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EVALUATION CHEST TUBE IN PATIENT WITH RIB FRACTURE UNDERGO MECHANICAL VENTILATION IN ICU AND OPERATION ROOM IN POORSINA HOSPITAL AND ARIA HOSPITAL FROM SEP2014 TO AUG2016 IN RASHT

Bahareh Mohtasham Alsharyeh[1*], Manouchehr Aghajanzadeh[2], Mohammadreza Mobayen[3], Farzad Ghotbi[4], Azadeh Rafipoor Kiaabadi[5], Omid Mosafaiee[6], Alimohammad Mohtasham Alsharyeh[7]

1,5,6. Resident of general surgery, guilan university of medical sciences, guilan, rasht, iran.
2. Inflammatory lung Disease Research center,Department of Internal Medicine ,Razi Hospital, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran.
3. Assistant proofessor of general surgery, guilan university of medical sciences, guilan, rasht, iran.
4. General surgeon, iran.
7. Student of medical sciences, iran.

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ABSTRACT

Introduction: Trauma is the most common cause of death in people 1-44 years old, and the third cause of death without consider of age. thoracic traumas are considered as one of the major causes of death of 10 to 30% of the total traumas and it accounts for 25% of deaths caused by trauma. Rib fracture as one of the consequences of thoracic trauma includes about 7 to 40% of the trauma hospitalizations. the treatment of delayed pneumothorax in positive pressure ventilation as one of the rib fracture complications is controversial in scientific texts,and we want to critique it.
Material and Method: The current research is a retrospective cohort study that was accomplished in patient with rib fracture referred to Pour Sina and Arya hospital in Rasht during two years, who were candidate for mechanical ventilation (for surgery or hospitalization in the ICU). Researcher-made questionnaire was used as tool to collect data, which it included two parts of demographic information (age, gender, etc.) and the information related to chest trauma (type of trauma, number of broken ribs, damage to other organs at the same time, length of hospitalization, need for ventilation, complications of embedding and removing chest tube thoracostomy). The validity of questionnaire was approved by professors of surgical department. The collected data were analyzed using descriptive statistics and Chi-square test, Mann-Whitney test and by using SPSS 22 software.
Results: In this study, 140 patient with rib fracture who were candidate for mechanically ventilation were examined in the two groups with chest tube thoracostomy (n = 65) and without chest tube thoracostomy (n = 75).mean of hospitalization in patients with chest tube thorachostomy was one day longer than that in patients without chest tube thoracostomy. In the group without chest tube thoracostomy, majority of people (78.7%) needed less than 24 hours of mechanical ventilation and in patients with chest tube thoracostomy, majority of patients (41.5%) needed more than 72 hours of mechanical ventilation, In addition, 12.3% of infection was observed in the chest tube thoracostomy, and 20% of the patients experienced symptomatic pneumothorax, after removing chest tube thoracostomy that majority of them (84.6%) were under mechanical ventilation for more than 72 hours before removing chest tube thoracostomy. In the group without chest tube thoracostomy, 77.3% of patients had no complications during and after general anesthesia and mechanical ventilation and 22.7% of patients experienced asymptomatic pneumothorax less than 10% of lung volume (within 48 hours in chest radiography), who were improved under conservative treatment.
Conclusion: According to the results of the research, it can be said that the lack of using chest tube thoracostomy in patients with rib fracture, who were candidate for mechanical ventilation is followed by less complications. and we recommended, close observation without chest tube thorachostomy in patients with rib fracture, who were candidate for mechanical ventilation.

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Corresponding Author: Bahareh Mohtasham Alsharyeh, Email: b.mohtashammd@gmail.com

Introduction

In the current world, trauma is the main cause of death, hospitalization, and disability in all age groups. In general, it is the most common cause of death in trauma in people aged 1-44 years and a third common cause of death without regard to the age. It is also a factor causes loss of productive life years. Traumatic injuries lead into more than 110.000 deaths per year that motor vehicle accident includes more than 40% of the cases. In this regard, thoracic traumas are considered as one of the major causes of death of 10 to 30% of the total traumas and it accounts for 25% of deaths caused by trauma in **[Figure 1]**.

