ORIGINAL ARTICLE

BLUNT PULMONARY CONTUSION: ADMISSION COMPUTED TOMOGRAPHY SCAN PREDICTS MECHANICAL VENTILATION

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BLUNT PULMONARY CONTUSION: ADMISSION COMPUTED TOMOGRAPHY SCAN PREDICTS MECHANICAL VENTILATION

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ABSTRACT

INTRODUCTION

Road traffic injury is one of the fastest growing health problems in Nepal with increasing number every year leading to morbidity and mortality. Blunt pulmonary contusion may not be seen in the initial plain radiographs as they evolve over 12-24 hours. Thus CT (Computed Tomography) scan can provide detailed information about the contusion and predict the need for mechanical ventilation.

MATERIAL AND METHODS

This is a prospective, observational longitudinal study conducted at Universal College of Medical Sciences, Bhairahawa from 1st January 2020 to 31st December 2020. The predictors for requirement of mechanical ventilation like Abbreviated Injury Scale (AIS), Injury Severity Score (ISS), GCS score and number of fractured ribs at the time of admission were recorded.

RESULTS

In this study, 100 cases with blunt pulmonary contusion were evaluated. Average age of patients with blunt pulmonary contusion was around 39.10±17.56 years with male predominance (82%). Total of 7 patients required mechanical ventilation among whom the AIS chest was 3.0±0.82, ISS score was 29.14±6.89, and GCS 9.14±3.13. The ROC curve showed that ISS score predicted significantly about the requirement of mechanical ventilation with sensitivity of 85.5% and specificity of 99.8 %.

CONCLUSION

Initial CT done in patients can show the presence or absence of pulmonary contusion and associated thoracic injuries and along with AIS, ISS and GCS scores we can predict early the requirement of mechanical ventilation.

KEYWORDS

Blunt pulmonary contusion, Mechanical ventilation

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INTRODUCTION

Road traffic injury is one of the fastest growing health problem in Nepal. Number of road traffic accidents are increasing every year leading to increased mortality and morbidity. It has become 10th leading cause of death in Nepal.[1]

Blunt chest trauma is reported as a predominant contributing factor in all trauma related deaths. Injury to chest may include fracture to ribs, pulmonary contusions, pneumothorax, hemothorax, airway injuries and cardiovascular injuries. A pulmonary contusion is an as alveolar hemorrhage and pulmonary parenchymal destruction after blunt chest trauma. A parenchymal lesion can occur during 24 hrs after injury and resolves within 3-14 days depending upon the size, number of lobes affected.[2] Clinical manifestations include respiratory distress with hypoxemia and hypercarbia as a result of ventilation/perfusion difficulties, increased intrapulmonary shunting, increased lung water, segmental lung damage, and a loss of compliance.[3]

Initial plain X-rays of chest may fail to reliably identify patients at risk of clinical deterioration. Chest CT scan is more sensitive than conventional CXR at detecting blunt thoracic injuries.[4] Admission computed tomography (CT) may offer accurate characterization of blunt pulmonary contusion (BPC) and early prediction of the need for mechanical ventilation (MV).

The Abbreviated Injury Scale (AIS) was developed to provide researchers with a simple numerical method for ranking and comparing injuries by severity, and to standardize the description of injuries. It is a numerical scale of injury severity ranging from 1 (minor injury) to 6 (maximal injury-unsurvivable). To summarize multiple body injuries, the Injury Severity Score (ISS) - a summary score that is based on the AIS - was developed by Baker and colleagues.[5,6] It is the sum of squares for the highest values in each of the three most severely injured body regions.

We intended to study the variables that predicted the requirement of mechanical ventilation for prior prediction so that heath care providers and patient party can prepare for the upcoming intervention.

MATERIAL AND METHODS

This is a prospective, longitudinal, observational study conducted at Universal College of Medical Sciences, after the approval was taken from Institutional Review Board (UCMS/IRC/031/20). The written consent was taken fromenrolled patients. The duration of study was from 1st January 2020 to 31st December 2020 and purposive non-probability sampling technique was used. The prevalence of pulmonary contusion was 7%.[7] The sample size was calculated using the formula $n=z^2pq/d^2$ and was calculated to be approximately 100.

Data was taken from patients medical records including age, sex, mechanism of injury, Abbreviated Injury Scale (AIS), Injury Severity Score, and GCS score at the time of admission. All patients were scanned on a 16 slice CT scanner and reporting was done by an attending radiologist. All cases were evaluated for presence or absence of contusion, pulmonary laceration, haemothorax, pneumothorax, and number of fractured ribs on either side.

Patients included in this study were all patients with blunt chest trauma who agreed to participate in the study. All the data was analyzed using SPSS version 20.0. Chi-square test was used to analyze the two categorical variables. Level of significance for all the analytical tests was set at 0.05 and p value <0.05 was considered significant.

