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Research Article

A comparison of intravenous lignocaine, intraperitoneal lignocaine, a combination of both on bowel recovery and pain relief in patients undergoing laparoscopic cholecystectomy

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ABSTRACT

Background: Laparoscopic cholecystectomy (LC) is being increasingly performed as a day care surgery. Pain and lack of early bowel movements are common reasons preventing discharge on the same day.
Methods: Study was conducted in a Government tertiary care institute in Kerala, South India. The effect of Intraperitoneal (IP), Intravenous (IV) and a combination of both on postoperative pain relief and bowel recovery was studied in 75 patients who were randomized in to 3 equal groups undergoing elective laparoscopic cholecystectomy. Group 1 IP lignocaine, Group 2 IV lignocaine and Group 3 combination of IP and IV lignocaine.
Results: The time of bowel recovery and the pain scales at different time was compared using ANOVA test. Intergroup comparison of bowel recovery and pain scale was done using Bonferroni test. Pain score shows a statistically significant difference between Group 1 and Group 2 with a p value <0.001 and a statistically significant difference between Group1 and Group3 with a p value 0.126, but no statistical significance between Group 2 & Group3. The return of bowel activity was noted with perception of bowel movements and time for passage of flatus compared among the group, there was a statistically significant difference between the three groups. Group 2 was found to be significantly better than the Group1 and Group3.
Conclusions: Intravenous lignocaine is superior in bringing out early return of bowel activity when compared to all groups and Intravenous lignocaine is superior compared to intraperitoneal lignocaine in pain relief.

Keywords: Laparoscopic cholecystectomy, Intravenous lignocaine, Intraperitoneal lignocaine, Pain

INTRODUCTION

Laparoscopic cholecystectomy (LC) is being increasingly performed as a day care surgery to reduce hospital costs. Various factors are responsible for precluding discharge following LC on a day-care basis. Pain and postoperative nausea and vomiting (PONV) are the most important parameters to be considered for discharge on the same day of surgery. Various strategies have been adopted to reduce the pain following LC like the non-steroidal anti-inflammatory drugs (NSAIDs), intraperitoneal local anaesthetics, wound site local anaesthetics, intraperitoneal saline infusion, removal of insufflated gas and intravenous infusion of lignocaine. The use of intraperitoneal local anaesthetics has been in vogue and has been proven to decrease the postoperative pain in LC.[1] The use of intravenous lignocaine has renewed interest among surgeons as it decreases pain and furthermore it expedites the return of bowel activity.[2]

This study was undertaken to compare the effects of intravenous lignocaine, intraperitoneal lignocaine and a combination of both for pain relief and bowel recovery following laparoscopic cholecystectomy.

METHODS

Prospective randomized single blinded comparative study conducted in elective operation theatre of Govt. Medical College, Kozhikode for 18 months in 75 subjects who was randomized into 3 groups with 25 subjects in each groups. Group I Intraperitoneal group (IP), Group II (IV) Intravenous group, Group III combined intraperitoneal and intravenous group.

Inclusion criteria

Patients undergoing elective laparoscopic cholecystectomy under general anaesthesia (GA) of either gender.

- Age 20-60 years
- Weight 50-80 kg
- ASA I and II

Exclusion criteria

- Patients with chronic pain diseases other than gall stones
- Patients on treatment with opioids, steroids or NSAIDs
- Allergy and contraindication to lignocaine
- Conversion to open cholecystectomy
- Patients who do not comprehend to numerical rating scale
- Procedures
- Informed consent was taken from each subject

Cases were randomized into 3 groups as mentioned above. All patients received oral ranitidine 150 mg and metoclopramide 10 mg on previous night of surgery and on the morning of surgery. On arrival to the operation theatre, monitors were attached for ECG monitoring, non-invasive blood pressure, SPO_2 and baseline parameters was recorded.

Each patient received IV glycopyrrolate 0.2mg and IV ondansetron 0.1 mg/kg and IV midazolam 0.01 mg/kg.

A person, independent of the investigators, involved in the patient care prepared sterile solutions outside the operating room and corresponding, solutions were given to the anaesthetist and operating team. To ensure blinding to the group allocation.

After pre oxygenation for three minutes, patient was induced with thiopentone sodium, endotracheal intubation was facilitated with muscle relaxant succinylcholine, and anaesthesia was maintained with isoflurane in a mixture of N_2O and O_2. Muscle relaxation maintained with intermittent doses of vecuronium bromide.

