder bed administration of bupivacaine is an effective, easy and safe method of providing early postoperative analgesia to patients and its administration should be made a routine practice in a standard laparoscopic cholecystectomy.*

***KEYWORDS**:Bupicavaine,laparoscopic cholecystectomy,pulmonary functions.*

I. Introduction

Operations on the biliary tract are one of the most commonly performed abdominal procedures in the modern era and cholecystectomy is the commonest amongst them. [1]

Pain is an inevitable consequence of any operation and proper attention to the source of pain and its control is needed. Besides relieving the patient of his/her agony, pain control significantly reduces the work load on those responsible for patient management. The problem of inadequate postoperative pain relief has been recognized for many years and has been the subject of considerable research.

Despite being the "Gold standard" for the management of symptomatic gall stone disease laparoscopic cholecystectomy is not a totally pain free procedure, which is particularly an important concern for many patients. [2]

Postoperative pain relief is a subject which is receiving increasing attention in the past few years because effective pain control is essential for optimal care of surgical patients. Despite advances in the knowledge of pathophysiology and pharmacology of analgesics and development of more effective techniques for postoperative pain relief, many patients continue to experience considerable discomfort. In addition abdominal surgery, especially upper abdominal surgical procedures are known to adversely affect pulmonary functions. [3] Pulmonary complications are the most frequent cause of morbidity and mortality postoperatively. The management of these two postoperative problems is therefore of significant interest to all treating physicians.

Although there have been few trials assessing the use of local anesthetics administrated subdiaphragmatically and in gall bladder bed in a standard 4 port laparoscopic cholecystectomy, the effects of preoperative and postoperative wound infiltration and nerve blockage is currently being studied in many centers around the world.

Pain after laparoscopic cholecystectomy is considered to be multifactorial, which in one way or the other results in activation of the afferent nerve terminals. Many authors have attributed the cause of post laparoscopic cholecystectomy pain to factors as:-

- Distension induced neuropraxia.
- Residual pneumoperitoneum
- Trauma to parietes.
- Acid intraperitoneal milieu, intraperitoneal procedures
- Referred from gall bladder bed.[4]

The cause of postoperative pulmonary complications might be the afferent stimulus arising from gall bladder and its bed which elicits reflex inhibition of the diaphragm. Pulmonary function would be improved by blocking this stimulus after laparoscopic cholecystectomy.[3]

Various methods that have been used to reduce post laparoscopic cholecystectomy pain include:-

- NSAIDS,
- Keeping insufflations pressure below 15mm of Hg
- Preemptive narcotics
- Wound infiltration with LA,
- Post LC peritoneal lavage with Normal saline.
- Subdiaphragmatic administration of LA such as bupivacaine[5]

These trials have met with equivocal results.

Hence keeping the above factors in mind, the present study was conducted in the Department of Surgery, Indira Gandhi Medical College and Hospital Shimla to study the effect of subdiaphragmatic and gall Bladder bed administration of bupivacaine for pain relief and to assess its effect on Pulmonary Functions following laparoscopic cholecystectomy.

II. Material And Methods

The study was conducted in the Department of Surgery and Department of Pulmonary Medicine, IGMC Shimla over a one year period between July 2010 to June 2011. Sixty patients who were admitted and subsequently underwent elective laparoscopic cholecystectomy were included in the present study after taking their informed consent. The study was approved by the hospital ethical committee. The patients had their gallstones imaged by ultrasound prior to admission in surgery wards and were divided randomly into three groups of twenty patients each. They were labeled as Group I (group 1), Group II (group 2) and Group III (group 3) respectively. All the patients were subjected to same general anesthesia, antibiotics, and intravenous fluids. Surgery was performed by a senior consultant surgeon with a resident as an assistant. A standard four port laparoscopic cholecystectomy was performed in all patients. Group I was administered 10ml of 0.5% bupivacaine in bilateral subdiaphragmatic space and 10ml in gall bladder bed, Group II was administered 10ml of 0.9% Normal saline in bilateral subdiaphragmatic space and 10ml of 0.5% bupivacaine in gall bladder bed while Group III was administered 10ml of 0.9% Normal saline in subdiaphragmatic space and 10ml of 0.9% Normal saline in gall bladder bed after removal of the gallbladder. Patient were analyzed postsoperatively according to the following parameters:

- Abdomen pain (at 4hr,8hr,12hr, $\geq$24hrs)
- Shoulder pain (at 4hr,8hr,12hr,, $\geq$24hrs)
- Pain at any other sites
- Analgesic requirement
- Nausea and vomiting
- Duration of hospital stay
- Wound sepsis
- Chest complication
- Intra-abdominal collection, if any
- Complications,if any

Pain assessment was done at 4hr, 8hr, 12hr, $\geq$24hrs postoperatively using the Visual Analogue Scale (VAS). Pulmonary function test was assessed using a spirometer (vitalograph compact model spirometer, England). Measurement was made with patient in sitting position. Forced vital capacity(FVC), peak expiratory flow rate (PEFR) and forced expiratory volume in 1second (FEV_1) was recorded on the day before surgery and after 24 hrs (1st post operative day) following surgery.

