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CASE REPORT

Effectiveness of Intraperitoneal Bupivacaine in General Anesthesia for Laparoscopic Appendectomy

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ABSTRACT

Introduction: Appendicitis is an inflammation of vermiform appendix organ. It is a medical emergency case and one of the most common acute abdominal cases. The removal of acute appendix with minimally invasive surgery, laparoscopic procedure, is associated with shortened recovery time and length of stay in hospital, reduced risk of postoperative wound infections, also improved cosmetic outcomes. Anesthesia procedure for laparoscopic in Indonesia is usually performed under general anesthesia (GA) which has effective and safe form of sedation. One local anesthesia agent that often used in laparoscopic procedure is bupivacaine. Studies have shown that intraperitoneal bupivacaine as analgesia after laparoscopy can reduce postoperative pain, such as visceral pain associated with tissue injury and the stretching of nerve endings in the peritoneal cavity, parietal pain related to the incisional trauma at the port sites, and shoulder pain referred by stretching of the diaphragm.

Case report: Mr. TA, 27 years old, his lower right abdomen hurt and he was diagnosed with acute appendicitis ASA II. Patients performed with laparoscopic procedure under general anesthesia. Fentanyl 2 mcg/kg, propofol 2 mg/kg, rocuronium 0.6 mg/kg, and sevoflurane 1 MAC, 50% FiO_2 : 50% water, 4 lpm flow were administered. After 90 minutes of surgery, 40 cc of 0.5% intraperitoneal bupivacaine was administered. Patient was assessed for the NRS score within 30 minutes after laparoscopic procedure. The NRS score was 0.

Conclusion: It has been reported a patient underwent laparoscopic appendicitis procedure received intraperitoneal bupivacaine as a postoperative analgesia which provided quicker recovery and good improvement of pain control without any significant negative consequences.

Keywords: Appendicitis; General anaesthesia (GA); Intraperitoneal Bupivacaine; Laparoscopy; Pain.

INTRODUCTION

The vermiform appendix is inflamed in appendicitis. Appendix is a hollow organ found near the cecum's tip, generally in the right bottom quadrant of the abdomen. Appendicitis most commonly affects people between the ages of 5 and 45, with a mean age of 28. The incidence is around 233 per 100,000 people. Men are somewhat more likely than women to have acute appendicitis, with lifetime incidence rates of 8.6% and 6.7%, respectively. In the United States, around 300,000 hospital visits are made each year for appendicitis-related complications[1,2].

An appendectomy is the gold standard therapy for acute appendicitis. However, the laparoscopic procedure is favoured over the open approach for appendectomy. Several studies have compared the results of laparoscopic appendectomy patients to those of open appendectomy patients. The findings implied that the patients who received laparoscopic procedure can be associated with a shortened recovery time and length of stay in the hospital, reduced risk of postoperative wound infections, also improved cosmetic outcomes. However, pain is one of the complication of laparoscopic procedure that must be treated. Several methods have been tried for controlling postoperative pain after laparoscopic, including the procedure of anesthesia that acted as analgesia[1,3].

Anesthesia procedure for laparoscopic is usually performed under general anesthesia (GA). General anesthesia (GA) helps to alleviate respiratory distress and cardiovascular alterations caused by laparoscopy's pneumoperitoneum induction. Therefore, general anesthesia (GA) is an effective and safe form of sedation for laparoscopic procedure. Besides, local anesthesia can be used to reduce postoperative pain without producing any side effects. The local anesthesia agents provide antinociception by affecting nerve membrane associated proteins and by inhibiting the release and action of prostaglandins that stimulates the nociceptors and causes inflammation. One agent of local anesthesia that often used is bupivacaine with intraperitoneal administration[4,5].

Thus, this case report aimed to explain the anaesthetic management of a patient who underwent laparoscopic appendicitis procedure, specifically to

investigate the use of intraperitoneal bupivacaine as analgesic for the patient under general anesthesia (GA).

