

Two Supportive Methods on Outcome of Patients with Chest Trauma

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Abstract

This study aimed to compare of epidural analgesia plus non-invasive ventilation with intravenous analgesia plus oxygen masks on the complication of chest trauma patients. This double-blind randomized clinical trial was performed on chest trauma patients who referred to the Bahonar Hospital Emergency Department of Kerman from October 2017 to October 2018. Considering the goals of the study, 25 people enrolled in each group. The main outcomes were the need for intubation, mortality rate, length of hospital stay, length of ICU stay and pneumonia. Collected data were analyzed by SPSS 21 software. Independent t-test was used to compare the length of hospital stay, intubation, and mortality rate, and chi-square tests were used to compare the qualitative variables. In the group of patients receiving epidural anesthesia with non-invasive ventilation average hospital days ($P = 0.004$), ICU hospitalization ($P = 0.01$) and pain ($P = 0.03$), death cases ($P = 0.04$) were significantly lower than the group of systemic anesthesia recipients with an oxygen mask. But pneumonia and the need for intubation were not significantly different between the two groups. The findings of this study showed that the method of epidural analgesia combined with non-invasive ventilation in patients with chest trauma is superior to systemic anesthesia with an oxygen mask. This is important in the therapeutic process of trauma patients to reduce mortality and morbidity.

Keywords: Noninvasive ventilation, Epidural anesthesia, Intubation, Chest trauma

INTRODUCTION

According to the World Health Organization's forecast by 2020, traffic accidents alone will be the second leading cause of death worldwide [1]. A survey of trauma-related deaths per 100,000 population shows that this number is 99 in the world and 58 in Iran [2].

Chest trauma is commonly seen in patients after an accident, leading to increased morbidity and mortality in these patients [3]. Chest trauma alone accounts for 45% of all trauma-related deaths [4]. Studies show that respiratory disorder in thoracic trauma is due to intra-alveolar and interstitial fluid accumulation [5]. On the other hand, the pain reduces the patient's ability to cough and breathe, resulting in fluid and sputum accumulation and lung atelectasis, which ultimately results in decreased lung compliance and impaired ventilation-perfusion and respiratory distress [6]. Pain also increases the activity of the sympathetic neuroendocrine system with increased heart rate and increased myocardial oxygen demand and immunosuppression, increased coagulation and catabolism, and movement limitations, resulting in pulmonary problems and delayed discharge. Pain is one of the most common complaints of patients admitted to intensive care units. Effective pain control is crucial to the patient's survival [7, 8]. Various methods are used to reduce pain, including non-steroidal anti-inflammatory drugs,

opioids, or nerve blocks at the level of the spinal cord. Opioids are commonly used for this purpose in intensive care units, but complications such as suppression of respiratory activity, sedation, gastrointestinal symptoms, and urinary retention, or itching. The intravenous injection also increases the risk of infection and causes a blood clot or gas embolism [9-11].

In a 2011 study that was conducted in Iran on 60 patients with chest trauma, patients were divided into two groups. The first group was given intravenous fentanyl in the first 24 hours and epidural fentanyl in the next 24 hours, and in the second group epidural fentanyl was administered in the first 24 hours, and

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intravenous fentanyl was injected later. This study indicates that the best method of pain control in the first 2 hours is intravenous administration and in the next few hours, epidural fentanyl administration and the intravenous method the level of consciousness has been higher [6]. A 2015-2016 study in Egypt of 30 patients with multiple rib fractures indicated that the epidural analgesic recipient group had improved significantly compared to the intravenous ketorolac group [4].

A Canadian study of patients with thoracic trauma between 2008 and 2013 showed a significant decrease in mortality in the epidural anesthesia recipient group [12]. One of the most important factors is the progression of complications in trauma atelectasis, which disrupts perfusion resistance and hypoxia, so positive-pressure ventilation is recommended to reduce atelectasis [13, 14]. Non-invasive ventilation is also more flexible in use than intubation, preserving the airway defense mechanism and not interfering with the ability to swallow and speak [5]. Meta-analysis performed in the US shows that early use of non-invasive ventilation in thoracic thoracic trauma reduces the need for intubation [15]. According to the results of a 2013 study in Germany, the use of non-invasive ventilation compared to two classic respiratory support techniques including oxygen masking and intubation reduces mortality risk, decreases ICU stay, and reduces the risk of infection [16].

Meanwhile, Kerman Martyr Bahonar Training Center, the largest trauma center in the south-east of the country, receives tens of injuries daily due to traffic accidents, according to the findings, we compared the two methods of analgesia in thoracic trauma patients to find a way to reduce mortality and morbidity in traffic accident victims. We compared the oxygen mask in the Survival of Patients with Chest Trauma to find a way to reduce morbidity and morbidity in these patients.