III. Results

The age of patients in the present study ranged from 23 to 75 years and the mean was 43.55±5.6years. The total number of males in the present study were 12 (20%) and total number of females were 48 (80%) showing a female preponderance.

General physical examination was normal in all of the patients. The routine clinical and blood investigations were normal in patients belonging to all the three groups.

Total time taken for surgery ranged from 15 to 74 minutes and the mean was 37.94±6.8 minutes. In the female patients total time taken ranged from 15 to 70 minutes and mean was 36.66±4.9 minutes. In the male patients total time taken ranged from 20 to 74 minutes and mean was 40.08±3.8. Statistical difference between duration of surgery in males and females was significant in the present study ($p=0.035$).

The visual analogue scores for Group I, II and III for postoperative pain abdomen are shown in Table I.

The difference in the mean of visual analogue score was statistically significant between group I and III at 4, 8 and 12 hours. ($p<0.05$).

The difference in the mean of visual analogue score was statistically significant between group II and III at 4, 8 and 12 hours. ($p<0.05$).However there was no significant difference after 12 hours at 24 and 48 hours between group I and III as well as group II and III. Group I and II were comparable at all times.($p>0.05$). The data showing the number of patients with shoulder pain scores, mean analgesic requirement is charted in TABLE II, III.

- The mean analgesic requirement was statistically significant between group I and III. ($p<0.05$).
- The mean analgesic requirement was statistically significant between group II and III ($p<0.05$).
- The mean analgesic requirement was statistically insignificant between group I and II. ($p>0.05$).

The various pulmonary function test preoperative and postoperative values were noted and are shown in TABLE IV and V. This data suggested that the pulmonary function had infact deteriorated following the performance of laparoscopic cholecystectomy on the patients.

- Mean duration of hospital stay in Group I was 23.4±1.46 hrs.
- Mean duration of hospital stay in Group II was 28.1±4.37 hrs.
- Mean duration of hospital stay in Group III was 39.3±8.55 hrs.

The difference in the mean of post operative hospital stay was statistically significant between group I and III. ($p<0.05$).

The difference in the mean of post operative hospital stay was statistically significant between group II and III ($p<0.05$).

The difference in the mean of post operative hospital stay was statistically insignificant between group I and II. ($p>0.05$).

There were no local or systemic complications following laparoscopic cholecystectomy in all the three Groups.

IV. Discussion

The mean age of males and females patients presenting with cholelithiasis in the present study was 44.16 years and 43.39 years respectively.

In a similar study **Thamil Selvi** concluded that the mean age of presentation was 45.90 yrs which was comparable to our present study.[5]

Female preponderance was evident in the present study with 80% patients being females in the present study. This supported the early established fact that gallstones are more common in female gender especially in Northern India.[6]

Pain abdomen and dyspepsia were the most common presenting symptoms occurring either alone or together. In many other studies these two symptoms are the most commonly reported symptoms among patients with cholelithiasis. Although cholelithiasis is stated to be more in obese patients the present study failed to show such a correlation. Another study involving a larger sample size would be required to establish the same.

Statistical difference between duration of surgery in males and females was significant in the present study ($p<0.05$) showing females generally presented with easy cholecystectomy as compared to their male counterparts. In a study conducted by Peter Ambe it was shown that mean duration of surgery in males was 40.11 and in females was 34.10 respectively. The difference in the duration was statistically significant ($p<0.0001$).[7]

The increased duration of surgery in males has been attributed to the higher pain threshold in males, their reluctance to seek treatment and increased incidence of fibrosis in males following inflammation due to stones.

The difference in the mean of visual analogue score was statistically significant between group 1 and 3 at 4, 8 and 12 hours. ($p< 0.05$).

The difference in the mean of visual analogue score was statistically significant between group 2 and 3 at 4, 8 and 12 hours. ($p< 0.05$). However there was no significant difference after 12 hours at 24 and 48 hours between group 1 and 3 as well as group 2 and 3.Group 1 and 2 were comparable at all times.($p>0.05$).

Thus in the present study it is established that local instillation of bupivacaine significantly reduced pain scores in the early period after laparoscopic cholecystectomy. However after 12 hours of surgery there was no difference amongst various groups.

Various factors attributed to causation of postoperative pain in patients undergoing laparoscopic cholecystectomy are distension induced neuropraxia, residual pneumoperitoneum, trauma to parietes, acid intraperitoneal milieu and pain referred from gall bladder bed. Mravoic in a study demonstrated that intraperitoneal instillation of bupivacaine significantly reduced pain in patients who underwent surgery for gall bladder stone disease.[8] The difference was most marked in the early period after surgery. Weber investigated the effect of sub-diaphragmatic instillation of bupivacaine after laparoscopic cholecystectomy.[9] The study results showed a considerable reduction of postoperative pain during the first 48 hours after surgery in patients who received bupivacaine instillation. It was concluded that instillation of long acting local anaesthetic such as bupivacaine into the sub-diaphragmatic space after laparoscopic cholecystectomy is effective in postoperative pain reduction. Dath in a study showed that the visual analogue scores in patient of laparoscopic cholecystectomy were significantly lower as compared to control group.[10] However this difference existed in the initial hours of postoperative period. After 10hr there was no difference amongst various study groups. All of these studies showed bupivacaine efficiency in mitigating pain in the early postoperative period after intraperitoneal instillation. The patients who received local instillation of bupivacaine in the present study complained less about shoulder pain discomfort.