CASE

Anamnesis

Mr. TA, 27 years old, working as a police officer, unmarried, and lived in East Jakarta, came to ER Bhayangkara TK I R. Said Sukanto Jakarta Hospital. He complained of pain in the lower right abdomen since 1 day ago. He said that at first, he felt pain in the middle of abdomen around the umbilical since 3 days ago. Then at night, abdominal pain was felt to migrate from the middle of abdomen to the lower right abdomen. Abdominal pain felt worse since 2 days ago, especially with changing positions from lying to sitting or when doing activities. Pain also persisted in the lower right abdomen. Other complaints experienced by him were fever, nausea, and vomiting 3 times containing food and water. The pain in the lower right abdomen was unbearable accompanied with lost of appetite since 1 day ago. He claimed that he felt weak since he threw up all of the meal. He can still fart, has no difficulty defecating, and did not experience liquid, mucus, or bloody stools. During urination and after urination, the patient did not feel pain, did not need to strain before urination, and the bladder was not gritty or bloody. Then, the patient was brought by family to ER Bhayangkara TK I R. Said Sukanto Jakarta Hospital for further treatment.

Hypertension, type 2 diabetes, heart disease, asthma, pulmonary tuberculosis, or allergies are denied by the patient. This is the first time that the patient has complained of right abdominal pain. There was no family history of hypertension, type 2 diabetes, heart disease, asthma, pulmonary tuberculosis, or allergies. The patient is not currently on any medications and has never had surgery. There was no history of smoking, drinking alcoholic beverages, or using illegal drugs.

Physical examination

During the preoperative physical examination, his weight is 102 kg and his height is 185 cm. General condition of the patient appeared to be moderately ill and compos mentis consciousness with GCS 15 (E4V5M6). Blood pressure = 115/72 mmHg, pulse = 80 bpm (beat per minute), respiratory rate = 20 x/minute, temperature = 36.5 ^{o}C, and oxygen saturation = 99% room air. On examination, the head was found to be normocephalic, there were no anemic

conjunctiva or icteric sclera in both eyes. On the face and neck, there was no injury, good neck movement in all directions. Symmetrical left and right chest movements, vesicular breathing sound in both lungs, no crackles or wheezing in both lungs. I/II heart sound was regular, no murmurs or gallops were found. On abdominal examination, there was a convex shape, no injury was found, bowel sounds (+), soft, there was tenderness in the right iliac region, and tympanic sounds throughout the abdominal area. Mc Burney's sign (+), Rovsing's sign (+), Blumberg's sign (+), Psoas sign (-), and Obturator sign (-). Alvarado score for the patient was 9, so that the patient was diagnosed with acute appendicitis. In the upper extremities, right and left, warm acrals were found, no edema, and capillary refill times were <2 seconds. In the lower extremities, right and left, warm acrals were found, no edema, and capillary refill times were <2 seconds.

Table 1 Alvarado Score[2]

Feature	Score	In this Patient
Migration of pain	1	1
Anorexia	1	1
Nausea	1	1
Tenderness in right lower quadrant	2	2
Rebound pain	1	1
Elevated temperature	1	0
Leukocytosis	2	2
Shift of white blood cell count to the left	1	1
	Total score	9

Total score 5-6: likely appendicitis (compatible)
Total score 7-8: most likely appendicitis (probable)
Total score 9–10: very likely appendicitis (very probable)

