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Original Research Article

Clinical Experience of Intraperitoneal Lavage with Sodium Bicarbonate Solution on Pain after Midline Laparotomy

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ABSTRACT

Introduction: Due to the fact that postoperative pain can cause complications and patient dissatisfaction, and since studies on the effect of sodium bicarbonate solution on postoperative pain are limited, the present study aimed to determine the effect of sodium bicarbonate solution on pain score. **Material and Methods:** In this study, which was the result of a clinical experiment during 2019, 50 patients who were candidates for elective surgery with midline laparotomy were examined. At the end of the operation, the patients underwent intraperitoneal lavage with 7% sodium bicarbonate solution and normal saline. Pain intensity was assessed using a visual pain scale. **Results:** The mean pain score 2,4,6,12,18 and hours after the intervention was significantly lower in the intervention group than the control group [P=0.001] **Conclusion:** Using a combination of sodium bicarbonate solution and normal saline for intraperitoneal lavage is a simple and uncomplicated method that can help reduce patients' pain for up to 24 hours after surgery and reduce the need for sedation.

Keywords: Intraperitoneal, Midline Laparotomy, Sodium Bicarbonate, Pain

Introduction

Surgery causes local tissue damage that results in the release of painful substances such as prostaglandins, histamine, serotonin, bradykinin, acetylcholine, lactic acid, hydrogen ions, potassium, and substance P. This stimulates and increases the sensitivity of pain receptors. Adverse effects of postoperative pain include non-discharge of respiratory secretions, respiratory problems, ileus, and prolonged hospital stay [1-3]. Hypertension and heart rate, myocardial ischemia or cardiac arrhythmias, endocrine disorders, ileus, nausea and vomiting, and deep vein thrombosis are other side effects of postoperative pain. Pain also causes anxiety and discomfort and insomnia and can delay the patient's recovery [4-6]. Proper management of postoperative pain treatment increases patient comfort, facilitates the recovery process, early return of the patient to physical activity, reduction of postoperative mortality, especially in high-risk patients, reduction of surgical complications and reduction of hospital stay [7-9]. However, according to the US National Survey, postoperative pain has remained uncontrolled and pain has not decreased in the last decade [8-10]. Today, the use of appropriate methods to control pain after surgery is a controversial medical topic. None of the pain control methods are without side effects [11]; For example, non-selective nonsteroidal anti-inflammatory drugs [NSAIDs] cause gastrointestinal disorders, platelet dysfunction, and hypovolemic kidney disease. Aspirin and nonsteroidal anti-inflammatory drugs [NSAIDs] reduce the synthesis of prostaglandins and thromboxane by inhibiting cyclooxygenase. The most common methods of pain control, especially in major surgeries, include epidural analgesia, local anesthetics combined with opioids, and intravenous opioid injections [12-14]. The main cause of pain in patients after surgery is pain following incision. Surgical incision increases lactate concentration and decreases pH in skin and muscle, which causes ischemia and subsequent pain [14]. As sodium bicarbonate solution creates an alkaline environment, it prevents acidosis and improves environmental parameters, which can lead to the removal of waste products, inflammatory tissues, and pain relief after surgery [15-17]. Due to the fact that postoperative pain can cause complications and patient dissatisfaction, and since studies on the effect of sodium bicarbonate solution on postoperative pain are limited, the present study aimed to determine the effect of sodium bicarbonate solution on pain score.

Material and Methods

Study design: The present study is a kind of clinical experience obtained from operating room operating on laparotomy patients, which was performed on 50 patients undergoing elective surgery with midline laparotomy at Imam Reza Medical Center [Tabriz Medical Sciences] in 2019.

Inclusion / Exclusion Criteria:

Inclusion criteria included being 18 to 60 years old, elective surgery with midline abdominal laparotomy, and duration of surgery between 1 and 4 hours. Exclusion criteria included decreased level of consciousness, heart problems [heart failure, ischemic diseases], hemodynamic disorders, liver, kidney and lung diseases, electrolyte disorders, mental disorders, patients with acute problems and undergoing emergency surgery and addiction.

