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Study of the Effect of Intra-abdominal Lidocaine on Postoperative Abdominal and Scapular Pain in Elective Laparoscopic Cholecystectomy Candidates

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ABSTRACT

Pain control during the first 24 hours after laparoscopic surgery is of particular importance. Different methods for this purpose are listed that include the intraperitoneal administration of Morphine, Bupivacaine, Lidocaine, etc. The aim of this study is prevalence of intraperitoneal administration of Lidocaine on pain and shoulder pain in the postoperative, in patients undergoing elective laparoscopic cholecystectomy surgery. This study was a double blind clinical trial on 80 patients that were for elective laparoscopic cholecystectomy surgery. They were divided randomly into two groups of 40 numbers that in the first group after laparoscopy and before leaving the trocar, 100 cc Normal Saline containing 200 mg of Lidocaine in the diaphragm, and peritoneal cavity was sprayed and in the second group only 100 cc of Normal Saline was sprayed into the abdomen. After the surgery abdominal pain and shoulder pain ruler of patients with pain (10.1) hours, 1, 2, 4, 6, 12, 18 and 24 were measured. The mean age in the saline group was 40.92±14.28 and in Lidocaine group was 43.95±17.79 (P=0.404). The mean weight in the saline group was 67.58±12.92 and in Lidocaine group was 68.65±11.7 (P=0.698). Results did not show the difference between the two groups in terms of sex, age and weight. The mean pain in 24 hours in normal saline group was 4.15±1.22 and in Lidocaine group was 1.52±0.63 (P=0.194). Nausea, vomiting, dizziness, Tinnitus and numbness around the mouth in both groups, at different times did not show a statistically significant difference. Tranquilizer intake for 1, 4, 6, 12 and 24 days after surgery in Lidocaine group compared with Normal Saline group was less but the difference was not significant. Intraperitoneal administration 200 mg Lidocaine in patients undergoing surgery elective laparoscopic cholecystectomy is not effective in reducing pain and shoulder after surgery.

Key words: Intra-abdominal, Lidocaine, Cholecystectomy, Elective Laparoscopic

1. INTRODUCTION

Postoperative pain is considered as one of the most common causes of patients' fear of surgery. Prevention and treatment of this pain can lead to increased patient satisfaction, their faster ambulation, and decreased complications as atelectasis and finally, reduced morbidity and mortality (1). Today, despite the pharmacological information on analgesics, narcotics, and pain physiology, and also vast developments in pain control methods, there is still considerable patient complaint of postoperative pain. Presently, narcotics used in the surgery to control pain have specific known complications and after-effects including respiratory depression, nausea, vomiting, and so on. Hence, the prevention and treatment of postoperative pain and the related side-effects as nausea and vomiting constitute one of the major problems of postoperative care which may not only lead to pathophysiologic effects, but also can change the patient's life quality and produce psychologic effects. So, pain control plays an important role in the patient's quick ambulation, decreasing the complications of atelectasis, nausea, and vomiting, and increasing the

patient's surgical satisfaction. In addition to this strategy, a decreased administration of narcotics and analgesics especially in bolus doses is favorable (2). Acute postoperative pain control during the first 24 hours after surgery in the Acute Pain Control Unit is the anesthesiologist's main responsibility for controlling the patient's postoperative acute pain. Most of the patients undergoing laparoscopic surgery complain of the postoperative scapular pain (shoulder pain). Joint injuries are among the uncommon causes of these pains (1). Thus, we may attribute the postoperative pain to the probable effects of administered anesthetics during surgery and the resulting tissue damage leading to the activation of pain path. This study investigated the effect of intra-abdominal lidocaine on postoperative abdominal and scapular pain in elective laparoscopic cholecystectomy candidates.