Table 2 Laboratory Examination on September 29th, 2022

Parameter	Result	Reference
Hb	14,3	13 – 16 g/dL
Htc	43	40 - 48 %
RBC	4,2	4 – 5 million/µL
WBC	11.140	5.000 – 10.000/µL
PLT	334.000	150.000 – 400.000/µL
Diff Count		
Bas	0	0 – 1 %
Eos	2	1 – 3 %
Stem neutrophils	5	2 – 6 %
Seg. neutrophils	85	50 – 70 %
Lymph	38	20 – 40 %
Mon	6	2 – 8 %
BT	2	1 – 6 Min
CT	11	10 – 15 Min
SGOT	14,2	<37 U/L
SGPT	18,7	<40 U/L
RBG	107	<200 mg/dL
Ureum	22	10-50 mg/dL
Creatinine	0,7	0,5-1,5 mg/dL
GFR	129	>=90 mL/min/1,73 m^2
Sodium	137	135 – 145 mmol/L
Pottasium	3,9	3,5 – 5,0 mmol/L
Chlroide	103	98 – 108 mmol/L
Alkaline Phosphate	77	53 – 128 U/L
Gamma GT (GTT)	22	<49 U/L
Albumin	4,5	3,5 – 5,2 g/dL
Total Protein	6,4	6,0 – 8,7 g/dL
Globulin	1,9	2,5 – 3,1 g/dL
Total Bilirubin	0,88	<1,5 mg/dL
Direct Bilirubin	0,16	0,5 mg/dL
Indirect Bilirubin	0,72	1,0 mg/dL
Urine		
Color	Dark yellow	
Clarity	Clear	
Reaction/pH	46,5	5 – 8,5
Specific gravity	1.0244	1.000 – 1.030
Protein	Negative	Negative
Bilirubin	Negative	Negative
Glucose	Negative	Negative
Ketones	Negative	Negative
Blood	Negative	Negative
Nitrite	Negative	Negative
Urobilinogen	0,1	0,1 – 1,0 IU
Leukocytes	Negative	Negative
*Erythrocytes	0 - 1	0 – 3/LFV
* Epithelial Cells	1+	Negative/SFV

*Cylinder	Negative	Negative/SFV
*Crystal	Negative	Negative/LFV
*Leukocytes	1 - 2	0 – 5/LFV

Chest X-ray examination of the patient showed no radiological abnormalities in the heart and lungs.

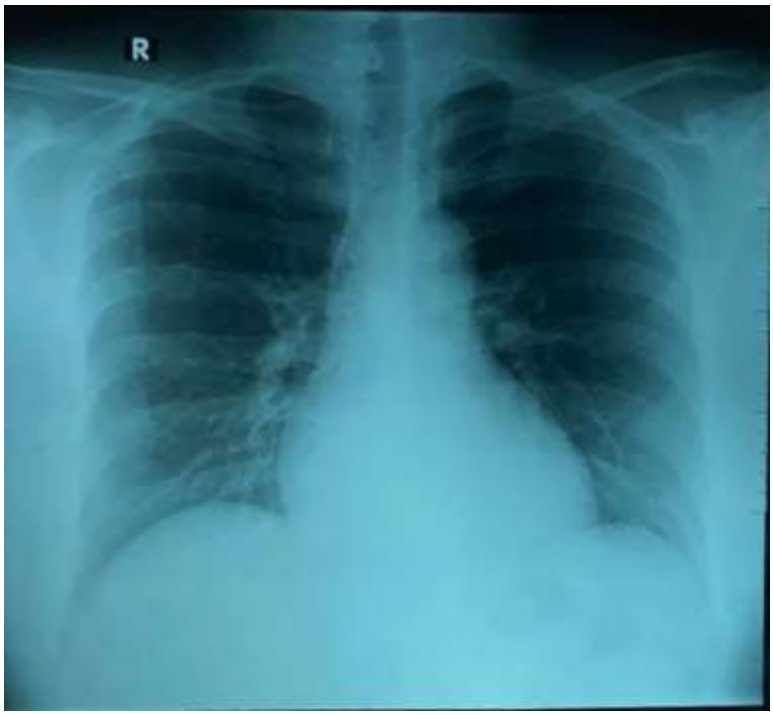

Figure 1. X-ray examination of the thorax (Source : Author's documentation)

Anesthesia Management

Before surgery, patients with physical status of the American Society of Anesthesiologists (ASA) class II were given intravenous fluids in the form of Ringer Lactate 500 cc 20 drops per minute. Premedication in this patient used midazolam injection at a dose of 5 mg intravenously and ondansetron injection at a dose of 4 mg intravenously. Then blood pressure, pulse rate, respiratory rate, and oxygen saturation were monitored. General anesthesia for the patient were fentanyl 2 mcg/kg body weight, propofol 2 mg/kg body weight, and rocuronium 0.6 mg/kg body weight. Sevoflurane 1 MAC, 50% FiO_2 : 50% water and a total flow of 4 lpm (liter per minute) is also administered for the patient. Hemodynamic state at the

beginning of the surgery was blood pressure 115/72 mmHg with a pulse rate of 80 bpm (beat per minute).

