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EFFECT OF LUNG RECRUITMENT TECHNIQUE WITH SOFT ABDOMINAL PRESSURE IN DECREASING POST-LAPAROSCOPIC PAIN

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ABSTRACT

Background: Laparoscopic surgery is more superior in rapid emergence. Laparoscopic surgery requires smaller incisions, has less pain after surgery compared to laparotomy. The frequency of shoulder pain following laparoscopic gynecologic surgery is 80%. **Goal**: To determine influence of intraperitoneal infusion of normal saline by surgeons or lung recruitment technique by anesthesiologists on the diminution of pain at shoulder and incision locations following elective laparoscopic surgery. **Methods**: Our prospective, randomized and double-blind study enrolled 120 patients, average aged 42.4 yrs. [31-55], American Society of Anesthesiologists physical status I, of both sexes and scheduled for different elective laparoscopic surgery at King Hussein hospital, KHMC hospital, Amman, Jordan, during the period Jan 2020 – Jan 2021.Patients were divided in three groups. Group I patients had intraperitoneal administration of saline with 1-2 ml/kg while group II patients had respiratory recruitment using 5 manual inflations at 60 cm H2Oand group III patients had mild abdominal pressure. All patients were evaluated during the 1st postoperative day. Outcomes were pain in shoulder or incision locations, and side effects were nausea, vomiting and distension. These were recorded instantly postoperatively and at 1, 4, 10 and 24 hours postoperatively. Verbal analog scale (VAS) was used to determine the pain severity (0: no pain;1-3: mild pain;4-7:moderate pain;8-10:severe pain). Multivariate ANOVA calibrated for agewas used to analyze the influence of procedures and duration on the outcome (shoulder pain and the incision locations pain). **Results**: There was a discrepant profile for pain in shoulder and incision locations at various time intervals within the different groups. Patients in group II experienced remarkably less shoulder pain one day following laparoscopic surgery ($P = 0.04$) and patients in group III experienced remarkably less incision location pain ($P < 0.003$). Interaction of time interval with procedure condition was remarkable for shoulder and incision locations pain ($P < 0.02$). **Conclusions**: Lung recruitment technique with soft abdominal pressure was better than intraperitoneal infusion of normal saline 0.9% with soft abdominal pressure for diminution of pain in the first day following elective laparoscopic surgery.

KEYWORDS: Lung Recruitment; Intraperitoneal Infusion; Laparoscopy; Pain.

INTRODUCTION

Laparoscopic surgery is more superior in rapid emergence.[1] Laparoscopic surgery requires smaller incisions, has less pain after surgery compared to laparotomy.[2] The frequency of shoulder pain following laparoscopic surgery is 35-80 %.[3] Shoulder pain might be severe during the first day following laparoscopy.[3]

If carbon dioxide is held in the area between liver and diaphragm during laparoscopic operation, it stimulates phrenic nerve with pain in shoulder and high abdomen.[3] Methods of decreasing post laparoscopic shoulder pain but with partial action are: less pressure gas, cleaning diaphragm with local anesthetic, local anesthesia of peritoneum and (NSAIDs) nonsteroidal anti-inflammatory drugs.[4]

There are other methods which potentially may reduce different types of pain following laparoscopic surgery. Intraperitoneal normal saline removes the CO2 as physiological buffer, lengthened-time action and can lessen pain in shoulder and high abdomen during laparoscopic operation.[5,6] Respiratory recruitment may lessen high abdominal pain after operation[7], by mechanically escalating intraperitoneal pressure to remove remaining CO2 postoperatively.[7]

The purpose of this study was to determine the influence of intraperitoneal administration of normal saline by surgeons and Respiratory recruitment by anesthesiologists on the diminution of pain in shoulder and the incision locations following elective laparoscopic surgery.

METHODS

This prospective, randomized and double-blind study enrolled 120 patients, average aged: 42.4 yrs.[20-65], American Society of Anesthesiologists physical status I, of both sexes and scheduled for various elective laparoscopic surgery at King Hussein hospital, KHMC hospital, Amman, Jordan, during the period Jan 2020 – Jan 2021 ,after obtaining written informed consent from all participants and approval from our local ethical and research board review committee of Jordanian Royal medical services. Patients were divided using sealed envelopes in three groups. Group I patients had intraperitoneal saline with 1 - 2 ml/kg at left, middle, and right upper quadrants of abdomen at the end of the operation while group II patients had respiratory recruitment using 5 manual inflations at 60 cm H2Owhile patients are in Trendelenburg position and group III patients had mild abdominal pressure and remaining CO2 was removed by passive deflation at the end of operation. All patients were evaluated during the first postoperative day.

Outcomes were pain in shoulder or incision locations, and side effects were nausea, vomiting and distension. These were recorded instantly postoperatively and at 1, 4, 10 and 24 hours postoperatively. Verbal analog scale (VAS) was used to determine the pain severity (0: no pain;1-3:mild pain;4-7:moderate pain;8-10:severe pain).

Statistics

The age and the surgery period were compared in the groups with (ANOVA). Multivariate ANOVA calibrated for age was used to analyze the effects of procedures and duration on the outcome (shoulder pain and incision locations pain).P< 0.05 was considered statistically significant.

RESULTS

There were no remarkable discrepancies regarding the average period of surgery between the groups (P< 0.02). Tables I-II. There was a discrepant profile for pain in the shoulder and incision locations at various time intervals. Interaction of time interval with procedure condition was remarkable for shoulder and incision locations pain (P <0.02). There was a potential advantageous effect of lung recruitment technique on the diminution of shoulder pain after surgery. Compared to other groups, patients receiving lung recruitment technique experienced moderate shoulder pain one day postoperatively. (Average= 0.5).