2. MATERIALS AND METHODS

The present study was a random double-blind clinical trial performed on 80 candidates of elective laparoscopic cholecystectomy under general anesthesia. The patients were selected with simple sampling and assigned randomly to one of the two groups: 40 patients in the experimental and 40 others in the control group. After wheeling the patients into the operating room, the patients' monitoring was performed including electrocardiography, pulse oximetry, $ETCo^2$, and noninvasive blood pressure. The anesthesia method in all patients was the same and included propofol 2.5 mg/kg, and fentanyl 2-3 µg/kg. Atracurium 0.5 mg/kg was used for muscular relaxation (flaccidity). To maintain anesthesia, a mixture of Nitrous oxide gas 50% along with oxygen and isoflurane 1-1.2% was used after intra-tracheal intubation. ECo^2 was maintained within 35-40 limits and the muscular relaxant was repeated every 20 minutes. The laparoscopic procedure was performed with the same surgical team using the same method for all of the patients. The laparoscopic surgery was performed after the peritoneal cavity was insufflated with CO^2 and the intra-abdominal (endoceliac) pressure reached to 13 mmHg. At the end of surgery, the muscular relaxation was counteracted (antagonized) using neostigmine 2.5 mg along with atropine 1.25 mg. The patients were extubated after appropriate awakening and proper respiration and transported to the recovery room. The patients were divided into two equal groups using the random numbers table. In the first group, 100 mL of Normal Saline Solution containing 200 mg of Lidocaine was applied to the phrenic and peritoneal region after the end of laparoscopy and before the removal of trocar. In the second group, only 100 mL of Normal Saline Solution was applied to the diaphragm and peritoneal region at the end of laparoscopy and before the removal of trocar. In the case of the presence of abdominal drainage, the drain was clamped for 15 min and the patients were positioned head-down so that the solution could be in touch with the tissues. The administrator of the solution was not aware of the type of the solution and it was prepared beforehand by the anesthesiologist's assistant and handed in to the surgical team. The patients were assigned to one of the two groups based. The codes given to them using the random numbers table. Written informed consent was obtained from each patient and they were informed about the study process and the types of probable drugs they were supposed to take. The abdominal and scapular pain scores after surgery and during the first 24 postoperative hours of 1, 2, 4, 6, 12, 18, and 24 were determined, and the amount of administered analgesics during the 24 postoperative hours and the postoperative consequences as nausea, vomiting, dizziness, tinnitus, and circumoral numbness and tingling were studied. The measurements and data record were performed by the researcher after surgery that was not aware of the prescribed drug for the patients. The abdominal pain was studied using the Pain Assessment Ruler. In this scale, pain is divided into 10 subscales and pain can range from no pain to severe pain. The scapular pain score was determined using the following method: 1) no pain, 2) unpleasant sensation without pain, 3) mild pain with no need for analgesics, 4) moderate pain and the need for analgesics, 5) severe pain in need of analgesics and narcotics. 25 mg of intravenous pethidine was administered if the patient had a pain score of 4 or more with pain assessment ruler or a scapular pain score of 4 or more. In the case of nausea or vomiting, 10 mg of intravenous metoclopramide was administered. The collected data in addition to the patients' demographic information were recorded in a questionnaire prepared beforehand. The data were collected and analyzed with SPSS16 using X^2 and Mann-Whitney Tests.

3. RESULTS AND DISCUSSION

A total of 80 patients underwent elective laparoscopic cholecystectomy in this study. 40 candidates were given intraperitoneal lidocaine. Of these, 13 patients (16.2%) were male and 67 patients (83.8%) were females. A comparison of gender, weight, and age shows no significant difference (P-value>0.05). The abdominal pain rates in the two groups at different times after surgery were not statistically different (P-value>0.05). The rate of postoperative abdominal pain decreased in both groups with the passage of time that was statistically significant (Table 1).

