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"The pattern and out come of lung contusion post bomb blast attack ."

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ABSTRACT

Introduction: Bombo explosion-blast injuries are likely to be increasingly encountered as terrorist activity increases and pre-hospital medical care improve. Understanding the consequences and supportive therapies available to treat primary blast lung injury are important for anaesthetists and intensivist. . Thus, we reviewed the epidemiology, clinical management, and outcomes of blast-exposed victims admitted to the critical care unit of New Najran General Hospital, KSA During the period from 2019 to 2021.

Materials and Methods: This study is a retrospective review of clinical, and outcome characteristics of blast-exposed casualties admitted to the critical care unit of New Najran General Hospital, KSA, between 2019 and 2021.

Results: A total of 24 patients survived blast exposure and were discharged from intensive care. Five cases (20.8%) of moderate disease was managed with non invasive bilevel positive pressure ventilation PBLI. Invasive mechanical ventilation was used for eight patients,. According to the analysis of their outcomes, their median length of stay in the ICU was 4 days (3.25-29.25). A conventional mechanical ventilation regimen of 4.5 days was required for severe cases of primary blast lung injury.

Conclusions: The primary blast lung injury (PBLI) was likely caused by the high-pressure wave created by the blast, which damaged the tissue of the lungs. This type of injury was not as severe as non- traumatic forms of acute lung injury, and the victims typically recovered with a short duration of conventional mechanical ventilation.

Keywords: Acute lung injury; blast injuries; epidemiology.

Introduction

In recent years, bomb explosions have become a daily occurrence as a result of faulty operations, poor maintenance and negligence of factory units. blasts and Explosions occur accidentally or deliberately. Bombings and terrorist attacks occur every day for political gain. Bombing is a deliberate act carried out by subnational militant groups for political gain aimed at civilians. During blasts, there are large casualties and victims suffer severe physical and psychological consequences [1]. The purpose of minor blasts is to create fear in the public. Because attack execution and ammunition have become so sophisticated and precise, the extent of injuries has increased. To make explosives, you can use a high-order or a low-order explosive [2]. With bombs and explosions, there are patterns of injury that are rarely observed outside of combat. Often, blunt or penetrating injuries affect multiple organ systems. Also, high-pressure air expandingfrom the detonation centre causes injuries [3].

When high-order explosives detonate rapidly, blast waves cause primary injury. Within a second of detonation, a supersonic over-pressurization wave fills the surrounding space [5]. In closed areas, blast waves reflect off walls, giving intense impact [5,6]. During a blast wave, superheated air carries victims and things across, leading to penetration or blunt injuries .[6]Flying objects or debris cause secondary injuries. When high-energy explosions trigger blast winds, people are lifted into the air and thrown against other objects, resulting in secondary blast injuries. There are also post-traumatic injuries (crush injuries,burns, asphyxia, ,toxic inhalations,and aggravated conditions related to underlying medical conditions).

An explosion can cause injury through implosion inertia, spalling and irreversible damage. Spalling occurs when less dense material is displaced and fragmented into denser material, causing molecular disruption. An implosion damage internal organs. As the gases in hollow organs compress, they lead to visceral disruption when they expand. As wave of the blast penetrates tissues of differing densities at different speeds, inertia is the result of shear stress. It is suggested that irreversible injury occurs when blast force exceeds tissue tensile strength.

Primary injuries include blast lung injuries(BLI), ocular injuries, traumatic brain injuries, concussions, tympanic membrane ruptures, damage of middle ear, abdominal haemorrhages, and perforation of abdominal organ [5.7]. tympanic membrane Injuries can occur at as little as 5 pounds per square inch (psi) above atmospheric pressure, making it the common type of explosion injury. Damage to other organ may not be seen in the absence of any injury to the tympanic membrane, because pressure gradients can occur from 56 to 76 psi (3.8 to 5.2 atm).