Patients in group III had the least incision location pain one day postoperatively (average = 1.01). Table III. The hazards frequency within the groups during the 1st postoperative day was discrepant. The overall frequency of distension in groups I and III was more than in the other groups. Table IV.

Table I: Patients demographics.

		I	II	III
NO		40	40	40
Age(yrs.)42.4(31-55)		39.5(34-47)	43.6(36-51)	40.2(31-49)
Sex	**M**	25	19	23
	F	15	21	17
ASA	**I**			
Procedure		intraperitoneal infusion of normal saline	lung recruitment technique	Gentle abdominal pressure
Laparoscopic surgery				
General surgery		11	7	9
Bariatric surgery		9	13	14
Urology surgery		8	5	7
Gynecology surgery		12	15	10

Table II: Average time of surgery between the Groups.

	GI	GII	GIII	P
NO.	40	40	40	
Time of surgery	94.4	90.9	89.8	0.35

Table III: Average pain scores Modifications from Baseline.

PAIN at:	Group	Postoperative					P(time interval and procedure)
		Instant	1	4	10	24	
shoulder							<0.04
	I	1.34	1.60	1.55	2.50	2.17	
	II	1.26	1.56	1.89	3.02	1.52	
	III	1.91	3.38	2.01	2.51	2.36	
Incision							<0.003
	I	1.87	3.92	3.61	3.50	2.46	
	II	3.56	3.61	3.56	2.96	2.33	
	III	3.59	4.26	3.19	2.68	2.04	

Table IV: Comparison of average pain scores at shoulder and incision.

Pain location	Postop. Time interval	Group	I	II	III	P-value
SHOULDER		Average pain score				
	Instant		1.35	1.22	1.87	<0.003
	1hrs		1.62	1.62	3.37	
	4hrs		1.52	1.82	1.97	
	10hrs		2.52	2.92	2.52	
	24hrs		2.12	1.42	2.32	
INCISION						
	Instant		1.92	3.62	3.52	<0.003
	1hrs		3.87	3.62	4.22	
	4hrs		3.52	3.52	3.12	
	10hrs		3.52	2.87	2.62	
	24hrs		2.42	2.32	1.92	

DISCUSSION

Our investigation demonstrated that compared to the other groups, lung recruitment technique remarkably reduced shoulder pain after one day of surgery. In patients who received soft abdominal pressure, the incision location pain remarkably reduced following one day. Intraperitoneal saline decreased pain following cholecystectomy.[8] and laparoscopic benign gynecological operation.[6] Respiratory recruitment was more advantageous than intraperitoneal saline in decreasing pain after operation.[7] The influence of intraperitoneal saline and lung recruitment on pain of incision location is speculated. Our investigation demonstrated that incision location pain was less in patients receiving mild abdominal pressure at the first day than in the other groups.

Shoulder pain after surgery was reduced in patients receiving intraperitoneal saline or respiratory recruitment.[6]This was in accordance with ours but they found that intraperitoneal saline was more efficient than respiratory recruitmentin decreasing shoulder pain following laparoscopic benign gynecological surgery. This was because of the discrepancy in duration of follow up observation. The influence of intraperitoneal saline was recorded following two days.[6] Although intraperitoneal saline is easy applicable, it was shown that the outcome of life within the immediate time after surgery is reduced.[7] The mechanism of post-laparoscopic shoulder pain is that the remaining CO2 in the peritoneal cavity irritates the phrenic nerve and diaphragm, causing referred C4 dermatomal shoulder pain.

Intraperitoneal saline and respiratory recruitment were evaluated in a previous investigation[9] which stated that combined intraperitoneal saline and respiratory recruitment had the influence in decreasing laparoscopic shoulder pain after operation. Using the two procedures in the same time are acting with various mechanisms at various states.[9] The influence of lung recruitment technique decreases by two days and lung recruitment technique has short-period actions. Intraperitoneal infusion of normal saline has long-period actions for more than two days.[6] Patients receiving lung recruitment and intraperitoneal saline experienced less incision location pain one day postoperatively and the overall incidence of nausea and vomiting was more than in the other groups.[1] Filling the peritoneal cavity with warm saline causes CO2 rising and escaping through the ports. Normal saline acts as a physiologic buffer to dissolve CO2.Saline infusion only may induce hazards in cardiac disease from volume overload if using more than one liter of saline. The lung recruitment technique causes alveolar hyperinflation with positive airway pressure, increasing intrathoracic pressure and intraperitoneal

pressure, enhancing removal of the remaining CO2 from the peritoneal cavity. Lung recruitment technique was done mostly using a maximal inspiratory pressure of 40 or 60 cm H2O. The more pressure is correlated with hazards as barotrauma or hemodynamic compromise. Respiratory recruitment removes remaining CO2 from the peritoneum and decreases intra-abdominal acidosis and phrenic nerve and peritoneal irritation.

The advantageous influence of pain decreasing procedures in elective laparoscopic operation in patients with higher grade ASA is speculated. New procedures to decrease laparoscopic shoulder pain after surgery are evolving as oral pregabalin[10], oral gabapentin[11], acetazolamide[12] and intraperitoneal sub-diaphragmatic bupivacaine with morphine.[13]

The group study was large to find even small discrepancies between the groups, but in the same time its short follow-up observation period had negativity. The action of intraperitoneal infusion of normal saline started in two days.

IN CONCLUSION

Lung recruitment technique with soft abdominal pressure was better than intraperitoneal infusion of normal saline 0.9% with soft abdominal pressure for diminution of pain in the first day following elective laparoscopic surgery. Lung recruitment procedure is safe and feasible. Soft abdominal pressure had less incision location pain at first day than other groups.

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