Table 1. Comparing of abdominal pain in two groups at different times

Group		Placebo			Lidocaine			P-value
Time	Med	Mean	Standard deviation	Med	Mean	Standard deviation		

1 hour	6.5	6.15	2.45	4.5	5.68	2.74	0.530
2 hour	4.5	4.64	1.93	4.5	4.87	1.82	0.442
4 hour	4.5	4.7	1.71	4.5	4.07	1.73	0.110
6 hour	4.5	4.61	1.91	4.5	3.92	1.74	0.109
12 hour	4.5	4	1.93	4.5	3.96	1.88	0.905
18 hour	2.5	2.77	1.39	2.5	3.11	1.57	0.315
24 hour	2.5	2.18	0.96	2.5	2.15	1.01	0.938
P-value		Less than 0.001			Less than 0.001		

The scapular pain rates in the two groups at different times after surgery were not statistically different (P-value>0.05). The rate of postoperative scapular pain decreased in both groups with the passage of time that was statistically significant (Table 2).

Table 2. Comparing of shoulder pain in two groups at different times

Group	**Normal Saline**			**Lidocaine**			**P-value**
Time	Med	Mean	Standard deviation	Med	Mean	Standard deviation	
1 hour	1	1.45	0.71	1.5	1.88	1.11	0.080
2 hour	1	1.78	1.07	1	1.75	1.03	0.924
4 hour	1	1.52	0.78	1	1.78	1.07	0.340
6 hour	1	1.40	0.63	1	1.52	0.716	0.438
12 hour	1	1.22	0.57	1	1.45	0.78	0.208
18 hour	1	1.10	0.30	1	1.25	0.71	0.457
24 hour	1	1.08	0.27	1	1.05	0.32	0.716
P-value		Less than 0.001			Less than 0.001		

The difference in the frequency distribution of nausea incidence till 6 hours after surgery was not statistically significant in the two groups (P-value>0.05). Only 12 hours after surgery there was a statistically significant difference in the frequency distribution of nausea in the two groups (P-value= 0.43). There was more nausea in the lidocaine group at this time compared to the NSS group. There was no nausea in any group after 24 hours (Table 3).

Table 3. Comparing the frequency of nausea at different times

Group		**Normal Saline**		**Lidocaine**		**P-value**
Time		Frequency	percent	Frequency	percent	
1 hour	Yes	8	20	12	30	0.302
	No	32	80	28	70	
2 hour	Yes	12	30	16	40	0.348
	No	28	70	24	60	
4 hour	Yes	14	35	8	20	0.133
	No	26	65	32	80	
6 hour	Yes	9	22.5	11	27.5	0.606
	No	31	77.5	29	72.5	
12 hour	Yes	2	5	8	20	0.043
	No	38	95	32	80	
18 hour	Yes	6	15	3	7.5	0.288
	No	34	85	37	92.5	
24 hour	Yes	0	0	0	0	1
	No	40	100	40	100	

The frequency distribution of postoperative nausea in the two groups at the studied times revealed no statistically significant difference (P-value>0.05). There was no vomiting in any group after 24 hours (Table 4).

Table 4. Comparing the frequency of vomiting at different times

Group		**Normal Saline**		**Lidocaine**		**P-value**
Time		Frequency	percent	Frequency	percent	
1 hour	Yes	6	15	5	12.5	0.745

	No	34	85	35	87.5	
2 hour	Yes	6	15	10	25	0.264
	No	34	85	30	75	
4 hour	Yes	9	22.5	6	15	0.390
	No	31	77.5	34	85	
6 hour	Yes	6	15	7	17.5	0.762
	No	34	85	33	82.5	
12 hour	Yes	2	5	7	17.5	0.077
	No	38	95	33	82.5	
18 hour	Yes	4	10	3	7.5	0.692
	No	36	90	37	92.5	
24 hour	Yes	0	0	0	0	1
	No	40	100	40	100	

The frequency distribution of the need for pethidine in the two groups at the studied times revealed no statistically significant difference (P-value>0.05). None of the groups needed pethidine after 24 hours (Table 5).