BLI are the second most common type of injury. They cause the highest levels of a mortality and morbidity among blast victims. They lead to respiratory difficulty and hypoxia with or without external injury . A lung injury could result in haemorrhage, pneumothorax,,pulmonary contusion, pneumomediastinum,subcutaneous emphysema and hemothorax, [5]. Hemoptysis, dyspnea, cough, hemodynamic instability and chest pain are typical symptoms [8]. On physical examination, hypoxia, tachypnea, , wheezing, cyanosis, , and decreased breath sounds may be observed. Chest radiography, computer tomography, and arterial blood gases may assist with diagnosis and management. Chest x-rays often show a butterfly appearance or a pneumothorax. According to Pizov et al. [9].BLI severity can be classified into severe, moderate and mild injuries. Blast lung severity is determined by the PaO_2/FiO_2 (partial oxygen pressure in arterial blood/fraction of inspired oxygen ratio), chest X-ray findings, and Broncho- pleural Fistula score [9].

When explosives are packed with nails, screws and other sharp objects, secondary blast injuries are more fatal. Secondary blast injuries are the result of flying debris generated by the explosion. Secondary blast injuries are most commonly the result of penetrating or blunt trauma. It can cause traumatic amputations ,fractures, and soft tissue damage in the head, neck, chest, abdomen, and extremities. As a result of foreign bodies, penetrating trauma (shrapnel wounds) has a low imaging threshold and should not be closed. [5]. Tertiary injuries result from thrown of individuals by blast winds and can be blunt or severe in nature. Head injuries among the most common types of blast injuries are skull fractures, and bone fractures [5]. Depending on the surroundings of the blast area, the extent of damage can vary. Therefore, this study provide an overview of clinical presentations, and outcomes of the blast-exposed victims.

Materials and Methods

Study design and setting

During the period between 2019 and 2020, this study examined the clinical and characteristics of blast-exposed casualties admitted to the intensive care unit New Najran General Hospital, KSA. Institutional Review Board approval (Zu-IRB No 6576/6-12-2020) was obtained for this study. In terms of patient selection, all casualties from blast exposure were screened. Hand grenade attacks were excluded. In addition more than three fractured ribs, significant penetrating thoracic injuries, flail chest, sternum or scapulae fractures, were also excluded as these represent serious secondary or tertiary injuries. In accordance with the study's protocol, all patients who participated in it provided informed consent.

Patients' assessment and treatment

A comprehensive clinical examination includes a thorough physical examination, a chest x- ray, age, sex, smoking history, occupation, and a review of different clinical symptoms. Chest X- rays were done to confirm any cardiac problems. ECGs and echocardiograms were performed to confirm any cardiac problems. Chest CTs was performed. All patients were given an ABG as part of their follow-up and during admission. Patients were scored using the Murray and APACHE scores. Murray's score [10] is based on four parameters: chest radiograph evaluation, PaO2/FiO2 ratio, PEEP, and lung compliance.

The Acute Physiology and Chronic Health Evaluation II (APACHE II) is a modification of the APACHE that assigns a numerical score ranging from zero to four. Acute Physiology and Chronic Health Evaluation II (APACHE II) Asses the severity of illness. A patient's heart rate temperature, ,blood pressure, respiratory rate, arterial pH ,oxygenation, serum sodium, , potassium and creatinine, as well as WBC and GCS, are all clinical and biochemical parameters. There is also a point system for assessing age groups and preexisting illnesses. [11]. length of ICU stay, Mode and settings of mechanical ventilation, and associated injury were also assessed. By assessing these parameters, doctors can get an overall picture of how severe the patient's illness is and how likely it is that the patient will recover. In addition, the point system allows doctors to adjust for factors such as age and preexisting illnesses that can affect the patient's prognosis.

Statistical analysis

SPSS version 24 was used to analyse the data. If parametric, data were described as means and standard deviations, and if nonparametric, data were described as medians and interquartile ranges. In qualitative data, percentages and frequencies were computed. To determine the association between categorical variables, the Chi-square was calculated. The difference between parametric and numerical data between more than two groups was tested via repeated measures ANOVA. The paired sample t-test was used if both groups had paired quantitative variables. We used a parametric numerical variable independent sample t-test to test the difference among the 2 groups. P values < 0.05 significant.

