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A COMPARATIVE STUDY BETWEEN LOW AND STANDARD PRESSURE PNEUMOPERITONEUM FOR LAPAROSCOPIC CHOLECYSTECTOMY.

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ABSTRACT

Laparoscopic cholecystectomy is the gold standard procedure for cholelithiasis. Pneumoperitoneum for laparoscopic cholecystectomy is most often created by insufflating carbon dioxide gas into the peritoneal cavity and then holding it at constant pressure till the end of surgery. Standard pressure pneumoperitoneum, employing a pressure range of 12-14 mm Hg, over prolonged periods has been associated with intra and postoperative adverse effects. An emerging trend has been the use of low-pressure pneumoperitoneum in the range of 7-10 mm Hg in an attempt to lower the impact of pneumoperitoneum on the human physiology while providing adequate working space. Our study proposes to compare the effects of low-pressure pneumoperitoneum with the use of standard pressure pneumoperitoneum with special reference to study frequency and intensity of postoperative pain.

Key words: Laparoscopic cholecystectomy, Low-pressure pneumoperitoneum, Postoperative pain.

INTRODUCTION

Laparoscopic cholecystectomy is the gold standard treatment for cholelithiasis. First human laparoscopic cholecystectomy was performed by Mouret in 1987.During laparoscopic cholecystectomy adequate working space is required in the abdomen for good exposure that contributes to satisfactory results and patient safety[1]. Common method to create working space in the abdomenis pneumoperitoneum. Pneumoperitoneum by carbon dioxide is essential for any laparoscopic procedure. Pneumoperitoneum into the abdominal cavity is control by using pressure regulating automatic insufflators and it provides adequate working space and exposure during the surgery. Usually intraperitoneal pressure is kept at 12-14 mm Hg during laparoscopic cholecystectomy[2]. There are various side effects of carbon dioxide like cardiovascular changes, acid-base disorders, decrease pulmonary compliance and postoperative pain due to its prolonged use. Some of these side effect result from a

positive intraperitoneal pressure itself, while others are associated with carbon dioxide absorption from the peritoneal cavity into the blood. The origin of pain after laparoscopic cholecystectomy is multifactorial with pain arising from the incision sites, the pneumoperitoneum and cholecystectomy[3].The exact mechanism of pain related to pneumoperitoneum after laparoscopy has yet to be clarified . The proposed mechanisms include diaphragmatic stretching, chemical irritation of peritoneum by carbonic acid formed from carbon diaoxide and sympathetic nervous system activation derived from hypercarbia leading to amplification of local tissue inflammatory response, as well as splanchnic mucosal ischemia[4,5]. These effects can be minimized by keeping low intraperitoneal pressure between 7-10 mm Hg especially in elderly and patients with cardiovascular and respiratory comorbidities. However, low pressures sometime may not provide adequate exposure and space during surgery leading to intraoperative complications and conversion to standard pressure[6]. In this study, we have compared various factors like intra operative difficulty, duration of surgery, hospital stay, use of analgesia , postoperative nausea and vomiting and postoperative pain in patients undergoing laparoscopic cholecystectomy under standard pressure versus low pressure.

AIM AND OBJECTIVE

AIM

- To assess and compare the effect of low pressure carbon dioxide pneumoperitoneum and standard pressure carbon dioxide pneumoperitoneum in cases undergoing laparoscopic cholecystectomy.

OBJECTIVES

- To assess and compare the proportion of intra operative complications between low pressure pneumoperitoneum and standard pressure pneumoperitoneum laparoscopic cholecystectomy.
- To assess and compare the mean difference in visual analogue pain scale score of postoperative pain between low pressure pneumoperitoneum and standard pressure pneumoperitoneum laparoscopic cholecystectomy

METHOD AND MATERIAL

STUDY AREA: This is a randomized controlled study carried out at Sawai Man Singh Medical College and Hospital, Jaipur Rajasthan .

STUDY DESIGN: The present study was a hospital based double blind randomised comparative interventional study.

STUDY PERIOD: The study period was from July 2019 to December 2020.

SAMPLING TECHNIQUE: This study included 120 patients of cholelithiasis which were divided into two groups of 60 patients each. Patients for each group were selected using a chit method. Group A was offered laparoscopic cholecystectomy under low pressure pneumoperitoneum (8 mm Hg) and group B underwent laparoscopic cholecystectomy using Standard pressure pneumoperitoneum (12 mm Hg).