Table 5. Comparing the frequency of vertigo at different times

Group		Normal Saline		Lidocaine		P-value
Time		Frequency	percent	Frequency	percent	
1 hour	Yes	1	2.5	4	10	0.166
	No	39	97.5	36	90	
2 hour	Yes	1	2.5	4	10	0.166
	No	39	97.5	36	90	
4 hour	Yes	3	7.5	2	5	0.644
	No	37	92.5	38	95	
6 hour	Yes	2	5	2	5	1
	No	38	95	38	95	
12 hour	Yes	0	0	0	0	1
	No	40	100	40	100	
18 hour	Yes	0	0	0	0	1
	No	40	100	40	100	
24 hour	Yes	0	0	0	0	1
	No	40	100	40	100	

Note: There was no tinnitus or circumoral numbness (tingling) in any patient.

On the whole, the lidocaine group received pethidine 1.55±1.55 times averagely and the NSS group 1.85±1.05 times which are not significantly different (P-value=0.228). This means that the lidocaine group patients received a mean amount of 38.75±28.83 mg of pethidine and the NSS patients received a mean amount of 46.25±26.28 mg of pethidine. The mean abdominal pain score of males was averagely 4.47±0.73 in the whole study and that of females was 3.98±1.22 which were not statistically significant (P-value = 0.444). The mean scapular pain score of males was averagely 1.18±0.40 in the whole study and that of females was 1.49±0.58 which were not statistically significant (P-value = 0.053). On the whole, 5 males (38.5%) and 42 females (62.7%) developed nausea which was not statistically significant regarding the low number of males (P-value=0.104). 4 males (30.8%) and 32 females (47.8%) developed vomiting which was not statistically significant regarding the low number of males (P-value=0.260). 3 males (23.1%) and 11 females (16.4%) developed vertigo (dizziness) which was not statistically significant (P-value=0.563). 12 males (92.3%) and 53 females received pethidine during the study which is not statistically significant (P-value=0.152). In the present study, 80 candidates of elective laparoscopic cholecystectomy were assigned to two groups of 40. The first group received 100 mL of normal saline containing 200 mg of lidocaine applied to the right and left regions of their diaphragm and the peritoneal cavity at the end of laparoscopy with the patients in the head-down position. The second group just received 100 mL of NSS applied to their endoceliac (intra-abdominal) region. The patients' pain rate was measured after surgery at hours 1, 2, 4, 6, 12, 18, and 24 with Pain Assessment Ruler (1-10). Also, the scapular pain score of the patients was determined at these hours. The mean of abdominal and scapular pain was statistically the same in both groups. Furthermore, the amount of narcotics administration during the 24 hours after surgery was the same in both groups. There was no significant difference between the two groups regarding the incidence of complications including nausea, vomiting, dizziness or