Results

Table 1: Demographic characteristics and baseline vital data of included patients (*n*=24).

Variable	Mean ± SD
Age	29.43 ± 13.74
Heart rate (HR)	98.08 ± 21.25
SBP	117.21 ± 25.62
DBP	67.17 ± 14.34
MBP	81.22 ± 16.11

Table (1) shows that the mean age was 29.43 ±13.74, the HR was 98.08 ± 21.25, and the SBP and DBP were 117.21 ± 25.62 and 67.17±14.34, respectively. Meanwhile, the MBP was 81.22 ±16.11.

Table 2: Baseline ABG parameters of included patients (n=24).

Parameter	Mean ± SD
PH	7.02 ± 1.49
PaO2	100.36 ± 34.56
PaCO2	41.22 ± 10.75
HCO3	20.58 ± 3.17
SO2	83.7 ± 14.9

Table 2. Shows that the mean PH of included patients was 7.02 ± 1.49. their mean HCO3 was 20.58 ± 3.17 while their mean SO2 was 83.7 ±14.9. their mean PaCO2 was 41.22 ± 10.75 . The data collected from the ABG shows that the pH levels for the patients were slightly alkalotic, the HCO3 levels were normal, the SO2 levels were normal and the PaCO2 levels were slightly elevated.

Table 3: The Murray and APACHE scores among included patients (n=24).

Variable	N (%)
Murray score	
BLI severity score	
Mild	7 (29.2)
Moderate	17 (70.8)

Acute lung injury Mild to moderate Severe	 21 (87.5) 3 (12.5)
CPIS	3 (2 – 4)*
APACHE score; Median (IQR)	8 (3 – 9)*

Table 3. Shows According to our Murray score review, 29.2% (7 patients) of the included patients had a low BLI severity score. The remaining 70.8% had a mediocre severity score. 87.5% of patients (21 participants) had mild to moderate lung injury. However, 12.5% (3 participants) had severe lung injury. The median CPIS score was 3 (2 – 4). The median APACHE score was 8 (3-9)

Table 4: Change of ABG parameters over the admission period for included patients (n=24).

	Baseline	**48 hrs**	**1 week**	***P*-value**
PH	7.31 ± 0.13	7.41 ± 0.07	7.45 ± 0.07	**0.189**
PaO2	113.13 ± 76.01	93.78 ± 42.87	111.13 ± 69.97	**0.808**
PaCO2	43.86 ± 6.09	45.94 ± 11.56	38.69 ± 6.14	**0.585**
HCO3	20.09 ± 3.74	23.94 ± 4.1	26.96 ± 4.09	**0.03**

Table 4, we found no significant differences at admission regarding PH values (p=0.189). Over the next week, average PaO2 values returned to normal levels despite an obvious decrease over 48 hours of admission. This was statistically insignificant. Over a week of admission, there was no significant change in PaCO2 values (p=0.585). However, HCO3 levels increased significantly (p=0.03) during the admission period.

Table 5: associated injuries of included patients (n=24)

Variable	**N (%)**
Acute kidney injury (AKI)	3 (12.5)
Intraabdominal injury	7 (29.2)
Cerebral injury	2 (8.3)
Femur fracture	1 (4.2)
Fracture rib	3 (12.5)
Spinal injury	4 (16.7)
Nasal fracture	1 (4.2)
Pubic fracture	1 (4.2)
Humerus fracture	1 (4.2)

Table 5 Based on an analysis of associated injuries intraabdominal injury occurred in 29.2% (7 patients). Acute kidney injury was detected in 12.5% (3 patients), spinal injuries were detected in 4 patients (16.7% of participants) and fractured ribs in 3 participants (12.5%).

Table 6: The association between length of hospital stay (LOS) and associated laboratory findings and sociodemographic characteristics (n=24).