STUDY POPULATION: All patients of symptomatic cholelithiasis between 18 years to 65 years of age report to general surgery department of SMS Hospital Jaipur Rajasthan .

INCLUSION CRITERIA: The patients with chronic calculous cholecystitis with American Society of Anaesthesiologists (ASA) physical status grades 1 and 2 .

EXCLUSION CRETERIA:

1. Patients with severe cardiorespiratory comorbidities, renal failure, hepatic failure. (ASA grade 3 or more)
2. morbid obesity.
3. previous upper abdominal surgery.
4. Acute calculous cholecystitis.
5. Gall bladder malignancy.
6. Haemorrhagic and bleeding disorders.
7. Empyema Gall bladder.
8. Age below 18 years and above 65 years.
9. Patients refusal to give informed consent.

METHODOLOGY: The study was approved by the ethical committee of the institute and a prior informed consent was taken from patients. All patients underwent basic relevant investigations and a formal preanesthetic check-up. In all the cases the same General Anaesthesia was used. All cases were operated by senior surgeons having more than 10-year experience in laparoscopic surgery. All patients underwent standard four-port laparoscopic cholecystectomy.

PROCEDURE: Pneumoperitoneum was created by using a Veress needle and first port was inserted at a pressure of 12 mm Hg. In the standard pressure group, the pressure was taken up to 12 mm Hg whilst in the low pressure group the pressure was reduced to 08mm Hg for the remaining duration of surgery. Factors such as surgical difficulty, duration of surgery and conversion to standard pressure were considered.

BLINDING: As postoperative pain is a subjective finding, so as to minimise the bias, double blinding was adapted . Both the patients and the investigator who recorded the Aisual Analogue Pain score did not know the group to which the patient was allocated.

Postoperative analgesia was administered in the form of injection Tramadole100 mg intramuscularly on demand. Postoperative pain was assessed using VAS score (0-10) at 1,6,12, 24 hours, respectively. Patients were encouraged for early ambulation and were allowed oral liquids 12 hours after surgery as protocol patients were discharged 48 hours following surgery.

All patients were evaluated for various intraoperative factors and postoperative outcome and data was analysed using the IBN statistical package for social sciences (SPSS) version 17.0. Chi-square test and unpaired T test were used for comparison of data between two groups. A *p* value of <.05 was considered significant.

OBSERVATION AND RESULT

Table 1 – Demographic profile

1.A Age Distribution	**Age Groups**	**Group -A 8 mmHg**	**Group -B 12 mmHg**	**Total**
1.	20 – 30	28	26	54
2.	31-40	14	16	30
3.	41-50	11	10	21
4.	51-60	07	08	15
Total		60	60	120
1.B Sex Distribution	Sex	Group – A 8 mmHg	Group-B 12 mmHg	Total
1.	Female	49	52	101
2.	Male	11	08	19
Total		60	60	120
1.C ASA Grading	Grade	Group – A 8 mmHg	Group-B 12 mmHg	Total
1.	I	48	46	94
2.	II	12	14	26
Total		60	60	120

Table 2 Operative Events

2.A Mean Duration of Surgery	**Group -A 8mmHg**	**Group- B 12mmHg**	**P value (0.473)**
Minutes	26.30	25.10	Insignificant
2.B Mean Intraoperative Gas Consumption	Group-A 8mmHg	Group-2 12mmHg	P value (0.000036)
Litres	52.15	74.12	Significant
2.C Intraoperative Complications	Group-A 8mmHg	Group-B 12mmHg	P value (0.761)
None	50	53	Insignificant
Bleeding	2	1	
Bile Spillage	3	1	
2.D Conversion (low to standard pressure)	Group-A	Group-B	P value (0.431)
Cases(number)	02	00	Insignificant

Table 3 Post Operative Events

3.A Abdominal Pain (Mean Visual Analogue Scale)	**Group-A 8mmHg**	**Group-B 12mmHg**	**P value (<0.001)**
1 hour	4.93	7.43	Significant
6 hour	2.39	4.74	Significant
12 hour	1.25	3.28	Significant
24 hour	0.31	1.18	Significant
3.B Shoulder Tip Pain	Group-A 8mmHg	Group-B 12mmHg	P value (0.00142)
Present	12.34%	36.32%	Significant
3.C Nausea and vomiting	Group-A 8mmHg	Group-B 12mmHg	P value (0.764)
Present	21%	22.4%	Insignificant
3.D Analgesic Required	Group-A	Group-B	P value (0.00132)
Yes	53.34%	78.46%	Significant
3.E Time at which first dose of analgesic given	Group-A	Group-B	P value (0.0051)
Time (mean) minutes	43	25	Significant
3.F Total Analgesic Requirement(Ampoules of Tramadol)	Group-A 8mmHg	Group- B 12mmHg	P value (.0041)
Ampoules (mean)	0.58	1.06	Significant