Gharaibeh in a study found out that the incidence of post operative shoulder pain was markedly less in patients receiving intraperitoneal Bupivacaine instillation as compared to control group. The difference was statistically significant ($p<0.0002$).[3] The incidence of postoperative nausea and vomiting were much less in the study as compared to control group.

In a study by Andrei Goldstein it was emphatically shown that bupivacaine intraperitoneal administration significantly reduced incidence of post operative nausea and vomiting which correlates with the result of present study.[11]

The difference in the mean of analgesic requirement was statistically significant between group I and III ($p <0.05$).

The difference in the mean of analgesic requirement was statistically significant between group II and III ($p <0.05$).

The difference in the mean of analgesic requirement was statistically insignificant between group I and II. ($p> 0.05$). Patients receiving bupivacaine had lesser demand of analgesics thus proving efficacy of bupivacaine in relieving pain as compared to patients who did not.

Alam in a similar study concluded that the use of intraperitoneal bupivacaine in laparoscopic cholecystectomy patients significantly reduced pain as well as analgesic requirement in the early postoperative period compared to control group patients. [12]

The present study showed more marked fall in pulmonary functions postoperatively as compared to their preoperative values in Group III. The pulmonary function tests showed modest fall in Group I and II. Though a difference in pulmonary status was observed the same could not be statistically proved to be significant in the present study. ($p>0.05$). Alptekin in a controlled trial concluded that the decrease in post operative pulmonary functions was most marked in the group which did not received any bupivacaine.[4]

A larger study involving bigger sample size would be required to establish role of bupivacaine in decreasing the extent of pulmonary function restriction due to surgery.

The difference in the mean duration of stay was statistically significant among the group receiving bupivacaine and control group ($p<0.05$). Patients in Group III had markedly longer postoperative stay in hospital compared to Group I and II. There was no statistically significant difference between Group I and II. ($p>0.05$)

S. Berven in a study demonstrated that intraperitoneal instillation of bupivacaine significantly reduced duration of hospital stay (1.3 day compared to 1.9 day in control group).[13]

V. Conclusion

Laparoscopic cholecystectomy has revolutionized the treatment of gall bladder stone disease in the modern era and has become the current gold standard treatment. Despite being a good treatment option it is still results in significant morbidity to the patient in terms of pain and surgical and anesthesia related complications. There is an ongoing constant effort and research to minimize such morbidities.

Subdiapharagmatic and gall bladder bed administration of bupivacaine, is an effective, easy and safe method of providing early postoperative analgesia to patients and its administration should be made a routine practice in a standard laparoscopic cholecystectomy.

Bupivacaine may have a role in causing comparatively less disturbance in pulmonary function in a patient undergoing laparoscopic cholecystectomy however larger studies are required to establish its efficacy in maintaining pulmonary function tests.

Bupivacaine routine use in laparoscopic cholecystectomy can result in increased patient comfort, early discharges as well as lower financial cost to the patients. It would also decrease the burden on hospital resources which can be utilized for other needy patients.

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Tables

	VAS 4Hr	VAS 8Hr	VAS 12Hr	VAS 24Hr	VAS 48Hr
Group I	2.8	2.3	1.7	0.9	0
Group II	2.85	2.4	1.7	0.95	0.2
Group III	6.45	5.75	3.1	1.6	0.55

Table I (Vas Scores At Different Postoperative Intervals)

	SHOULDER PAIN 4Hr	SHOULDER PAIN 8Hr	SHOULDER PAIN 12Hr	SHOULDER PAIN 24Hr	SHOULDER PAIN 48Hr
Group I(no. of pt)	3	2	0	0	0
Group II(no. of pt)	3	3	2	0	0
GroupIII(no. of pt)	6	6	4	0	0

Table II (No. Of Patients With Shoulder Pain At Different Postoperative Intervals)

	Analgesic requirement (mean)
Group I	0.95
Group II	1
Group III	2.8

Table III (Mean Analgesic Requirement In Different Groups)

	MEAN FVC (L)	MEAN FEV1(L)	MEAN FEV1/FVC(%)	MEAN PEFR (L/MIN)
Group I	2.316	1.924	0.8355	308.3
Group II	2.571	2.156	0.843	358.5
Group III	2.714	2.236	0.822	346.75

Table IV (Preoperative Values Of Pulmonary Functions In Various Groups)

	MEAN FVC (L)	MEAN FEV1(L)	MEAN FEV1/ FVC(%)	MEAN PEFR (L/MIN)
Group I	1.748	1.4125	0.7795	226.75
Group II	1.7705	1.381	0.727	232.2
Group III	1.515	1.232	0.6715	165.95

Table V (Postoperative Pulmonary Functions In Various Groups)