vertigo, tinnitus, and circumoral numbness. The spread of drug in peritoneum and the presence of a little amount of it in the manipulated site of peritoneum may be one of the probable causes of ineffectiveness of endoperitoneal lidocaine on the patients' postoperative pain. Another probable cause can be the narcotic received during the surgery, the effect of which may remain after surgery and lead to the patients' reduced need for analgesics at least in the initial hours after surgery. Regarding postoperative complications, no sign of poisoning was found in patients due to the safe and secure dose of lidocaine. Besides, pain assessment is a complicated issue and criteria as VAS and VRS are all subjective and does not show the patient's exact pain. If more accurate scales were used, there might be some difference in the rates of abdominal and scapular pain in the two groups. In the study by Walled El Shelbina et al, 75 patients aged 21-38 underwent gynecologic minor laparoscopy. 60 of these patients received lidocaine 120 mg thinned down in 20 mL of NSS and 15 received only 20 mL of NSS. The postoperative pain score was assessed at minute 15, and hours 1, 2, 4, 12, 24 after surgery using WBFS (Wand-baker Face pain scale). This score was lower in the lidocaine group at hours 1, 2, 4 after surgery compared to the NSS group. However, there was no significant difference between the two groups at min 15 and hours 12 and 24 after surgery (2). As it can be observed, the findings of this study are not consistent with ours. Of course, the main difference between this study and ours is in the type of surgery. These patients were candidates of gynecologic minor laparoscopy which causes less tissue damage compared to cholecystectomy. In the study by S. Striped et al, 74 female patients underwent gynecologic laparoscopy for infertility in two groups of 37. The first group received 15 mL (75 mg) of bupivacaine 0.5% and the second group received NSS. The postoperative pain at hours 2, 6, 12, 24, and 48 after surgery was not clearly different in the two groups. Yet, the amount of nausea and vomiting in the first group had reduced. This shows that the injection of 75 mg of intraperitoneal bupivacaine has no effect on postoperative pain and decreasing analgesic consumption. Yet, it has brought about a decreased rate of nausea and vomiting (3). So, the findings of this study are consistent with ours regarding abdominal pain and analgesic administration rate, yet they are not in line with our study regarding the decrease in the incidence of nausea and vomiting. Also, the intraperitoneal administration of bupivacaine has led to a decrease in these complications postoperatively. One privilege of our study is the use of lidocaine instead of bupivacaine which is safer regarding the creation of systemic poisoning as the intraperitoneal administration of 100-150 mg of bupivacaine can induce a toxic plasma concentration. Additionally, the postoperative scapular pain is studied in our research while in the study above only the postoperative abdominal pain is investigated. In the study by Ratanalappaiboon et al, 60 postpartum females undergoing TL were randomly divided into three groups: The first group received isotonic NSS, the second group 100 mg lidocaine, and the third group 200 mg intra-abdominal lidocaine. The pain score in the lidocaine groups (groups 2 and 3) was considerably lower compared to the first group; yet, the pain scores of groups 2 and 3 were not significantly different. This finding revealed the point that the administration of intra-abdominal lidocaine reduced postoperative pain in patients after TL (4). This finding is not consistent with ours. It is also inconsistent with the findings of the studies investigating the effect of local anesthetic just in gynecologic laparoscopic surgeries since there is tissue injury in TL, too. Another finding of this study concerns the lidocaine dose applied. The 100 and 200 doses are compared and no difference is reported in the results, so it can be reasoned that the low dose of lidocaine had no effect on the negative results of our study. Another important point related to the effect of local anesthetic on postoperative pain control is the injection site and patient position during injection. This might have modified the effect of local anesthetic in TL surgeries. In our study, the local anesthetic is administered in the head-down position and the drug infused into both left and right diaphragmatic regions driving the drug towards the celiac and the tail of phrenic nerve. In the study above, the drug is administered at the end of surgery. G-Smith reported briefly in British Journal of Anesthesia that local anesthesia performed intraperitoneally is effective solely in gynecologic laparoscopy and is ineffective in cholecystectomic laparoscopy since cholecystectomic laparoscopy is a long procedure causing more tissue injury. Recent evidence demonstrates that the simultaneous administration of local anesthesia in the peritoneum and incision site following cholecystectomy is still needed (5). As it can be observed, the finding of this study concerning the lack of effectiveness of local intraperitoneal anesthetic for postoperative pain control after laparoscopic cholecystectomy is consistent with ours and the less postoperative pain in women in gynecologic laparoscopic surgery using local anesthetic is due to less tissue injury in these operations. Generally, the postoperative pain in these patients is minor. Ellsberg and co-workers investigated 65 patients who were candidates of elective laparoscopic cholecystectomy. These patients were given intraperitoneal bupivacaine. The patients' pain score was assessed postoperatively with VAS at hours 2, 4, 8, 24, and 48. Their analgesics administration was also recorded. The patients' PEF (Peak Expiratory Flow) was also recorded postoperatively at hours 2, 4, 8, and 24. There was no difference among the patients regarding PEF, analgesics administration, and hospital stay (6). This finding is quite consistent with ours. Of course, bupivacaine was used for these patients and scapular pain was ignored. In a similar study by I. C. Show et al, 56 patients divided into two groups of 28 underwent major gynecologic laparoscopy. The first group received 1000 mL of NSS containing 100 mg of bupivacaine. The second group received only 1000 mL of NSS. The patients' pain score was assessed via VAS