DISCUSSION

Laparoscopic cholecystectomy is the gold standard procedure for symptomatic cholelithiasis. It is a novel technique which results in less pain, minimal scar and early recovery[7]. However early postoperative pain after laparoscopic cholecystectomy is a frequent complain. Nowadays surgical procedures shift towards day care surgery thus emphasizing the importance of improving early postoperative pain. The pain after laparoscopic cholecystectomy may be incisional, intra -abdominal or referred to shoulder as shoulder tip pain[8,9]. There are numerous measures in the literature to reduce the frequency and intensity of pain like the use of intraperitoneal local anaesthetic , intra peritoneal normal saline infusion and the use of heated carbon dioxide gas at 37^0 C for laparoscopy but none of the above mentioned inventions have found a routine use in every day practice[10,11].Several studies shown that the degree of stretching of the intra abdominalcavity is a significant source of post operative pain and overstretching of the diaphragmatic muscle fibres due to the high pressure of insufflation causes shoulder tip pain after laparoscopy[12,13] . In our study, we have analysed and compare various intra and post operativefactors while doing laparoscopic cholecystectomy under low pressure settings (08 mm Hg).

In our study Cholelithiasis is commonly seen in middle aged females. This study also showed female predominance with a mean age of 36.12 ± 3.1 years[1]. There was no significant difference in terms of complication like bleeding or bile duct injury and conversion to open cholecystectomy in both groups.

There was no difference in mean duration of surgery in both the groups which is comparable with the results of previous studies. The mean carbon dioxide gas consumption was significantly higher in the 12mm Hg group .

Abdominal pain ,Shoulder tip pain was significantly reduced at 1 ,6 , 12 hours and 24 hours postoperatively in the low pressure group, but it was similar at 48 hours in both the groups. Analgesic requirement significantly decrease in low pressure group. Analgesic requirement in standard pressure group significantly demand in early compare to low pressure group[14]. Total amount of analgesia was significantly higher in standard pressure group. Various studies on shoulder tip pain post cholecystectomy under low pressure had shown similar results. There were no long term complications.

Low-pressure pneumoperitoneum laparoscopic cholecystectomy (LPLC) has been shown to have less postoperative abdominal pain and shoulder-tip pain. All patients in both groups could be discharged on the next day. Patients' demographics and operation time were comparable in both groups. There were no treatment-related morbidity and mortality. Two patients in the LPLC convert to standard pressure because of inadequate exposure due to bleeding and adhesions, and the operations were successful in all of them. Otherwise, no conversion to open procedure was noted in both groups. The consumption of analgesics was minimal and a high level of satisfaction was achieved in both groups of patients. The present study demonstrated significant difference in LPLC and standard-pressure pneumoperitoneum laparoscopic cholecystectomy in the outcomes of out patient laparoscopic cholecystectomy[15,16] . Routine use of lower-pressure pneumoperitoneum in outpatient LC would be recommended in selected straightforward cases.

Pain following pneumoperitoneum for laparoscopic cholecystectomy is related to a number of factors[17]. Whilst tissue injury at port insertion sites and gall bladder bed are probably the most important contributing factors, other factors that have been proposed are peritoneal stretch, diaphragmatic stretch and chemical irritation of the peritoneum by carbon dioxide and attendant carbonic acid formation, and stimulation of the sympathetic nervous system by hypercarbia[18]. our study shows high incidence of abdominal and shoulder tip pain in standard pressure group compare to low pressure group with statistical difference. It also shows that higher demand for analgesia was significant in the first 24 hours after surgery for the standard pressure group compare to low pressure group .

CONCLUSION

Laparoscopic cholecystectomy under low pressure settings (08 mm Hg) causes minimal cardiorespiratory changes and significant reduction in both the incidence and the intensity of the post-operative pain. Laparoscopic cholecystectomy under low pressure may be suitable for the elderly and patients with mild cardiorespiratory comorbidities. On the basis of these results the widespread use of low pressure pneumoperitoneum for laparoscopic cholecystectomy in experienced hands is recommended.

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