The patient was in trendelenburg position at the time of laparoscopic procedure. After 90 minutes of surgery, the patient was in supine position and 40 cc of 0.5% bupivacaine was administered intraperitoneal. Intraperitoneal administration of bupivacaine was done by the laparoscopic operator (surgeon) by spraying it thoroughly in the abdominal cavity right before all the trocars were removed from their sites.

The hemodynamic state during the laparoscopy ranged from 115-128 mmHg for systolic blood pressure, 72-88 mmHg for diastolic blood pressure, and 80-87 bpm (beat per minute) for pulse rate.

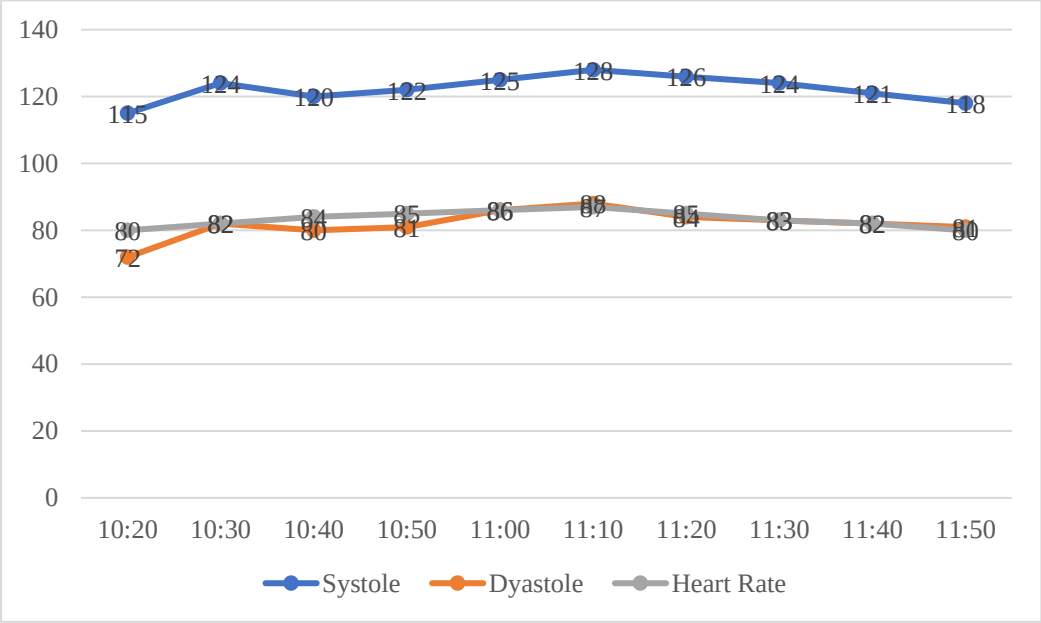

Figure 2. Intra-Anesthesia Vital Signs (Source : Author's documentation)

Postoperative Management

After the laparoscopic procedure was completed, the patient was transferred to the recovery room. The patient was conscious, blood pressure was 118/81 mmHg, pulse rate was 80 bpm (beat per minute), respiratory rate was 18 x/minute, and oxygen saturation was 97% with nasal cannula O_2 2L/minute. Pain assessment was performed on the patient 30 minutes after laparoscopic and NRS (Numeric

Rating Scale) was obtained 0. 30 mg of ketorolac was administered intravenously if needed. NRS was carried out for 24 hours after patient underwent the laparoscopic procedure. The result of the NRS (Numeric Rating Scale) after 2 hours of the laparoscopic procedure was 0, after 6 hours was 2, after 12 hours was 3, after 18 hours was 1, and after 24 hours of the laparoscopic procedure was 0. There was also a graph which explained the NRS (Numeric Rating Scale) from the patient in this case after the laparoscopic procedure.