Figure 1: Rib fracture

Rib fracture as one of the consequences of thoracic trauma includes about 7 to 40% of the trauma hospitalizations that death caused by it is directly associated with number of rib fracture. Rib fractures can cause special problems to traumatic patients including pain and impairment in breathing and as result in pulmonary parenchymal atelectasis, parietal and visceral pleura rupture caused by the displacement of rib parts broken, leading to the creation of pneumothorax, pulmonary laceration, and hemothorax, and thus respiratory distress in patients [1-5]. If pneumothorax as one of the complications of rib fracture is not diagnosed and treated effectively and timely, it can be followed by wide range of pulmonary complications including mild to progressive shortness of breath, respiratory distress, and loss of oxygen in arterial blood, mild to severe subcutaneous emphysema. Reducing venous return is created due to positive pressure caused by pneumothorax within thoracic space and drop in systolic blood pressure and cardiac-pulmonary dysfunction, which it creates threatening conditions for life in **[Figure 2]**.

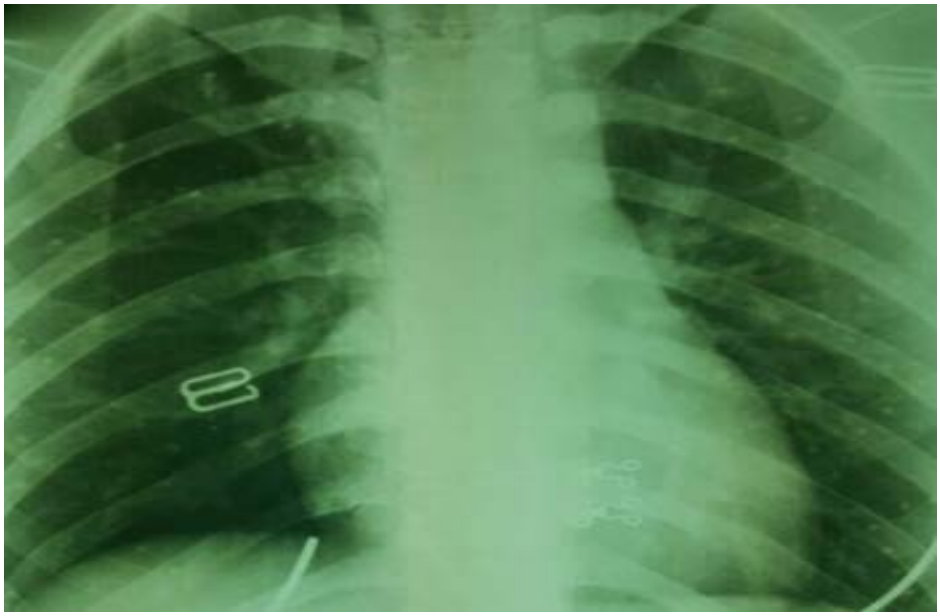

Figure 2: Rib fractures on chest x-ray

Chest tube thoracostomy is a simple and common procedure in the treatment of complications of rib fracture including pneumothorax. While this procedure potentially saves life, it is associated with over 25% complications. Some complications arising from it include unwanted progression to other places or organs including perforation of the lung tissue, the entrance to the intra-abdominal viscera, secondary bleeding to intercostal vessels injury or damage to great vessels even heart perforation due to low experience of operator and increased clinical emergency. Some other complications caused by prolonged use of chest tube thoracostomy include bronchopleural fistula and empyema, which require additional procedures including re-implantation of chest tube thoracostomy, video-assisted thoracoscopic surgery (VATS) or thoracotomy. In addition, by increasing the pain caused by rib fracture, chest tube thoracostomy leads to pulmonary atelectasis caused by respiratory distress and increased hospitalization. Inaction caused by pain of chest tube thoracostomy can lead to a venous thromboembolism and its leads to increased mortality during hospitalization and increased medical costs. On the one