RESULTS

In this study, 100 cases with blunt pulmonary contusion were evaluated. Out of 100 cases studied, road traffic accidents (74%) was the most common mode of injury, followed by fall from height (22%) and physical assault (4%) (Table 1). Average age of patients was around 39.1±17.56 years with male predominance (82%), with ISS ranging from 3-34 (mean 11.66) and GCS from 3-15 (mean 14.45). The clinical features of patients with BPC are presented in Table 2.

Table 1. Demographic variables

Mechanism of injury	
Road traffic accidents	74%
Fall from height	22%
Physical assault	4%

Table 2. Clinical features of patients

Variables	Patients with BPC
Age	39.10±17.56
Male	82 % (n=82)
AIS	1.91±0.73
ISS	11.66±7.88

Similarly, among 100 patients with BPC there were other associated thoracic injuries like 34 patients had pneumothorax, 42 had haemothorax, 39 patients had rib fracture on right side, 37 patients had rib fracture on left side and 8 patients had B\L rib fracture as shown in Table 3.

Table 3. Associated thoracic injuries

Variables	Frequency	Percentage
Pneumothorax	34	34
Haemothorax	42	42
Rib right fracture	39	39
Rib left fracture	37	37
Both right & left fracture	8	8

Total of 7 patients required mechanical ventilation among whom the AIS chest was 3.0±0.82, ISS score was 29.14±6.89, and GCS 9.14±3.13(Table 4).

Table 4. Mechanical ventilation according to AIS, ISS and GCS score

	Mechanical ventilation		
	Yes	No	*p* value
AIS	3.0±0.82	1.83±0.65	0.008
ISS	29.14±6.89	10.34±6.22	<0.001
GCS	9.14±3.13	14.85±0.74	0.003

The ROC Curve shows that ISS score predicts significantly about the requirement of mechanical ventilation with sensitivity of 85.5% and specificity of 99.8 %(Table 5).
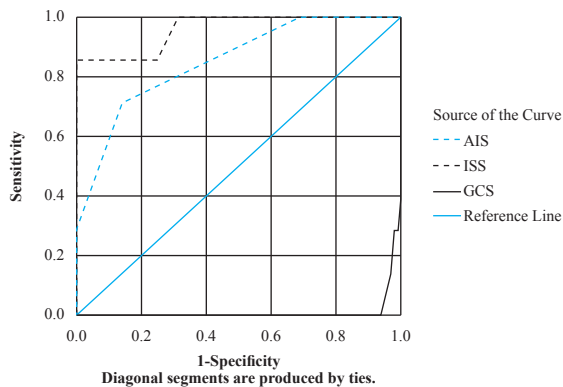
Diagonal segments are produced by ties.

Table 5. Sensitivity and specificity of test variables

Test result variables	Area	Sensitivity	Specificity	Cut-off score
AIS	0.852	0.714	0.86	2.5
ISS	0.960	0.857	0.9989	24
GCS	0.012	0.286	0.011	12.5

DISCUSSION

Our study has shown majority of male patients with road traffic accidents being the most common mode of injury. CXR has traditionally been used as a screening method in blunt thoracic trauma. However, a normal CXR upon admission does not rule out BPC and other associated injuries.[8]

A study conducted by Chapagain et al among 100 patients reported road traffic accidents as major cause of blunt chest trauma (68%) followed by fall from height (19%) and with male predominance (73% male)[9] which was similar with our study with road traffic accident (74%) being the major cause of blunt chest trauma.

In our study all patients underwent CT scan study. In a study conducted by Chapagain et al. among 129 patients found that CT chest was more informative and superior to plain chest X-ray as CT diagnosed pulmonary contusion in 30% cases of blunt chest trauma as compared to 10% in plain chest X-ray.[10]

DeMoya et al reported out of 392 patients (Abbreviated Injury Scale (AIS) score chest, 3± 1; and Injury Severity Score [ISS], 13±6) had BPC. Twenty-five (6%) patients required MV and two (0.5%) died. Glasgow Coma Scale (GCS) score <14 predicted MV in 100% of the cases.[11] In our study study AIS 1.91±0.73, ISS 11.66±7.88 had BPC, whereas 7% patients required mechanical ventilation and the patients who required mechanical ventilation had GCS 9.14±3.13. In study done by Pozgain et al reported that among all the admitted patients diagnosed with a pulmonary contusion 16% required mechanical ventilation.[7]

The main limitation of the study was that it was conducted in a single centre with small sample size.

CONCLUSION

Initial CT done in patients can show the presence or absence of pulmonary contusion and associated thoracic injuries and along with AIS, ISS and GCS scores we can predict the requirement of mechanical ventilation early.

CONFLICT OF INTEREST

None

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