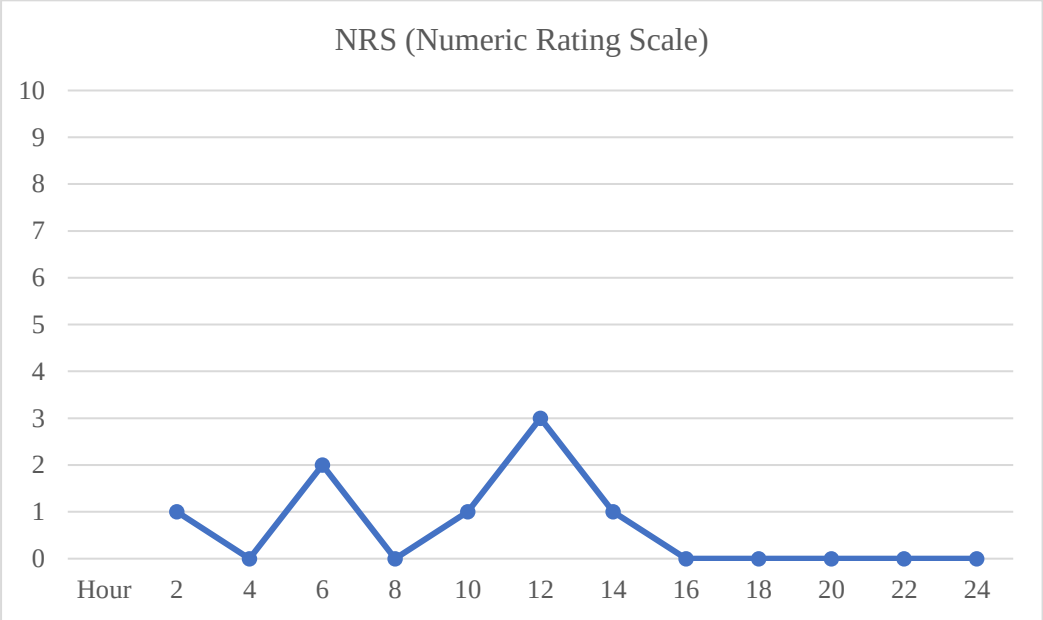

Figure 3. Numeric Rating Scale (Source : Author's documentation)

DISCUSSION

Mr. TA went to the Emergency Room of the Bhayangkara TK I R. Said Sukanto Jakarta Hospital. He was 27 years old, worked as a police officer, single, and lived in East Jakarta. Since the previous day, the patient has been complaining of pain in the lower right abdomen. Based on physical examination and investigations, the patient was diagnosed with acute appendicitis. Appendix is a midgut organ and is first identified at 8 weeks of gestation as a small outpouching of the cecum. During progression of gestational phase, it becomes longer, tubular, and fixed in the right lower quadrant of abdomen. The size of the appendix is vary (5 to 35 cm in length) but averages 9 cm in length in adults.

The blood supply of the appendix is derived from the superior mesenteric artery. The appendiceal tip may be found in a variety of locations, such as retrocecal (60%), pelvic (30%), and retroperitoneal (7-10%). Knowledge of the location of the appendiceal tip is important for diagnosing acute appendicitis patient according to their clinical symptoms[6].

Appendicitis is an inflammatory process or inflammation of the vermiform appendix organ. Acute appendicitis is a medical emergency case and is one of the most common acute abdominal cases. It is caused by obstruction of the lumen of the appendix which causes vascular congestion, ischemic necrosis, and infection[1].

Appendicitis is most common at the age of 10-20 years. The ratio of men to women ratio is 1.4:1. Studies in the United States showed the lifetime risk of developing appendicitis was 8.6% for men and 6.7% for women. Complicated appendicitis was reported in 16.5% to 24.4% of cases[2,7].