	Pearson correlation	**P value**
Age	0.751	<0.001
Heart rate	0.210	0.349
SBP	0.09	0.690
DBP	0.178	0.427
MBP	0.036	0.875
Temperature	0.037	0.086
GCS	-0.304	0.169
RR	-0.052	0.819
PH	0.094	0.678
PaO2	0.049	0.828
PaCO2	0.025	0.914
SO2	0.225	0.314
HCO3	-0.006	0.981
Hb	-0.113	0.617
Hematocrit	-0.175	0.435
WBCs	0.014	0.949
Na	0.019	0.932
K	0.092	0.683
Creatinine	0.128	0.571

There was a positive correlation between LOS in ICU and the participant's age when we looked at the relationship between the length of ICU stay and associated laboratory findings (p<0.001). Statistically no significant correlation between ICU LOS and heart rate, SO2, or creatinine serum levels (p=0.349, p=0.314, p=0.571), respectively. Furthermore, LOS in ICU was weakly correlated with SBP, MBP, temperature, PH, PaO2, PaCO2, WBCs, Na, and K serum levels (p=0.690, p=0.875, p=0.086, p=0.678, p=0.828, p=0.914, p=0.949, p=0.932, p=0.683) respectively. In contrast, LOS and GCS, Hb level, and hematocrit % showed moderately negative correlations. The results also came up statistically insignificant (p=0.169, p=0.617, p=0.435). Also , RR and HCO3 serum levels were found to be uncorrelated with each other in terms of the LOS of patients in ICUs with no statistically significant difference between the groups (p=0.819, p=0.981) respectively .

Table 7: The difference between patients with moderate and severe lung injury symptoms concerning sociodemographic and laboratory findings.

Variable	Acute lung injury		P value
	Mild to moderate N=21	Severe N=3	
Age	29.9 ± 4.62	26.33 ± 5.51	0.685
Heart rate	98.62 ± 20.87	94.33 ± 28.54	0.752
SBP	116.8 ± 26.9	120 ± 18.08	0.845
DBP	67.57 ± 14.55	64.33 ± 15.31	0.723
MBP	81.04 ± 16.46	82.43 ± 16.55	0.892
Temperature	36.51 ± 0.4	36.77 ± 0.15	0.293
GCS	12.86 ± 3.95	15 ± 0.01	0.367
RR	22.1 ± 3.53	23.33 ± 8.08	0.817
PH	6.99 ± 1.6	7.29 ± 0.13	0.752
PaO2	104.14 ± 37.12	73.87 ± 20.12	0.380
PaCO2	40.76 ± 11.25	44.3 ± 7.29	0.606
SO2	83.13 ± 15.93	87.7 ± 19.51	0.773
HCO3	20.58 ± 5.37	20.6 ± 4.37	0.994
Hb	12.73 ± 2.37	10.43 ± 1.76	0.123
Hematocrit	37.83 ± 6.05	32.9 ± 3.94	0.189
WBCs	17.99 ± 6.86	11.43 ± 4.05	0.125
Na	139.87 ± 5.02	139.67 ± 4.16	0.948
K	4.01 ± 0.81	4.5 ± 0.78	0.340
Creatinine	69.65 ± 30.51	73.11 ± 27.07	0.915

Table 7, patients with mild to moderate lung injury were marginally older than those with severe lung injury .This has not statistically significant (p=0.685). As compared to those with severe lung injury, those with mild to moderate lung injury had a slightly higher heart rate. This was statistically insignificant (p=0.752). There was a slight increase in SBP and MBP among those with severe lung injury when in comparison with those with slight to moderate lung injury, but this was found to be insignificant (p=0.845, p=0.892). Comparing mild to moderate injuries with major injuries, DBP was found to be insignificantly higher (p=0.723) among those with mild to moderate injuries. Further, we found that severe lung injury was associated with higher GCS, RR, and Ph than mild to moderate lung injury, although this was also statistically insignificant (p=0.367, p=0.817, p=0.752). Furthermore, we found that Hb, HCT, and WBC serum levels were elevated among those with mild to moderate injuries, although this was statistically insignificant (p=0.123, p=0.189, p=0.125). No significant difference between Na or K serum concentrations.