hand, removing chest tube thoracostomy can be associated with recreation of pneumothorax and subcutaneous infection of its place entered to chest, which needs therapeutic re-intervention. Pneumothorax progress during mechanical ventilation with positive pressure can be potentially life threatening. On the other hand, chest tube thoracostomy is used as a simple but highly morbid procedure in the treatment rib fracture. Therefore, this study was conducted to compare the consequences of the use or non-use of chest tube thoracostomy in patients with broken rib undergoing mechanical ventilation in a retrospective cohort study according to controversy without subject in literature and scientific texts.

Materials and method

The researcher has collected data after asking for permission from the University Research Assistance and Research Center of Razi and Aria Hospitals in Rasht maintaining ethical considerations.

The current research is a retrospective cohort study conducted on 140 patients with fractured ribs referred to Pour Sina and Arya hospital in Rasht during two years, who were candidate for mechanical ventilation (for surgery or hospitalization in the ICU). Inclusion criteria included all patients with uncomplicated rib fractures and without the history of chest trauma during past month and without history of chronic lung disease. Researcher-made questionnaire was used as tool to collect data, which it included two parts of demographic information (age, gender, etc.) and the information related to chest trauma (type of trauma, number of broken ribs, damage to other organs at the same time, length of hospitalization, need for ventilation, complications of embedding and removing chest tube thoracostomy). The validity of questionnaire was approved by professors of surgical department. The collected data were analyzed using descriptive statistics and Chi-square test, Mann-Whitney test and by using SPSS 22 software.

Findings

In this study, 140 patient with rib fracture who were candidate for mechanically ventilation were examined in the two groups with chest tube thoracostomy (n = 65) and without chest tube thoracostomy (n = 75). The mean age of the patients was (CI (95%) 93/17±24/49=23/52-24/46) years, with median of 50, and age range 8 to 90 years. The greatest frequency of rib fracture under ventilation was seen in the age group of 46 to 65 years, which included 38.9% of the patients [Chart 1].