MATERIALS AND METHODS

This study was a double-blind randomized clinical trial that was performed on patients with thoracic trauma referred to Bahonar Hospital Emergency Department of Kerman from October 2017 to October 2018.

$$n_1 = n_2 = \frac{(S_1^2 + S_2^2) \left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta} \right)^2}{(\bar{X}_1 - \bar{X}_2)^2} \quad (1)$$

With an alpha of 5% and a beta of 20%, the mean standard deviation length of hospital stay in the epidural anesthesia group was 8.07 ± 4.39 and in the systemic analgesia group 11.47 ± 4.36 days in previous studies. In that study, there were 26 people in each group, which were studied according to the multiple goals of the project, [4]. Inclusion criteria included 18 to 60 years of age, no previous disease history, patients with lung contusion with or without rib fractures who may

need respiratory support and care in the intensive care unit for reasons such as severe traumatic pain, ABG changes, etc.

Exclusion criteria included a history of previous illness, pulmonary embolism, spinal trauma, drug allergy, need for surgery, and transplantation to the operating room requiring patient intubation, personal dissatisfaction, unstable vital signs, and long bone fractures.

Study Design Methods

50 eligible individuals were randomly divided into two groups, one of epidural analgesia with noninvasive ventilation and the other with systemic analgesia with an oxygen mask using 1:1 ratio software.

In the first group, after insertion of the thoracic epidural catheter on admission to the intensive care unit in mid-thoracic epidural space (T6-T7), administration of 10 cc ropivacaine 0.5% and then 10 cc ropivacaine 0.2% per hour via pump syringe. After 12 hours, we evaluated the severity of the pain and respiratory condition of the patients through the arterial blood gas analysis, cardiac rhythm, and respiratory pattern. Simultaneous oxygen therapy was started with BIPAP with 5-10 cm of water, which was changed based on blood gas analysis and patient comfort. The second group received 5mg morphine and 30mg ketorolac through the peripheral vein and were repeated every 6 hours with a respiratory support mask that was changed based on Fio2 blood gases. A visual pain scale was used to measure pain scores.

None of the study groups were excluded from routine interventions and services routinely provided to patients with chest trauma. The main outcome measure is the need for intubation and mortality rate in patients in both groups. Secondary outcome measures included length of hospital stay, length of stay in the intensive care unit, and pneumonia.

The data collection tool was a checklist and included demographic information including trauma mechanism, vital signs, length of hospital stay, length of stay in the intensive care unit, need for intubation, pneumonia, and patient death. Patients were included in this study by obtaining consent from the patient's companions and explaining the potential benefits and risks. The data recorded from the patients in the case files will be kept confidential. Before the intervention with the patient, an explanation was given about the effects of analgesia to reduce the complications and improve the prognosis of the patient, as well as the mechanism of action of the drug by both epidural and intravenous injection. It was also assured that patient placement in either of these categories would not interfere with routine patient treatments. After data collection, data was analyzed by SPSS 21 software. Independent t-test was used to compare the length of hospital stay, intubation, and mortality rate, and chi-square tests were used to compare the qualitative variables.

The Ethics Committee of the Neurology Research Center, Kerman University of Medical Sciences, approved the protocol of the study under the code IRCT20190922044842N1 and ethical code of K/93/366. All the subjects signed an informed consent form.

RESULTS AND DISCUSSION

Of the 50 patients admitted to the Bahonar Hospital Emergency Hospital in Kerman, 25 were in group A (recipients of epidural anesthesia with non-invasive ventilation) and 25 in group B (recipients of systemic analgesia with Oxygen mask). In group A the mean hospital stay was 17 days, and 25.5 days in group B which was significantly lower in group A ($P = 0.004$). In group A the mean pain score was 3.8 and in the group, B was 4.7 which was significantly lower in group A ($P = 0.01$). In group A, the average number of days spent in ICU was 11.1 days and in group B, it was 16 days. It was inferred that the length of stay was significantly lower in group A ($P = 0.03$) (**Table 1**).

Table 1. Comparison of Hospitalization time, ICU time, Pain Score in the two groups

Variable	Systematic		Epidural		P-value
	Mean	s.d	Mean	s.d	
Hospitalization time	25/5	9/7	17	8/5	0/004
ICU time	16	8/3	11/1	7/4	0/03
Pain Score	4/7	1/4	3/8	1/2	0/01

There were 2 cases of death in group A and 7 in group B, concluding that the morbidity rate was significantly lower in group A. In group A, there were 4 cases of pneumonia in hospitalization and 7 in group B, with no significant difference between the two groups. Group A had 5 intubation requirements and group B had 10 cases with no significant difference between the two groups (**Table 2**).

Table 2. comparison Outcome, pneumonia, Intubation in the two groups

Variable		Systematic		Epidural		P-value
		Frequency	PERCENT	Frequency	PERCENT	
Outcome	Dead	7	28	2	8	0/0001
	Alive	18	72	23	92	
pneumonia	Yes	7	28	4	16	0/3
	No	18	72	21	84	
Intubation	Yes	10	40	5	20	0/1
	No	15	60	20	80	

This study aimed to compare two methods of analgesia in thoracic trauma patients to find a way to reduce mortality and

morbidity in traffic accident victims in Shahid Bahonar Hospital in Kerman. The findings of this study showed that mortality was significantly lower in patients with epidural anesthesia with non-invasive ventilation compared with systemic anesthesia with an oxygen mask. Similar to the present study in a Canadian study of thoracic trauma patients between 2008 and 2013, findings also showed a significant decrease in mortality in the epidural anesthesia group [12]. Research findings in the US have also shown that the early use of non-invasive ventilation in thoracic trauma reduces mortality [15]. The results of a study in Germany also showed that the use of non-invasive ventilation techniques reduced the risk of mortality compared to the two classic respiratory support methods including oxygen masking and intubation [16].