Pneumoperitoneum with a standard intra-abdominal pressure (12 mmHg) was created.

Group I (IP) received 100ml 0.2% lignocaine in the right diaphragmatic surface at the end of the surgery.

Group II (IV) received 1.5 mg/kg lignocaine intravenous bolus dose at induction and was maintained on an infusion at 2mg/kg/hour for entire duration of surgery and this was continued till the end of one hour in the postoperative period. Solution used in this study was 2% lignocaine for intravenous use (Xylocard).

Group III (IP + IV) received 1.5mg/kg bolus and followed by 1mg/kg infusion for entire duration surgery was continued to the end of one hour in postoperative period along with 100ml of 0.1% intraperitoneally over the right diaphragmatic surface.

RESULTS

The data collected using a proforma and tabulated in Microsoft Excel spreadsheet and analysed using SPSS. The time of bowel recovery and the pain scales at different time was compared using ANOVA test. Intergroup comparison for bowel recovery and pain scale was done using Bonferroni test.

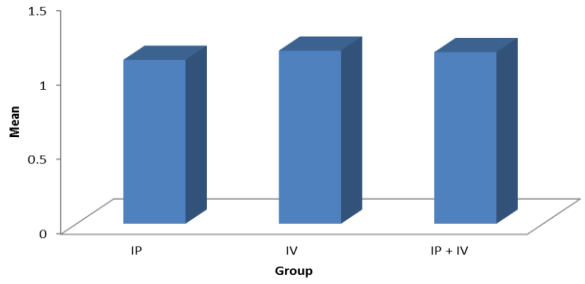

Figure 1: Duration of surgery.

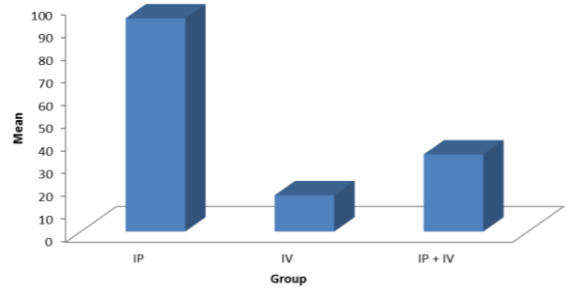

Figure 2: Total analgesic requirement.

Age distribution

Mean age of study population (mean+SD)

IP group was (48.04+14.752)

IV group was (47.80+12.646)

IP + IV group was (43.92+10.508)

Weight distribution

The mean distribution of weight in the

IP group was (61.34+9.2508)

IV group was (61.160+11.1596)

IP + IV group was (62.344+12.7286)

Sex distribution

Females outnumbered males in the entire study population with 47 females and 28 males. In the group I (IP) females were 18 and 7 males; group II (IV) 17 females and 8 males and in group III (IP+IV) 12 females and 13 males.

Co-morbidities

In the study, those in group I (IP), 10 (40%) had no comorbidities, 5 (20%) had diabetes mellitus, 7 (28%) had hypertension, 2 (8%) had other comorbidities; 1 (4%) had both DM and hypertension and other comorbidities. Those in group II (IV) 14 (56%) had no comorbidities, 5 (20%) had DM, 4 (16%) had hypertension, 1 (4%) had other comorbidities, 1 (4%) had DM, HTN and other comorbidities. Those in group III (IP + IV) 16 (64%) had no comorbidities, 1 (4%) had DM, 6 (24%) had hypertension, 2 (8%) had DM and hypertension (Table 1).

Duration of surgery

The mean duration of surgery in hours (mean + SD) in 3 groups were,

Group I (IP) 1.1000 + 0.28541

Group II (IV) 1.1620 + 0.37726

Group III (IP + IV) 1.1520 + 0.32483

Duration of surgery in hours was compared among the 3 groups using ANOVA test and the difference was not statistically significant with a p value of 0.778 (Chart1).

Pain scores

Pain score at 1 hour

The mean pain score in group I (IP) was 5.40 + 1.472. In group II (IV) was 2.28+1.568 and group III (IP+IV) was 3.64+1.846 which shows that the mean pain score was less in group II (IV) compared to the other two groups at the end of 1 hour postoperatively.