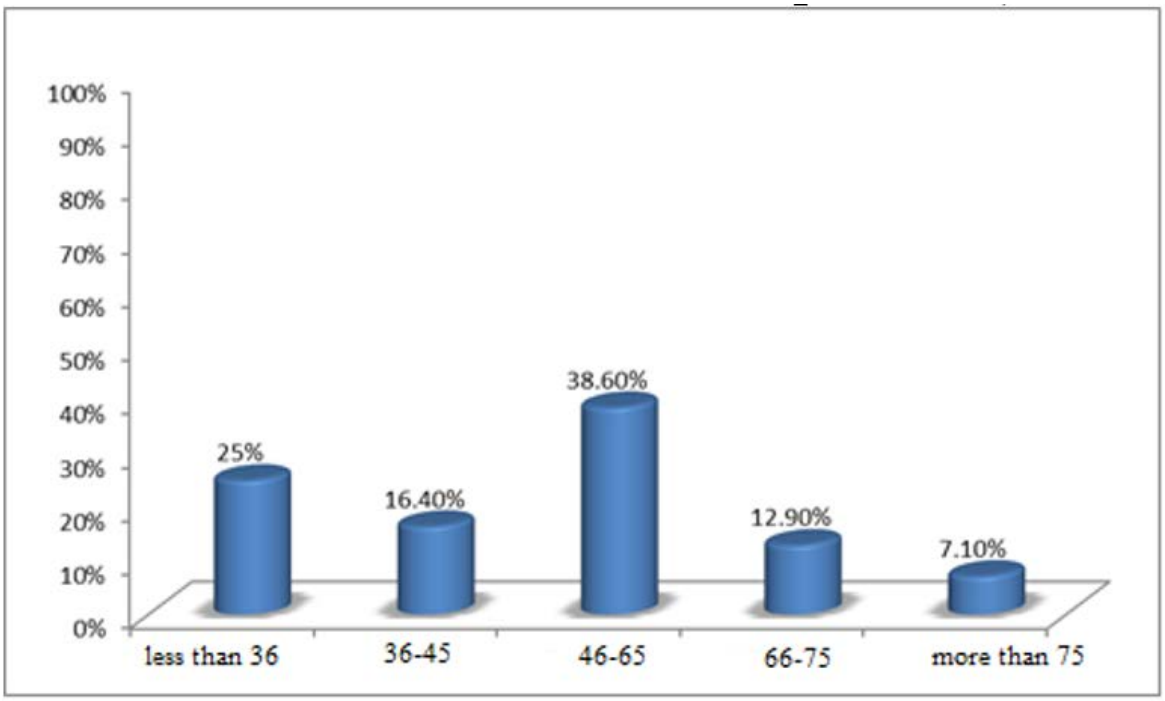

Chart 1: Frequency percentage of subjects in different age groups

The mean duration of hospitalization in patients with chest tube thoracostomy according to **[Table 1]** was nearly a day longer than that in patients without chest tube thoracostomy

Table 1: The mean duration of hospitalization in patients with chest tube thoracostomy

Hospital	mean ±SD	P Value*
Pour Sina with chest tube thoracostomy	3/74±7/34	0/041
Arya without chest tube thoracostomy	4/18±6/47	

*Mann- Whitney

In the group without chest tube thoracostomy, majority of people (59 people, 78.7%) needed less than 24 hours of mechanical ventilation and in patients with chest tube thoracostomy, majority of patients (27 people, 41.5%) needed more than 72 hours of mechanical ventilation **[Table 2]**.

Table 2: Duration of mechanical ventilation in rib fractures of patients with/ without tube thoracostomy

Hospital	less than 24 hours	48-72 hours	more than 72 hours	Total	P value*
Pour Sina with chest tube thoracostomy	)38/5% (25	)20% (13	)41/5% (27	100%)(65	0/001<
Arya without chest tube thoracostomy	)78/7% (59	)14/7% (11	)6.7% (5	)100% (75	
Total	)60% (84	)17/1% (24	)22/9% (32	140(100%)	

*Chi-square

In addition, 12.3% of infection was observed in the chest tube thoracostomy, and 20% of the patients experienced symptomatic pneumothorax, after removing chest tube thoracostomy that majority of them (84.6%) were under mechanical ventilation for more than 72 hours before removing chest tube thoracostomy. The mean duration of chest tube thoracostomy in this group was (CI (95%) 45/4±8=69/10-31.5) days with median of 8 and range from 3 to 20 days versus (CI (95%) 79/2±25/5=03/6-47/4) 4 / 47-6 / 03 = CI (95%) 79/2 ± 25/5) days with median of 5 and range from 1 to 12 days in patients without complication after removing chest tube thoracostomy (almost 3 days longer than patients without complication of removing chest tube thoracostomy) **[Table 3]**.

Table 3: Average duration of tube thoracostomy in patients with/without complication followed by pulling chest tube

pneumothorax complication after removing chest tube thoracostomy	Duration of thoracostomy in day (mean ±SD)	P Value*
Yes	4/45±8	0/025
No	2/79±5/25	

*Mann- Whitney

In the group without chest tube thoracostomy, 77.3% of patients had no complications during and after general anesthesia and mechanical ventilation and 22.7% of patients experienced asymptomatic pneumothorax less than 10% of lung volume (within 48 hours in chest radiography), who were improved under conservative treatment. In this regard, 11.8% of them had less than 3 fractured ribs, and 88.2% of them had more than 3 fractured ribs. However, significant correlation was not found between pneumothorax complication less than 10% of lung capacity after general anesthesia and the number of rib fractured (p=0.216) **[Table 4]**.