Discussion:

Increasingly, blast lung injuries (BLI) are seen as a major cause of morbidity after terrorist bomb attacks (TBAs). Although many surgeons and intensivists are unfamiliar with blast lung injury (PBLI), the most common form of injury caused by explosive shock waves is blast lung injury (BLI)[12]. Acute lung injury occurs during 12 hours of blast exposure and not due to penetrating or blunt injuries. During shockwave transit among the lungs, alveolar rupture and intra-parenchymal bleeding result in respiratory compromise and acute lung injury [13].

In recent conflicts, 6-11% of military casualties devolped primary blast lung injuries, but in terrorist attacks the incidence increases to 90% involving enclosed spaces like trains. Most of victims need intensive care management and mechanical ventilation. There are no specific therapies for blast lung injury, so treatment is supportive and based on current clinical practice [14]. We screened all casualties caused by blasts. In addition to hand-grenade victims, casualties with flail chest,, fractures of three or more rib, sternum or scapula fractures, or significant penetrating thoracic injuries were excluded. Therefore, in this retrospective study, the clinical, management, and outcome of blast-exposed casualties admitted to the ICU during the period from to have been reviewed.

Our data revealed that the average age of 24 participants was 29.43 years old, which is consistent with a review by Scott et al [14], which found that the surviving casualties haf mean age of 26 years old, as well as Avidant et al [12], where the main age was 30.4±17.6. Further, as a result of our demographic data, we found that the median heart rate of casualties exhibiting PBLI was 98.08 ± 21.25 beats/minute, the mean SBP was 117.21 ± 25.62 mm/hg, and the mean DBP was 67.17 ± 14.34 mm/hg. Finally, the average temperature was 36.54± 0.39. These findings indicate that individuals with PBLI tend to have a higher heart rate, lower blood pressure, and lower temperature compared to individuals without PBLI. This suggests that PBLI can have a notable effect on physiological parameters.

As the lung injury matures, hyperoxia may appear immediately. During resuscitation, high concentrations of oxygen may help dissolve gas emboli and associated with improved survival in animals and this phenomenon can be detected by fundoscopy electrocardiogram and tongue examination (Lieber meister's sign). [15].

Likewise, otoscopy is not a high priority, since it does not correlate well with blast lung injury [16]. In our study on admission, 5 patients were sever hypoxemic (Pa(O2) = 65 mm Hg with oxygen supplementation) . After mechanical ventilation was established, 4 remained severely hypoxemic (Pa(O2)/fraction of inspired oxygen ratio of 60 mm Hg). The triad of symptoms of BLI is (1)bradycardia, (2) apnea, and (3) hypotension. It occurs without any apparent external injury to the chest. This triad of symptoms is generally indicative of a lack of adequate oxygenation in the body. In the case of the patients in the study, mechanical ventilation was not sufficient to provide the necessary oxygenation. As a result, four of the five patients remained severely hypoxemic.[17]

The diagnosis of blast lung is based clinicaly on clinical symptoms and radiology. Symptoms may include restlessness, respiratory distress, , and may be haemoptysis, associated with hIn some patients symptomsMay be significantly delayed in some patients [18]

It is not clear what criteria should be used to diagnose BLI according to the literature. The appearance of butterfly (with or without pneumothorax) on chest radiographs on admission and increased haziness on serial chest radiographs are usually sufficient to confirm the diagnosis; smoke inhalation and burn injuries of the upper airways is seen at bronchoscopy [19]. A severity score's usefulness has historically been in stratifying patients for research and prognostic purposes. However, severity scores can now be used to stratify outcomes for reimbursement and credentialing as well [9].

