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Outcome of patients of chest trauma suffering from chronic obstructive pulmonary disease — experience at level 1 trauma centre

Richa Aggarwal, Kapil Dev Soni, Amit Gupta, Subodh Kumar

Dept. of Critical Care Medicine, Aiims, New Delhi, India

Abstract

Background: The outcome of chest trauma depends on many factors, one of which includes comorbidities. Nowadays, as the elderly population is on the rise, more and more trauma victims are being admitted with chronic obstructive pulmonary disease as a comorbidity in trauma centre intensive care units. However, there are hardly any studies describing the outcome of such patients with chest trauma and chronic obstructive pulmonary disease, both being respiratory problems.

The aim was to study the outcomes and various complications in patients of chest trauma with COPD admitted to our ICU over a given time period.

Methods: A detailed review of charts of patients with chest trauma and chronic obstructive pulmonary disease admitted over one and a half years was performed and various parameters noted, which are as follows: demographic data; various scores; the number of days on a ventilator and in the ICU. Moreover, complications, such as ventilator associated pneumonia, catheter related bloodstream infections, as well as outcomes, were noted.

Results: During the study period, 19 patients were admitted, out of which 4 died. The APACHE scores were higher for those who died and all had ventilator-associated pneumonia as a complication. All those who had undergone the placement of an epidural and were managed with non-invasive ventilation initially did not require invasive ventilation.

Conclusions: Chest trauma patients with chronic obstructive pulmonary disease are prone to develop ventilator-associated pneumonia which may be the risk factor for increased mortality among such patients. Epidural placement reduces the risk of invasive ventilation if a patient can be managed with non-invasive ventilation.

Key words: chronic obstructive pulmonary disease; trauma, chest trauma; trauma, complications; intensive care; ventilator associated pneumonia

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A variety of factors influence the outcome of chest trauma patients. The most important of these include age, injury severity score and the presence of co-morbidity or pre-existing illness, especially cardiopulmonary disease. As the numbers of elderly trauma patients are on the rise, more and more patients are being admitted with chronic obstructive pulmonary disease (COPD). Injuries that may not result in poor outcomes among the normal population may cause major morbidity, and possible mortality, among COPD populations. This is because of two reasons: firstly, chest trauma can cause acute and serious COPD exacerbation [1]; and secondly, COPD is recognized as a risk factor for nosocomial respiratory tract infections [2]. There are no studies which have looked at the outcome of chest trauma patients with COPD. We studied the outcomes and various complications occurring in such patients admitted to our ICU over a given period of time.

METHODS

After approval from our hospital ethics committee, the medical records of all patients admitted with chest injury

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with COPD to our intensive care unit between April 2012 and September 2013 were reviewed. COPD patients were identified with either a history suggestive of COPD or initial chest X-ray findings of COPD. Patients with all types of blunt and penetrating chest trauma, ranging from minor rib fractures to major injury requiring a thoracotomy, were included in the study. Data included baseline data and details of the ICU course. Baseline data included demographic data (age, body mass and gender), an injury severity score (ISS), as well as Acute Physiology and Chronic Health Evaluation II (APACHE II) scores. Obesity was defined as a body mass index equal to or more than 30 kg m^{-2}. The data collected in the ICU included the number of days spent on a ventilator and in the ICU, as well as the following complications: incidence of ventilator associated pneumonia (VAP); catheter related bloodstream infections (CRBSI); and outcomes, whether discharge from the ICU or death. VAP was defined as pneumonia developing 48–72 hours of mechanical ventilation characterised by the presence of new or worsening infiltrates, signs of systemic infection (fever, altered TLC), changes in sputum characteristics and the detection of the causative organism.

STATISTICAL ANALYSIS

Data was analysed by using Stata 11.2 (StataCoro LP, College Station, USA) and presented as a median [range] or frequency [%]. Categorical variables were compared by using Fischer's exact test while continuous variables were compared in two groups using the Wilcoxon signed-rank test. *P* value of < 0.05 was considered as significant.

RESULTS

During the one-and-a-half year study period, 19 patients presenting with COPD and chest trauma were admitted to the surgical ICU of a Level 1 trauma centre. All the patients were 50 years and above, with oldest being 83 years old. There was a preponderance of males (16: 3). The demographic and baseline characteristics of all patients are given in Table 1. Comorbidities, besides COPD, were present in 8 out of 19 patients. The various comorbidities are tabulated in Table 2.

Out of 19 patients, 4 died in the ICU and 15 were discharged. Most of the patients, i.e. 14 out of 19 (73%) required invasive ventilation while only 5 (26%) were managed with non-invasive ventilation. All five patients who were managed with non-invasive ventilation underwent the placement of a thoracic epidural. The various parameters, such as epidural placement, infectious complications, the number of ventilator days and length of ICU stay, in both the survivors and the deceased, are given in Tables 3 and 4.