Table 4: Frequency of asymptomatic delayed pneumothorax regarding the number of rib fractures in patients without tube thoracostomy after mechanical ventilation

Pneumothorax after mechanical ventilation in Arya hospital without Thoracostomy	Less than 3 ribs fractured	3 or more ribs fractured	Total	P value*
Yes	)11/8% (2	)88/2% (15	)100% (17	0/216
No	)27/6% (16	)72/4% (42	)100%(58	
Total	18(24%)	)76% (57	)100% (75	

*Fisher Exact Test

Discussion

In this study, mean duration of hospitalization in patients with rib fractures, who went under chest tube thoracostomy before mechanical ventilation (Pour Sina Hospital) was 7.34 ± 3.74 days, and in patients with rib fractures without chest tube went under close observation and under mechanical ventilation (Aria hospital), it was 6.47 ± 4.18 days. In our study, the mean length of hospitalization in patients of Pour Sina Hospital with chest tube thoracostomy was one day more than that in patients studied in Arya Hospital and without chest tube thoracostomy, and this difference was statistically significant (p=0.041). In terms of the duration of going to mechanical ventilation with positive pressure in patients of Arya hospital without chest tube thoracostomy, majority of subjects (59 people, 78.7%) underwent mechanical ventilation for less than 24 hours and in patients of Pour Sina Hospital with chest tube thoracostomy, majority of patients (27 people, 41.5%) underwent mechanical ventilation for more than 72 hours, which this difference between two groups was significant (p>0.001). In a study conducted by Wilson et al in 2009 that entitled hidden pneumothorax in trauma patients, among 68 trauma patients with rib fractures and without symptomatic pulmonary complications, who underwent ventilation with positive pressure, 48.4% of them were improved without need for chest tube thoracostomy under the conservative treatment and duration of their hospitalization was one day less than that in group underwent chest tube thoracostomy. Among the 65 patients studied in Pour Sina that with rib fracture underwent chest tube thoracostomy before mechanical ventilation, 12.3% infection complication at the place of chest tube thoracostomy (in the form of empyema or chest wall infection) and 1.5% of them experienced serious bleeding leading to thoracotomy at the place of chest tube thoracostomy embedding. In a study conducted by Patrick et al in 2012 under the title of hidden pneumothorax in intensive units on 90 patients, it was concluded that in 1.3% of patients under mechanical ventilation with positive pressure who went under chest tube thoracostomy due to pneumothorax, complications of pleural drainage in the form of empyema and infection at the place of thoracostomy were reported. As complications of pleural drainage were high unacceptably, conservative treatment instead of prophylactic drainage was recommended to determine to special factors among people with rib fracture who were candidate for embedding ventilation with positive pressure [8]. The mean duration of having chest tube thoracostomy in people with pneumothorax after removing thoracostomy tube (8 ± 4.45) was approximately 3 days longer than that in patients without complication after removing the tube (5.25 ± 2.79 days). Based on the results obtained, there was a significant relationship between the rate of complications of thoracostomy tube and length of tube thoracostomy (p=0.025). In our study, among the 20% of patients experienced pneumothorax complication after removing thoracostomy tube, 84.6% of patients were under mechanical ventilation with positive pressure for more than 72 hours after removing thoracostomy. Based on the results obtained, a significant correlation was found between the complications of removing thoracostomy tube and duration of mechanical ventilation (p=0.001). Among the 75 patients studied in in Arya hospital underwent mechanical ventilation with close observation due to rib fracture without chest tube thoracostomy, in 77.35 of the patients, no complication during and after general anesthesia and mechanical ventilation with positive pressure was seen. In addition, in 22.7% of people, pneumothorax less than 10 percent of the lung capacity (asymptomatic and proven by chest radiography within 24 to 48 hours after being exposed to positive pressure ventilation)