The pain scores at the end of 1 hour postoperatively was compared in between the 3 groups using bonferroni test which shows a statistically significant difference between group I (IP) and group II (IV) with a p value of <0.001 and a statistically significant difference between group I (IP) and group III (IP+IV) with a p value of 0.001 but no statistically significant difference between group II (IV) and group III (IP+IV) (Table 2).

Pain score at 8 hours

The mean pain score in group I (IP) was 3.68+2.076. In group II (IV) was 0.96+1.338 and group III (IP+IV) was 1.88+1.616 which shows that the mean pain score was less in group II (IV) compared to the other two groups at the end of 8 hours postoperatively.

The pain scores at the end of 8 hours postoperatively was compared in between the 3 groups using bonferroni test which shows a statistically significant difference between group I (IP) and group II (IV) with a p value of <0.001 and a statistically significant difference between group I (IP) and group III (IP+IV) with a p value of 0.001 but no statistically significant difference between group II (IV) and group III (IP+IV) with a p value of 0.181 (Table 3).

Pain score at 24 hours

The mean pain score in group I (IP) was 1.36 + 1.319. In group II (IV) was 0.12 + 0.332 and group III (IP + IV) was 0.68 + 0.945 which shows that the mean pain score was less in group II (IV) compared to the other two groups at the end of 24 hours postoperatively.

The pain scores at the end of 24 hours postoperatively was compared in between the 3 groups using bonferroni test which shows a statistically significant difference between group I (IP) and group II (IV) with a p value of <0.001 and a statistically significant difference between group I (IP) and group III (IP + IV) with a p value of 0.043 but no statistically significant difference between group II (IV) and group III (IP + IV) with a p value of 0.126 (Table 4).

Return of bowel activity

The mean time taken by the patient to perceive the bowel movement was 22.164+2.6191 in group I (IP). In the group II (IV) 16.320+3.1253 and group III (IP+IV) was 19.728+1.887.The time for passage of flatus is expressed as (mean + SD) in group I (IP), group II (IV) and group III (IP + IV) was (23.148+2.4989), (17.832+2.6780) and (20.528+2.0578) respectively.

The perception of bowel movement and time for passage of flatus was compared using Bonferroni test and there

was a statistically significant difference in between the three groups which also shows that the group II (IV) to be better in bowel recovery compared to the group I(IP) group and group III (IP + IV) (Table 5).

Total analgesic requirement in 24 hours

The mean tramadol requirement for patient in the

Group I (IP) was (94+44.06)

Group II (IV) was (16+31.358)

Group III (IP+IV) was (34.417+7.48)

The mean analgesic requirement in 24 hours was highest in group I (IP) and lowest in group II (IV). These were compared in between the groups and found that there is a statistically significant difference between group II (IV) and group I (IP) and group III (IP+IV) but no statistically significant difference between group II (IV) and group III (IP+IV) (Chart 2).

Table 1: Co-morbidities.

Group	Co-morbidities	Frequency	Percentage
IP Group	No comorbidities	10	40
	Diabetes mellitus	5	20
	Hypertension	7	28
	Others	2	8
	DM + HTN + others	1	4
	Total	25	100
IV group	No comorbidities	14	56
	Diabetes mellitus	5	20
	Hypertension	4	16
	Others	1	4
	DM + HTN + others	1	4
	Total	25	100
IP + IV group	No comorbidities	16	64
	Diabetes mellitus	1	4
	Hypertension	6	24
	Others	2	8
	Total	25	100

Table 2: Intergroup comparison for pain score at 1 hour.

Dependent variable	(I) Randomization group	(J) Randomization group	Mean difference (I-J)	Std. Error	Sig.
Pain 1 hour	1	2	3.120*	0.463	0.000
		3	1.760*	0.463	0.001
	2	1	-3.120*	0.463	0.000
		3	-1.360*	0.463	0.013
	3	1	-1760*	0.463	0.000
		2	1.360*	0.463	0.013

Table 3: Intergroup comparison for pain score at 8 hours.

Dependent variable	(I) Randomization group	(J) Randomization group	Mean difference (I-J)	Std. Error	Sig.
Pain 8 hr	1	2	2.720*	0.482	0.000
		3	1.800*	0.482	0.001
	2	1	-2.720*	0.482	0.000
		3	-0.920	0.482	0.181
	3	1	-1.800*	0.482	0.001
		2	0.920	0.482	0.181

Table 4: Intergroup comparison for pain score at 24 hours.