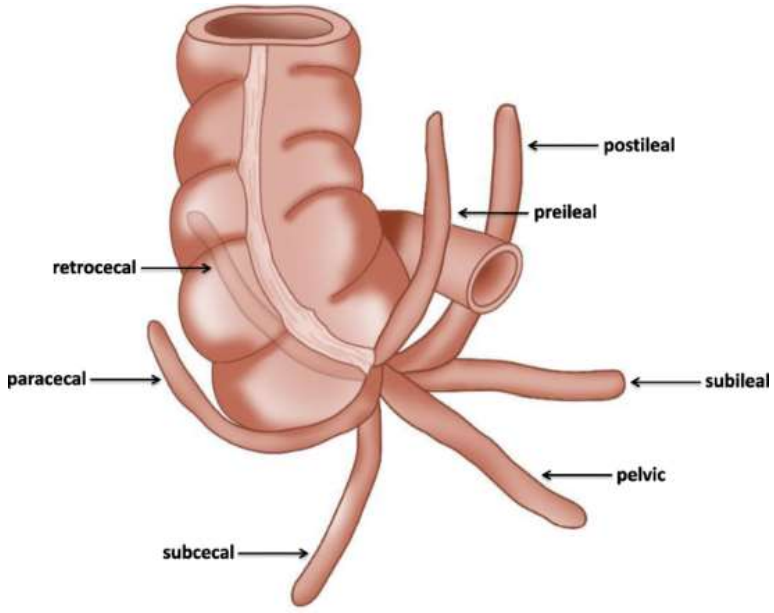

Figure 4. Anatomy of Appendix (Source : Fenwick, A.K., Hartery, A. Appendicitis and beyond: a pictorial review of various appendiceal abnormalities. Emerg Radiol 28, 651–664 (2021).

In this case, the patient felt pain in the middle of abdomen around the umbilical at first then the pain migrated and localized in the lower right abdomen. Typically, appendicitis presents as an initial generalized or

periumbilical abdominal pain that localizes to the right lower quadrant. Initially, the visceral afferent nerve fibers at T8 through T10 are stimulated, leading to vague centralized pain. As the appendix becomes more inflamed and the adjacent parietal peritoneum is irritated, the pain becomes more localized to the right lower quadrant. The initial pain represents a referred symptom resulting from the visceral innervation of the midgut, and the localized pain is caused by involvement of the parietal peritoneum after progression of the inflammatory process. Pain may or may not be accompanied by any of the following symptoms such as anorexia, nausea/vomiting, fever (40% of patients), diarrhea, generalize malaise, and urinary frequency or urgency. The time course of symptoms is variable but typically progresses from early appendicitis at 12 to 24 hours to perforation at greater than 48 hours. Seventy-five percent of patients present within 24 hours of the onset of symptoms. The risk of rupture is variable but is about 2% at 36 hours and increases about 5% every 12 hours after that[9].

The patient was defined as American Society of Anesthesiologists (ASA) class II. Then, the patient was decided to undergo surgery. Appendectomy, or appendix removal, is the primary treatment for an appendix that is inflamed or has burst. During a laparoscopic, a surgeon reaches the appendix through a few small incisions in the abdomen. They use a small, narrow tube called a cannula to inflate the abdomen with carbon dioxide. The gas allows them to see the appendix more clearly. After the surgeon has inflated the abdomen, they will insert a laparoscope through the incision. A laparoscope is a long, thin tube with a bright light and a camera at the front. The camera displays images on a screen, allowing the surgeon to see inside the abdomen. The appendix is tied off with stitches and removed. The small incisions are then cleaned, closed, and dressed. Laparoscopic surgery typically has fewer risks and a shorter recovery time than open appendectomy[10].

Other study said that laparoscopic procedure has several advantages over open surgery that have been demonstrated to be beneficial for both adults and children. These advantages include a shorter length of stay in the hospital, a lower risk of

postoperative wound infections, a quicker recovery time, and improved cosmetic outcomes. After a laparoscopic appendectomy, patients report much less postoperative discomfort and use less analgesic medication than those who undergo the open procedure. However, another study said that approximately one half of all surgical procedures, including in laparoscopic procedure, postoperative pain is inadequately treated so that it can cause abdominal pain and pain in other parts of the body. Abdominal pain consists two components. There are visceral pain which associated with tissue injury and the stretching of nerve endings in the peritoneal cavity also parietal pain which related to the incisional trauma at the port sites. Another postoperative pain is shoulder pain which is referred by stretching of the diaphragm. Therefore, anesthetic management is needed to reduce or even eliminate the postoperative pain[11,12].

Considerations in choosing the type of anesthesia are influenced by the following factors, such as the type and duration of the surgical procedure, the location or area of the body to be operated on, whether the procedure is an emergency or not, the length of time that the patient must fasting preoperatively, and the operating position according to indications. So, general anaesthesia (GA) is the safest and most effective form of sedation for patients undergoing laparoscopic operations as the patient in this case[13,14].