at hours 1, 2, 6, 12, 18, and 24 after surgery. Based on the findings, there was no significant difference among the patients regarding the postoperative pain, and the amount of analgesics administration (7). This study is also consistent with ours and the researchers attribute the reasons of their findings to the laparoscopy being a major surgery and also low dose of bupivacaine which could not produce a suitable plasma concentration. The study by K. Barclay investigated 62 patients 33 of whom received 2% lidocaine. The pain of this group of patients was less than that of the control group one hour after returning to the hospitalization ward. Yet, there was no significant difference between the pain at the time of returning to the ward, discharge time, and 24 hours after operation (8). The findings of this study are not consistent with ours. The probable cause of the less pain in these patients at initial hours after surgery and their invariable painlessness in the following hours may be attributable to the short-time effect of lidocaine. The other cause may be the remaining effect of administered narcotics used during the operation. Another study was conducted by Shann Ay et al in which 370 pregnant patients with preterm delivery, caesarean indication, and no previous history of abdominal pain, randomly received intraperitoneal lidocaine or normal saline. Pain score was recorded for the first day and day 15 after surgery showing that abdominal and epigastric pain was less in the lidocaine group compared to the control group. This study revealed the effectiveness of the intraperitoneal administration of 200 mg lidocaine on reducing post-caesarean pain (9). The findings of this study are inconsistent with ours. Of course, this study deals mostly with the long-term complications of surgery. In another study by Rizvan et al 206 candidates of laparoscopic cholecystectomy were divided into two groups: 106 patients received lidocaine 2% 10 mL and another group received bupivacaine 0.5% 10 mL and NSS 10 mL. The patients' pain was assessed at hours 0, 4, 8, 12, and 24 after surgery. The abdominal pain decreased with the passage of time. However, there was no difference in the abdominal and scapular pain between the two groups at any of the times above. The study demonstrated that both lidocaine and bupivacaine are harmless and reduce the pain after laparoscopic cholecystectomy (10). The findings of this study are also different from ours. The important point in this study is that both lidocaine and bupivacaine produce a similar effect on postoperative pain reduction. The study by Yuval kaufman and co-workers divided 40 candidates of elective gynecologic laparoscopy into two groups of 20. The experimental group received bupivacaine 1% 10 mL as treatment and the control group received distilled water 10 mL intraperitoneally. The study showed no significant difference between the groups regarding abdominal pain. The abdominal and scapular pain was similar at minutes 30, 60, 120, and at hours 6 and 24 after surgery. Further, the postoperative administration of narcotics had no significant difference between the two groups (11). The findings of this study are consistent with ours. Of course, this study used bupivacaine instead of lidocaine. Furthermore, the study by Keita et al (2003) divided 65 candidates of gynecologic laparoscopy into four groups. In the first group, 16 patients received intraperitoneal 0.9% saline. In the second group, 15 patients received 0.5% bupivacaine 100 mL. In the third group, 16 patients received morphine 3 mg and in the fourth group, 18 patients received a combination of morphine 3 mg and bupivacaine (12). The postoperative pain score was not different at rest and coughing in the four groups based on VAS. Also, the incidence of nausea and vomiting was not different among the four groups. Further, the use of multi-modal analgesia (morphine and bupivacaine) did not reduce the postoperative pain significantly in patients. This finding is consistent with our results. Even the addition of intraperitoneal morphine to local anesthetic could not affect the postoperative pain and complications in patients.

4. CONCLUSION

Generally speaking, based on the findings of this study, it seems that the intraperitoneal administration of lidocaine 200 mL after elective laparoscopic cholecystectomy has no considerable effect on the abdominal and scapular pain and also postoperative complications.

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