Dependent variable	(I) Randomization group	(J) Randomization group	Mean difference (I-J)	Std. Error	Sig.
Pain 24 hr	1	2	1.240*	0.270	0.000
		3	0.680*	0.270	0.043
	2	1	-1.240*	0.270	0.000
		3	-0.560*	0.270	0.126
	3	1	-0.680*	0.270	0.043
		2	0.560	0.270	0.126

Table 5: Intergroup comparison for return of bowel activity.

Dependent variable	(I) Randomization group	(J) Randomization group	Mean difference (I-J)	Std. Error	Sig.
Percept of bowel movements	1	2	5.8440*	0.7337	0.000
		3	2.4360*	0.7337	0.004
	2	1	-5.8440*	0.7337	0.000
		3	-3.4080*	0.7337	0.000
	3	1	-2.4360*	0.7337	0.004
		2	3.4080*	0.7337	0.000
Time of passage of flatus	1	2	5.3160*	0.6861	0.000
		3	2.6200*	0.6861	0.001
	2	1	-5.3160*	0.6861	0.000
		3	-2.6960*	0.6861	0.001
	3	1	-2.6200*	0.6861	0.001
		2	2.6960*	0.6861	0.001

DISCUSSION

Due to improvements in laparoscopic techniques and the growing expertise, LC is increasingly being performed as a day-care procedure. But early discharge has been restricted by postoperative factors like pain and PONV3.Hence, pain following LC is a major limiting factor to early discharge. This in turn increases the duration of hospital stay, delays return to daily activities, increases costs associated with opioid usage and treatment of complications associated with opioid usage and treatment expenses thereby undermining the very basis of performing LC as a day care procedure despite minimization of surgical complications.

Pain following LC is complex and multifactorial in nature, including incisional pain, visceral pain and shoulder tip pain and it does not resemble pain following other laparoscopic procedures.[4] Of these three types of pain incision pain accounts for 50% to 70% of the pain followed by pain due to creation of pneumoperitoneum which is 20% to 30% and the remaining 10% to 20% is due to cholecystectomy.[5] Pain following LC is usually most intense on the day of surgery and declines to low levels over the next 2-4 days.[5] Various methods have been described to reduce the postoperative pain following LC. They are, using reduce size trocars, gas insufflation at a lower pressure, use of nitrous oxide in place of carbon dioxide, active evacuation of gas by manual compression or suction or both at the end of the surgery, use of pre-warmed, humid gas instead of cold and dry gas, use of incisional local anaesthetics, use of non-steroidal anti-inflammatory drugs (NSAIDs),epidural analgesia, multimodal analgesia including prophylactic NSAIDs along with incisional and intraperitoneal local anaesthetics and the use of intravenous lignocaine have been described in an attempt to reduce postoperative pain.[4,3,6] In the present study we have attempted to compare the effect of intraperitoneal and intravenous lignocaine and a combination of both to reduce the postoperative pain and early bowel recovery.

Lignocaine has been administered intraperitoneally for pain relief by various researchers and a metaanalysis which reviewed the use of intraperitoneal use of local anaesthetics has shown an overall reduction in visceral and parietal pain, postoperative opioid analgesic and the need for rescue analgesia.[7] The mechanism by which intraperitoneal lignocaine acts is blockade of free afferent nerve endings in the peritoneum along with reduced nociception due to absorption of the drug from the peritoneal cavity.[7]

A study done by Elhakim et al used 200 ml of 0.1% lignocaine instillation in the gall bladder fossa after removal of gall bladder in LC and observed decreased

pain and opioid usage.[8] Ahmed et al in their study found reduced pain and analgesic requirement following the use of lignocaine and bupivacaine.[9] In the present study intraperitoneal lignocaine was used to provide pain relief. As this study is a comparative study with no placebo group the efficacy of IP lignocaine could not be assessed, but the pain scores were more when compared with IV lignocaine and combined intravenous and intraperitoneal lignocaine group.