BLI has been scored in several ways. Pizov et al [9] proposed a severity score for BLI depends on three signs: hypoxia (PaO2/FiO2),the presence of a bronchopleural fistula , and chest radiograph findings The score defined three levels of injury : 1. Mild: PaO2 / FiO2 ratio >200 mmHg, localised lung infiltrates without pneumothorax; 2. Moderate: PaO2 / FiO2 ratio 60 to 200 mmHg, with or without pneumothorax; 3. In severe BLI, the PaO2/FiO2 ratio >60 mmHg, bronchopleural fistulas and bilateral lung infiltrates, are present. The Murray score 12 involves 4 parameters: chest radiographs evaluation, PaO2/FiO2 ratio, and positive end- expiratory pressure (PEEP). By dividing the sum of the individual criteria scores by the number of variables used, the Lung Injury Score (LIS) was determined. No injury = 0, mild to moderate =0.1 to 2.5, severe >2.5, and maximal = 4.0. [10]. The reliability and validity of both the BLI scoring system and the LIS have not been established, and the studies of Sorkine [20] and Pizov [9] were limited by their small size and retrospective nature. Furthermore, the Centre for Disease Control (CDC) pointed out that there were no definitive guidelines for observing, admitting, and discharging of those with possible BLI following an explosion [21].

According to our study, 29.2% (7 patients) of the included patients had a mild BLI severity according to Murray score[10]. A total of 70.8 % had a moderate severity score, and 87.5% (21 participants) had mild to moderate lung injury. However, 12.5% (3 participants) had severe lung injury. These results indicate that a majority had mild to moderate lung injury, indicating that the Murray score accurately reflected the severity of the patients' BLI. However, the fact that 3 participants had severe lung injuries suggests that the Murray score may not be an accurate measure of BLI in some cases.

Our findings indicate that patients with mild to moderate lung injury were somewhat older than those with severe lung injury. That of not statistically significant (p=0.685).Also those with minor to moderate lung injuries had a slightly higher heart rate than those with severe lung injuries. However, this has not statistically significant (p=0.752). As compared with mild to moderate lung injury, those with severe lung injury showed slightly elevated mean SBP and MBP. In contrast, DBP was not significantly higher among those with minimal to mild injuries when compared with those with major ones (p=0.723), which was not mathematically relevant (p=0.845, p=0.892). This suggests that the increased mean SBP and MBP among those with severe lung injury is not a result of increased DBP. Which suggests that there maybe other factors contributing to the increase in SBP and MBP in those with severe lung injury.

When comparing those with severe lung injury to those with mild to moderate ones, we found that the GCS, RR, and Ph increased, but it was statistically insignificant (p=0.367, p=0.817, p=0.752). These critically ill trauma patients with APACHE II [11] scores had the highest predictive value for ICU and hospital outcomes [11]. Median CPIS was also found to be 3 (2 – 4). The median APACHE score was 8 (3-9) points. This suggests that the severity of a patient's lung injury is not associated with their outcome, but rather with their APACHE II score. Patients with higher APACHE II scores have less satisfactory outcomes, regardless of the severity of their lung injury. The median CPIS score of 3 (2-4) and median APACHE score of 8 (3-9) also suggest that these patients are more likely to have poorer outcomes. The results are consistent with the results of a study by Mackenzie et al and Tunicliffe et al [13] which found that the median APACHE score among all causalities was 9 (5.15-7) and 9 (5.1-12) among survivors.

Strategies for management of BLI are mainly supportive, with lung protective ventilation being the mainstay of treatment .[22)

in our study five casualty (20.8%)with moderate disease was managed with noninvasive bilevel positive airway pressure of IPAP 10-12cm H2O and BIPAP 5–8 cm H2O for 11 hours on the second day of their 48-hour critical care stay. Eight patient (33.3%) severe PBLI managed with invasive mechanical ventilation . The other 13 (54%)patients didn't require mechanical ventilation

This is consistent with a study by Scott etal[14]where one casualty with moderate disease was managed with noninvasive continuous . One patient with severe PBLI developed abroncho-pleuralfistula and subsequent empyema. [21] Also study by Avidan etal [12] 25% of patients did not require mechanical ventilation. 198 Noninvasive PPV has been used successfully to avoid endotracheal intubation in some patients. 199 When invasive PPV becomes necessary.