took place, improved under conservative treatment and without embedding chest tube thoracostomy. Among these patients (asymptomatic pneumothorax less than 10% of lung capacity), 88.2% of people had 3 or more than 3 fractured ribs. Significant correlation was not seen between pneumothorax less than 10% of lung capacity after general anesthesia and number of rib fractures (p =0.216). In a study conducted by Ming Shin et al in 2007 entitled as delayed pneumothorax caused by rib fractures in trauma patients on 295 patients, it was concluded that 78 patients with 3 or more rib fractures underwent mechanical ventilation with positive pressure experienced symptomatic delayed pneumothorax during 48 hours, leading to chest tube thoracostomy embedding, which statistically significant difference was not found between the number of ribs fractured and delayed pneumothorax delayed [6]. In a study conducted by Tuidmir et al in 2007 entitled as conservative treatment of asymptomatic in traumatic patients on 128 patients, it was concluded that patients with asymptomatic pneumothorax less than 10% of lung capacity (25.8%) did not need chest tube thoracostomy. In addition, among them, 25.8 of people with hidden pneumothorax (asymptomatic, less than 10% of the lung capacity) underwent ventilation with positive pressure, only 4 people (3.2%) need chest tube thoracostomy. Accordingly, conservative treatment was recommended for asymptomatic pneumothorax in this study [9]. In a retrospective study conducted by Lu et al entitled as delayed pneumothorax in patients with chest traumatic fracture in 2008, it was concluded that among 300 patients with rib fractures, 178 patients had less than three rib fractures and among them, 95 patients underwent intubation and mechanical ventilation, and among them 16 patients experienced asymptomatic delayed pneumothorax in chest radiography within 48 hours, which 12 of them treated in conservative form. Accordingly, this study recommended conservative treatment for asymptomatic pneumothorax [10]. In a study conducted by Aghajanzadeh et al between 2001 and 2011 under the title of treatment and classification of subcutaneous emphysema in patients under mechanical ventilation, [11] it was concluded that in 35 patients underwent positive mechanical ventilation with subcutaneous emphysema, only 2 cm incision of bilateral infraclavicular without imbedding chest tube thoracostomy was effective in re-opening the lung [12]. In a study conducted by Yu Cha Lin et al, entitled the of pigtail cutter in pneumothorax management in patients undergoing mechanical ventilation on 62 patients during 2004 to 2007, it was concluded that pigtail catheter drainage was effective in the treatment of iatrogenic pneumothorax caused by barotrauma in patients under mechanical ventilation with positive pressure in the 57 people,[13-15] and in 5 people with pneumothorax less than 20% of lung capacity with conservative treatment without embedding cutter [7]. Among the 140 patients studied, only one case of complication during general anesthesia and positive ventilation was seen, in the form of arterial oxygenation in the patient with rib fracture in Pour Sina underwent chest tube thoracostomy before undergoing positive ventilation.[15-22]

Conclusion

According to the results of the research, it can be said that the lack of using chest tube thoracostomy in patients with rib fracture, who were candidate for mechanical ventilation is followed by less complications. Our study showed that the mean length of hospitalization in patients with rib fractures, who underwent chest tube thoracostomy before undergoing mechanical ventilation, was one day more than that in the group with rib fracture and without thoracostomy underwent mechanical ventilation. On the other hand, according to our study, the length to undergo mechanical ventilation support in the group of chest tune thoracostomy was more compared to that in the group without chest tube thoracostomy. In addition, the rate of complications caused by chest tube thoracostomy and complications caused by removing it was more compared to complications of lack of embedding chest tube thoracostomy in patients with rib fracture who were candidate for mechanical ventilation. Therefore, it is recommended that more extensive studies to be conducted to find the factors effective in reducing chest tube thoracostomy and factors effective in reducing complications caused by embedding and removing chest tube thoracostomy. Conspiring type of the study, one limitations of this study is incomplete information contained in the file of the patients that leads to exclusion for study, so it is recommended that this case to be considered in future studies.

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