Methodology

Patients were divided into two groups of 25 using the tenth random block method. Patients in the intervention group underwent intraperitoneal lavage with 7% sodium bicarbonate solution and normal saline. Considering that the maximum peritoneal absorption of this solution is 30%, the sodium bicarbonate solution was calculated with a dose of 2 mA / kg and a maximum dose of 80 mA / kg. Then diluted with one liter of normal saline and used for 2 to 5 minutes to wash the abdomen and after 5 minutes the fluid was sucked. The control group was washed intraperitoneally with normal saline solution alone. At the end of the treatment, arterial blood samples were taken from the patients and in case of any disorder, the necessary treatment was performed and repeated every 20 minutes until the patient normalized. After transferring patients to the ward, patients' pain intensity was recorded 12 and 24 hours after surgery. Data collection tools were patient demographic questionnaire and Visual Analog Scale [VAS]. On this scale, pain size is measured from zero to 10. To control postoperative pain, 30 mg ampoules of ketorolac and 25 mg ampoules of pethidine were injected into all patients every 8 hours for 24 hours. If patients' pain is not relieved, analgesia is added whenever necessary.

Ethical considerations

This study is the result of a research project approved by the ethics committee of Tabriz University of Medical Sciences under the number IR.TBZMED.REC.1398.278; Consent was obtained from all patients and after signing the consent, they entered the study; None of the participants were charged for participating in the study, and the project was conducted free of charge to manage their pain.

Statistical analysis: Finally, the obtained data were analyzed using SPSS software version 16. Descriptive and analytical data were analyzed and research variables were analyzed using Chi-square, Student t and Mann-Whitney tests. Significance level in this study was considered 0.05.

Results

Based on the findings of the present study, the age of patients in the control and intervention groups with the type of treatment used was not statistically significant [$P=0.47$]. Also, there was no difference between the two groups in terms of gender [$P=0.61$]. About 12 patients had colon cancer and 9 had small bowel cancer. The mean pain score 12 hours after the intervention in the intervention and control groups was 6.1 ± 1.4 and 7.5 ± 1.4 , respectively. The mean pain score 12 hours after the intervention was significantly lower in the intervention group than the control group [$P=0.001$]. Also, the mean pain scores of patients in the intervention and control groups, 24 hours after the intervention, were 2.2 ± 1.2 and 3.6 ± 1.7 , respectively. The mean pain score 24 hours after the intervention was significantly lower in the intervention group than the control group [$P=0.001$]. In order to better control pain, all patients were injected with 30 mg ampoules of ketorolac and 25 mg ampoules of pethidine every 8 hours for 24 hours. In the control group, due to the severity of pain, 2 patients [8%] also received morphine in addition to the above analgesics. Comparison of complications after using the intervention in patients Based on the findings, there was no statistically significant difference between patients in the control and intervention groups in terms of complications.

Table 1: Comparison of mean pain scores of patients in the intervention and control groups after the intervention

Variable	Groups [N=50]		P Value
	Intervention[N=25]	Control [N=25]	
Pain in 2 hours after surgery	8.2 ±1.4	9.3 ±1.2	0.001
Pain in 4 hours after surgery	7.3 ±1.4	8.6 ±1.9	0.001
Pain in 6 hours after surgery	6.5 ±1.3	7.6 ±1.3	0.001
Pain in 12 hours after surgery	6.1 ±1.7	7.56 ±1.4	0.001
Pain in 18 hours after surgery	3.4 ±1.2	5.2 ±1.6	0.001
Pain in 24 hours after surgery	2.20±1.2	3.6±1.7	0.001