IV lignocaine has been proved to reduce postoperative pain, duration of postoperative ileus, PONV along with reduction in opioid consumption, following abdominal surgeries.[10]

The mechanism by which IV lignocaine causes pain reduction is by suppression of neural excitability, in the dorsal horn neurons, depressing the spike activity, amplitude and conduction time in myelinated A and unmyelinated C fibres, blockade or inhibition of nerve conduction, suppressing central sensitization, inhibiting spinal visceromotor neurons and by virtue of its anti-inflammatory effect.[11] IV lignocaine also reduces the postoperative ileus by decreasing the opioid consumption, decreasing the sympathetic tone and by its anti-inflammatory activity.[10]

A study done by Wu et al had used IV lignocaine in LC to evaluate the interaction effect of combination of pre-incisional dextromethorphan and IV lidocaine on pain management.[11] They concluded that the combination provides an additional effect on postoperative pain relief and a synergistic effect to accelerate recovery of bowel function following LC. In this study there was no significant improvement in bowel function. This was attributed to the differences in the total dosage of lignocaine and severity of laparoscopic cholecystectomy.

Rimback et al studied the use of intravenous lignocaine in open cholecystectomy and found that there was an early return of bowel function (37.60+2.40 hours) following surgery.[12] The current study has also proved that IV lignocaine provides a faster return of bowel function in contrary to the study done by Wu et al. In the present study, the time to passage of flatus in group II (IV) was (17.832+2.678 hours), group I (IP) was (23.148+2.4989) and group III (IP+IV) was (20.528+2.0578).

The current study attempted a comparison between IV and IP lignocaine and combination of both.

A similar study comparing preventative IP versus IV lignocaine has been done in patients undergoing laparoscopic appendicectomy.[13] They observed both IV and IP lignocaine to be equally effective. In the present study IV lignocaine was superior to IP lignocaine and combination of both in recovery of bowel activity.

In the current study, the pain score measured using numerical pain scoring was done and compared between the IP, IV and combined groups found that there was significant difference in the pain score between the intravenous group and intraperitoneal group and between intraperitoneal group and combined group but there was no statistically significant difference on the pain score between intravenous group and combined group.

The total analgesic requirement was more in the intraperitoneal group and was less on the intravenous group. They were compared in between the three groups and there was a statistically significant difference in between intravenous and intraperitoneal group and also on intraperitoneal and combined group, but there was no statistically significant difference between the intravenous group and combined group.

This study attempted to find out which route of administration of lignocaine is more efficacious. Though Intravenous lignocaine is effective, it is difficult to administer a calculated dose of lignocaine throughout the surgery and for one hour postoperatively. The cumulative dose needed is substantially higher than intraperitoneal route, where a fixed dose is administered. It is relatively easier to administer intraperitoneal lignocaine. There were no side effects related to lignocaine toxicity in form of cardiovascular or neurological complications in the current study. Intravenous lignocaine administration may be difficult compared to intraperitoneal lignocaine. Also, the dose needed may be higher if the duration of LC is prolonged due to operative factors.

A study done by Wulf et al using intraperitoneal bupivacaine found no difference in time of passage of flatus.[14] But the current study observed an early return of bowel activity noted in patients receiving intravenous lignocaine in line with the metaanalysis10. This property of intravenous lignocaine can boost its use as a reliable analgesic in the setting of day-care surgery for LC.

Intraperitoneal lignocaine is inferior to intravenous lignocaine in reducing postoperative pain, analgesic requirement and return of bowel activity. However intraperitoneal lignocaine was not administered as a preventive modality when compared to intravenous lignocaine. Preventative analgesia has been shown to reduce postoperative pain and analgesic requirement when compared to other modalities because of reduction in afferent signalling and decreased mediator release. Through these parameters it is clear that administration of intraperitoneal lignocaine at the end of the surgery can be an effective alternative when intravenous lignocaine administration is not possible or contraindicated.

The merits of this study were that this is the first trial comparing intravenous and intraperitoneal lignocaine and combination of both in LC. The limitation of the current study was that blood lignocaine levels were not monitored in the patients. However a similar dosage and route of administration of lignocaine was found safe in other studies. The efficacy of intraperitoneal lignocaine

was not assessed independently due to lack of a placebo group. The timing of administration of intraperitoneal and intravenous lignocaine was also different. This could not be rectified because intraperitoneal lignocaine is administered in the gallbladder fossa at the end of the surgery.

CONCLUSION

Intravenous lignocaine is superior to intraperitoneal lignocaine and its combination in bringing out early return of bowel activity.

Intravenous lignocaine is superior compared to intraperitoneal lignocaine in pain relief following laparoscopic cholecystectomy but however there is no advantage of combining both in terms of postoperative pain relief.

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