The patient in this case received bupivacaine which was administered intraperitoneally. Bupivacaine is a potent and long acting local anaesthetic having distinct properties among the amide group of local anaesthetics. Local anaesthetics usually inhibit action potential production in nerve cells by raising the threshold for electrical stimulation[13,15]. Recently, there is an increasing tendency to alternative methods with the least side effects and less invasive for relieving pain such as intraperitoneal local anesthesia. At 2 and 6 hours following laparoscopic surgery, intraperitoneal local anesthesia was quite successful in reducing postoperative pain and bupivacaine didn't appear to have any significant negative consequences[16].

Intraperitoneal local anesthetic (IPLA) delivery is a straightforward, low-cost procedure with no significant side effects. A visceral afferent pain signal is blocked by an IPLA instillation,

which may help manage visceral discomfort. It is not entirely understood how intraperitoneal instillation of local anesthetics generates analgesia; this is a particular area of uncertainty. It is possible that the primary reason is a blockage of afferent nerves and vagal endings in the peritoneum and the intestine[13,17].

Study conducted with 30 patients were in control and 37 in bupivacaine group (one patient withdrew consent before starting anesthesia) show different results. Seven control and four bupivacaine patients were eliminated. 23 control patients and 33 bupivacaine patients finished the research. Operative results matched preoperative demographics. Both groups had postoperative discomfort and used analgesics. Subgroup analysis showed that the VAS pain score after 24 hours was substantially lower in the bupivacaine group (2.1) than the control group (3.8, P = 0.007) when operation exceeded 40 minutes. Bupivacaine patients needed less opioid (9.1 mg) postoperatively than controls (10.4 mg)[10].

In terms of pain, analysis showed that VAS scores were significantly lower in the postoperative period in RA (Regional Anesthesia) patients than their counterparts (RA-VAS vs GA-VAS: 1.85 ± 0.58 vs 3.77 ± 0.73 ; $P < 0.001$)[15]. This makes it possible for patients receiving GA to require adjuvant analgesics after surgery. A successful anaesthesia was achieved during a laparoscopic appendectomy performed under low-pressure CO2 pneumoperitoneum by using a combination of hyperbaric bupivacaine at a concentration of 0.5% and a fentanyl. It provides patients with improved pain control, quicker recovery, and reduced expenditures associated with the operating room. We urge that spinal anaesthesia be used more frequently for laparoscopic appendectomy, particularly in patients who pose dangers for general anaesthesia[11]. It would appear that intraperitoneal bupivacaine instillation at the site of surgery and in the subdiaphragmatic region does not impact postoperative pain score (PS) or insicional pain (IP) in children. On the other hand, it appears to lessen the severity of the postoperative pain at 12 and 24 hours after the operation and also lessen the requirement for postoperative

analgesics. An increase in the number of patients will allow for the generation of findings that are more relevant[10].

Previous studies have proven the effectiveness of intraperitoneal local anesthesia administration in providing postoperative pain relief. Postoperative patients who received intraperitoneal local anesthesia consumed fewer opioid than patients who did not receive intraperitoneal local anesthesia (intravenous or placebo). Consequently, there were fewer opioid-mediated side effects in patients who received the intraperitoneal local anesthesia[13].

Another studies that have been conducted reported the administration of 20 ml bupivacaine 0.25% intraperitoneally in the minimally invasive surgery reduced the pain score which was measured on the day of the surgery. It also reduced the used of narcotic/opioid drugs on the day of surgery and the first day after surgery. Thus, it can be concluded that although the dose was smaller, the effectiveness of pain prevention was better and also the cost was low with or without the using of opioid[18]. In this case, 40 cc of bupivacaine was administered because the patient was obese so it was expected with 40 cc dose, the effect of bupivacaine would remain optimal. However, this case report has some limitations because it was performed only in one patient and it did not record the need for opioid use.

CONCLUSION

It has been reported that a patient underwent laparoscopic appendicitis procedure using general anesthesia (GA). In this case, the patient received intraperitoneal bupivacaine as a postoperative analgesia. Therefore, intraperitoneal bupivacaine has been shown to be very useful in laparoscopic appendicitis procedure under general anesthesia (GA).

It has been reported that a patient underwent laparoscopic appendicitis procedure received intraperitoneal bupivacaine as a postoperative analgesia which provided quicker recovery and good improvement of pain control for the patient without any significant negative consequences.

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