Another finding of this study was the lower number of hospital days in Group A compared to Group B. The number of days in ICU was significantly lower than in group B. A 2013 study by Roberts *et al.* in Germany also found that using non-invasive ventilation compared to two traditional respiratory support techniques, including oxygen masking and intubation, reduced the length of intensive care unit stay and reduced the risk of infection [16]. This is important in some ways. First, limited resources in the country's health sector necessitate efficient use of these resources, which is one of the most important indicators of the efficiency of hospital stay management to reduce hospital stays. On the other hand, it also provides more service. It also improves the quality of treatment for patients by reducing the number of days in the hospital. It also improves the quality of treatment for patients by reducing the number of days in the hospital. Patients in group A also felt less pain than patients in group B. Research findings by Ahmadinejad and colleagues in Iran also indicated that the best method of pain control in the first 2 hours was intravenous administration and in the next hours, epidural administration of fentanyl, and in the intravenous method, the level of consciousness was higher [6]. Another study reported that non-invasive ventilation is more flexible in use than intubation, preserving the airway's defense mechanism and not interfering with swallowing and speaking ability, thus making patients less likely to experience better management. The course will be cured [5]. There are various methods to reduce pain in traumatic patients, but these have some side effects for the patient that should be minimized as far as possible in this study, there was no significant difference in the rate of pneumonia in hospitalization between the two groups, which may be due to proper care of the patients studied by the hospital medical staff. Concerning the need for intubation, the findings also showed that in group A, there were 5 cases for intubation and in group B, there were 10 cases but the difference between the two groups was not significant. A study by Veysi *et al.* also suggested that early use of non-invasive ventilation in thoracic trauma reduces the need for intubation [15]. Airway management in patients is one of the primary responsibilities of an emergency medicine specialist. However, potential airway intubation is a

potentially hazardous invasive process, so using methods that reduce the need for intubation is recommended.

Fattori *et al.* In a systematic review concluded that non-invasive ventilation is a supportive treatment that can prevent intubation in patients with chest trauma as long as physiological conditions are stable, regardless of the severity of the chest injury [17]. As our results show the usefulness of non-invasive mechanical ventilation in these patients.

In a study wick conducted by Liu *et al.* It was found that Non-Invasive-Ventilation with helmet decreased complications, increased PaO₂/FiO₂, and improved Patient cooperation compared with NIV with face mask in chest trauma patients [18]. These results, like our study, demonstrate the benefits of using non-invasive mechanical ventilation in patients with chest trauma.

The correct choice of patients is one of the most important factors for success in non-invasive mechanical ventilation, as the use of this method in patients who do not cooperate well or are unstable in terms of hemodynamics will lead to treatment failure. The results of Göksu *et al.* The use of NIV in the emergency department in well-selected chest trauma patients improves their outcomes [19].

In the study of Lovisari *et al.*, It was found that early and effective control of pain showed that it plays an essential role in the recovery of patients with chest trauma [20]. In intubated patients, intravenous analgesia is the method of choice (ICU). The selective approach should be tailored to the individual patient and, if possible, a multifaceted strategy. In our study, the concomitant use of neuroaxial and NIV analgesia improved autocomplete and reduced complications in patients with chest trauma.

Contrary to our results, the results of Bachoumas *et al.* Showed that epidural chest pain was not associated with a lower risk of intubation in patients with chest trauma with at least 3 rib fractures and moderate pain [21]. They recommended further studies to elucidate the optimal strategy for pain control in patients with chest trauma. However, in our study, epidural chest analgesia was used in conjunction with NIV, which combined to reduce complications and intubation.

CONCLUSION

The findings of this study comparing the use of two methods of epidural analgesia and non-invasive ventilation with intravenous analgesia and the use of oxygen masks showed the survival of patients with chest trauma patients with epidural anesthesia with non-invasive ventilation have fewer deaths, fewer hospitalizations, fewer ICU days, and less pain intensity. And there was no significant difference in the rate of pneumonia and the need for intubation compared to the use of intravenous anesthesia with an oxygen mask in the survivors. These findings suggest a preference for epidural

analgesia and non-invasive ventilation in thoracic trauma patients, which could be of interest to health professionals and specialists in better management of disease and quality and efficacy of the therapeutic process in traumatic patients and as an effective method.

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ETHICS STATEMENT: The approval of the Research Council of the Kerman University of Medical Sciences (K/93/366) and clinical trial code (IRCT20190922044842N1) were sought before the start of the study. Written informed consent was obtained from the patient's before entering the study. In addition, they were informed that they can withdraw from the study at any time.

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