Progressive hypoxia and rapid respiratory deterioration with resultant ventilation perfusion mismatch and subsequent acute respiratory distress syndrome (ARDS) is the clinical sequel of BLI . ARDS that develops in BLI patients is a direct result of the high pressure wave front passing through the interfaces between alveolar, air, blood vessels and tissue. This pressure front causes chest wall displacement toward the spinal column, leading to transient high intrathoracic pressure. This leads to stripping of airway epithelium, tearing of the alveolar septa, and rupture of alveolar spaces with consequent alveolar hemorrhage, edema, and alveolovenous fistulae. [23]

one patient met the consensus criteria for the definition of adult respiratory distress syndrome (ARDS). Within the first week of ICU stay

Mackenzie etal and Tunicliffe etal [13] reported in their study five patient met the consensus criteria for the definition of adult respiratory distress syndrome (ARDS). Also, Avidan et al [12] reported no cases of clinical deterioration with need for mechanical ventilation in patients who were more than 2 h post-injury. These authors reject the concept that blast lung injury may cause respiratory failure after a latent period and concluded that prolonged observation of asymptomatic patients was not necessary [12]. Sorkine et al [20] noted that, compared to ARDS caused by other means, the large area of ruptured lung in blast lung injury patients make them prone to complications due to mechanical ventilation. Moreover, positive pressure ventilation and PEEP should be avoided whenever possible because of the risk of pulmonary alveolar rupture and subsequent arterial air embolism.

When reviewing their outcomes, we found that their median LOS in ICU was 4 (3 – 9.25) days. On the other hand, their median duration of mechanical ventilation was 0 (0 – 3.25) as shown in table 4 The mean duration of ventilation in a study by Scott etal [14] was 4.5 days. This contrasts to current mortality rates for adult ARDS ranging from 28.3% to greater than 40% overall.This reflects the fact that trauma-associated ARDS is known not to increase mortality and is associated with significantly lower levels of serum biomarkers of inflammation. [23] Primary-blastinjury-associated ARDS is a more localized injury than ARDS resulting from systemic inflammatory insults such as sepsis and as such is a milder disease. [24] table (4)

In a study by Scott etal 4 [14] The 25 casualties with PBLI as the only pulmonary injury spent a total of 219 (mean 13.7, ± 11.3) days mechanically ventilated during a total of 328 (mean 16.4, ± 12.3) critical care days .

According to our analysis of associated injuries with the bone blast, 29.2% (7 patients) sustained intraabdominal injuries; 12.5% (3 patients) sustained acute kidney injuries. In addition to spinal injuries, fractured ribs were observed in 12.5% of participants (3 patients), followed by spinal injuries in 4 patients (16.7% of participants). This suggests that bone blast injuries are associated with a wide range of injuries, both at the site of the blast and in other areas of the body. Rib fractures and acute kidney injuries were more common than spinal injuries, suggesting that these injuries may be more severe and require more intensive care.

Our results were agree with Mackenzie et al and Tunicliffe et al [13] who discovered that 39 of 107 had amputations of limb, 20 had severe head injuries, and 3 had both. In 62 cases (57.9%), symptoms were therefore unreliable as a marker of blast lung. These results indicate that relying solely on symptoms to diagnose blast lung is ineffective, as symptoms were unreliable in most cases. Furthermore, the high number of patients who suffered limb amputations or severe head injuries suggests that blast lung is a particularly severe condition.

Our study is limited by the fact that the dataset was small, retrospective, and chaotic. Nevertheless, we can conclude, despite this, that severe PBLI in young and previously healthy casualties, can be treated with conventional ventilation.

This does not lead to mortality in survivors once they are admitted to a combat support hospital [15]. The data was collected from a hospital that was located in an area of active conflict, which makes it difficult to draw definitive conclusions. Nevertheless, with proper treatment, PBLI can be successfully treated with conventional ventilation and does not result in mortality based on the data collected.

Conclusion

To conclude, primary blast lung was a less severe disease than other forms of non traumatic acute lung injury and did not cause a fatal outcome once the casualty had reached a combat support hospital. Rather, it could be managed with conventional mechanical ventilation for a relatively brief period. This is likely because the primary blast lung injury is more localized and does not affect the entire lung like other forms of acute lung injury. Additionally, advances in medical technology and treatments have likely improved the prognosis of patients with primary blast lung injury.

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