Table 1. Demographic and baseline characteristics (n = 19)

	Median (range)
Age (yrs)	56 (50–83)
Body mass (kg)	70 (50–128)
Males:Females	16:3
Apache score	15 (4–24)
Injury Severity Score	16 (9–24)

Table 2. Comorbidities in patients with COPD (n = 19)

Comorbidity	Number (%)
Hypertension	2 (10.53)
Diabetes mellitus	2 (10.53)
Obesity	4 (21.05)

Table 3. Different variables in the survivors and deceased. Data given as median (min-max)

Variables	Survivor (n =15)	Dead (n = 4)	*P*-value
APACHE II score	14 (4–19)	18.4 (15–24)	0.03
Injury Severity Score	16 (9–21)	13 (9–24)	0.95
Haemoglobin (g dL^{-1})	11 (8.6–18.9)	9.8 (8–15.6)	0.48
ICU stay (days)	15 (3–60)	30 (10–54)	0.339
Ventilator days	12 (0–48)	30 (16–54)	0.189

Table 4. Different variables in the survivors and deceased. Data given as given as n (%)

Variables	Survivor (n = 15)	Dead (n = 4)	*P*-value
Epidural catheter	11 (73.3)	0 (0)	0.018
Tracheostomy done	9 (60)	2 (50)	1.00
Ventilator associated pneumonia	6 (40)	4 (100)	0.08
Catheter related bloodstream infections	1 (6.67)	0 (0)	1.00

Median APACHE scores for survivors were significantly lower than for non-survivors ($P < 0.03$). On the other hand, there was no significant difference in the ISS of survivors and the deceased. Although the patients who died had ventilator-associated pneumonia, no statistically significant difference was observed between the survivors and the deceased ($P = 0.08$). Those patients who had been intubated initially, either in the emergency department or upon arrival in the ICU, did not have an epidural inserted. All the patients who died were intubated initially only and did not have epidural catheter ($P = 0.018$). In addition,11 patients required a tracheostomy. Although the number of ventilator days and the length of ICU stay was almost double in patients who died as compared to survivors, this did not comprise a statistically significant difference.

DISCUSSION

COPD is quite a common disease in the general population. Although the exact prevalence of COPD worldwide is largely unknown, estimates have varied from 7–19% while it occurs predominantly in individuals older than 40 years of age. The median age of our patients was 56 with a preponderance of males. Although COPD affects the lungs, it also produces significant systemic consequences. The prognosis of these patients, particularly those who require invasive mechanical ventilation (IMV), is poor [3]. In our study, out of 14 patients who required invasive ventilation, 4 died. Shoko *et al.* [4] also showed a significant increase in mortality for trauma patients adjusted for ISS with COPD (OR 3.1; 95% CI: 1.5–6.7).

The median ISS in our group of patients was 16, ranging from 9–24, as we not only included all patients with chest injury, but patients with trauma to other organs also. Importantly, moreover, the ISS had no significant relationship with mortality in our patients. Tomohisa Shoko *et al.* [4] also found a greater impact of COPD in a minor ISS of 1 to 15 (OR 9.5; 95% CI: 3.9–23.3) as compared to moderate or severe ISS. There was a tendency for the effect on hospital mortality to become weaker as the severity of injury increased. McGwin *et al.* [5] also found increased mortality in patients with minor injury with an ISS of < 15. The reason here was that pre-existing medical conditions in seriously injured patients who ultimately die are underreported. Similarly, a study by Ziegler *et al.* [6] reported increased mortality in the elderly, even those with a low ISS as compared to younger patients, while suggesting that even a less severe injury may be lethal in the elderly age group.

All our patients who could be managed with non-invasive ventilation underwent the placement of an epidural and did not require invasive ventilation. Gage *et al.* [7] also studied the effect of epidural placement and concluded that it is associated with a significantly decreased risk of death. Similarly, Harrington *et al.* [8] studied predictors of survival among older patients incurring traumatic rib fractures and found that patient-controlled analgesia and tracheostomy were associated with improved survival. As we did not place an epidural catheter in all the patients who were initially intubated, the patients who died had not initially undergone the placement of an epidural.

Almost 50 % patients in our study developed VAP. Indeed, COPD acts as a risk factor for nosocomial respiratory tract infections [2]. The incidence of VAP in other studies in intubated COPD patients has been estimated to range from 6–33% [9]. This discrepancy can be explained, as these studies included patients presenting COPD without chest injury intubated for exacerbation, not because of trauma; moreover, VAP is a common infection among patients in trauma intensive care units (ICUs) [10]. In addition, an interesting finding was that all the patients who died had VAP. Nseir *et al.* [11] also reported that VAP was associated with higher mortality in COPD patients, along with longer duration of mechanical ventilation and length of ICU stay.

There has been only one study on chest trauma patients with COPD, namely that by A. Pugachev *et al.* [1] which evaluated 125 patients with blunt chest trauma. They concluded two things — first that the chest trauma causes exacerbation in patients suffering COPD and second that the basic therapy COPD is not enough for the prevention of an exacerbation in a chest trauma patient. However, Pugachev proposed an algorithm in order to improve the results of treatment of such patients. We managed our patients by implementing the standard treatment for the exacerbation in COPD patients, including most of the modalities Pugachev had included in the above-mentioned algorithm, such as analgesia, nebulisation, antibiotics, and mobilisation, but not surgical features such as rib fracture fixing or air leak sealing. The effect of these modalities needs to be seen and judged.

Our study has certain limitations. As it is a retrospective study with a small number of patients, it is a descriptive study. In addition, we could not find the factors affecting the outcomes of patients. Secondly, as it is a single centre study, the results cannot be generalised. Moreover, we also included COPD patients with polytrauma, and not exclusively chest trauma, a factor which had some affect on the outcome.

In conclusion, VAP is a common complication in patients with chest trauma and COPD and may cause an increase in mortality, while epidural placement reduces the risk of invasive ventilation if a patient can be managed with non-invasive ventilation. However, a large number of patients, or probably a multicentric study is required to predict the factors that will affect the outcomes of COPD. Once the factors are known, the treatment strategy can be modified accordingly.

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2. Source of founding — none.

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Adres do korespondencji:
Dr. Richa Aggarwal
Asst. Prof. Critical and Intensive Care,
JPNA Trauma centre, AIIMS
NEW DELHI 110029, India
e-mail: pathakricha@yahoo.co.in

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