Discussion

Based on the findings of the present study, the mean pain scores 12 and 24 hours after the intervention were significantly lower in the intervention group than the control group. Limited studies have been performed on the effect of peritoneal lavage of the surgical site with a combination of sodium bicarbonate and normal saline. / 0], duration of washing, intervention method [bicarbonate alone or in combination with normal saline and lidocaine], type of surgery and method of administration [washing or injection] are observed [18-20]. Despite the increasing advances in abdominal surgery, postoperative pain is still a serious problem. Typically, the pain increases during the first hour after surgery and gradually decreases after 48 to 72 hours. Also, after surgery, acute pain leads to sodium and water retention, increased free fatty acids, body ketones, and lactate, which can lead to high blood pressure, myocardial ischemia, and impaired wound healing [21-23]. There are several methods that can be used to reduce postoperative pain in patients. In their study, the researchers showed that the use of sodium bicarbonate after laparoscopic cholecystectomy reduces pain in these patients. In general, sodium bicarbonate simultaneously neutralizes the acidic effect of the peritoneal cavity environment and causes damage to the gallbladder nerve, which reduces postoperative pain [24-26]. Another study at Yamaguchi University in Japan used 7% sodium bicarbonate solution to reduce pain and flush the peritoneal cavity [27-29]. The results of this study showed that sodium bicarbonate solution is effective in reducing pain if used in an amount of more than half a liter for more than 5 minutes [30]. In another study, the effect of intra-articular injection of sodium bicarbonate with 1 dose of calcium gluconate [SBCG1] with 2 doses of calcium gluconate [SBCG2] on reducing osteoarthritis

pain in the knee was investigated. According to the findings, the pain in the first and second groups decreased by 80 and 82%, respectively, during the year [31]. The researchers found that sodium bicarbonate and lidocaine resulted in longer lasting and more effective analgesia than lidocaine alone in patients. In other similar studies, severe postoperative pain relief has been reported as a result of rinsing the diaphragm with sodium bicarbonate solution and normal saline. The researchers concluded that one of the possible mechanisms for the positive effect of intraperitoneal lavage in reducing post-laparoscopic pain is due to the improved discharge of carbon dioxide remaining from the peritoneal cavity, especially below the diaphragm area [3]. The main cause of pain in operated patients is pain following incision. Postoperative pain due to ischemia is caused by an increase in lactate concentration and a decrease in pH in the skin and muscles. Sodium bicarbonate solution creates an alkaline environment and prevents acidosis. Sodium bicarbonate solution, on the other hand, improves environmental parameters including increased phagocytic activity of peritoneal macrophages, followed by inflammation, reduced accumulation of glycosylation products, and better preservation and uniformity of mesothelial cells, which reduces pain [32]. Various studies have shown that sodium bicarbonate solution is a good mucolytic for peritoneal lavage, which reduces pain due to this property and the removal of waste products and inflammatory tissues. The results obtained from the present study show that the pain score in patients undergoing intraperitoneal lavage with sodium bicarbonate solution and normal saline is lower than those in the control group. Also, in the control group, two people needed additional narcotics due to the severity of the pain, while the intervention group did not need more painkillers, which indicates that the frequency of infection complications and the need for additional narcotics in the intervention group was lower than the control group. Was; But there was no statistically significant difference between the two groups in terms of the frequency of drug use and the incidence of complications [15]. One of the important problems in the field of public health is research on postoperative pain, its mechanism and risk factors. Improving postoperative pain increases the patient's comfort, facilitates recovery and early return of the patient to physical activity, reduces the rate of postoperative mortality, especially in high-risk patients, improves the surgical outcome and reduces the length of hospital stay. There are several ways to control postoperative pain [16]; These include the use of sedatives, anesthetics, systemic narcotics, and nonsteroidal anti-inflammatory drugs. On the other hand, the use of sedatives and anesthetics may lead to environmental and central allergies in patients. Nowadays, using new methods of creating

analgesia independently or in a complementary way can reduce some of the problems of patients and public health professionals. Reducing the frequency and severity of preoperative pain and minimizing its effect after surgery, especially in persistent and progressive pain, may require a multifaceted approach; For example, if possible, use surgical techniques that cause less tissue damage, nerve damage and inflammation. In addition, identifying patients who are prone to pain during or after surgery, during preoperative visits, can be helpful in considering measures to reduce surgical stress [17].

Concussion

Using a combination of sodium bicarbonate solution and normal saline for intraperitoneal lavage is a simple and uncomplicated method that can help reduce patients' pain for up to 24 hours after surgery and reduce the need for sedation.

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