Clinics of Surgery

Research Article

ISSN: 2638-1451 | Volume 8

Profile of Chest Injury in the Peri-COVID-19 Period: A Single Centre Series

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Received: 02 Sep 2022
Accepted: 15 Sep 2022
Published: 20 Sep 2022
J Short Name: COS

Citation:

Ekpe EE. Profile of Chest Injury in the Peri-COVID-19 Period: A Single Centre Series. Clin Surg. 2022; 8(2): 1-7

Keywords:

Chest injury; peri-COVID-19 era

1. Abstract

1.1. Background: Chest traumas continue to constitute about 30% of all traumas and contribute to 25-50% of trauma-related deaths. COVID-19 has its primary pathophysiologies in the lung, and can worsen the morbidity and mortality of chest trauma if it occurs concomitantly.

1.2. Methods: A retrospective analysis of cases of chest trauma in the peri-COVID-19 period (mid-Nov 2019 to mid-March 2022) in a level 2 trauma centre.

1.3. Results: Eighty-five cases of chest trauma met inclusion criteria within the 28 month's period, M: F = 7.5:1, age range 3-80years, mean age (38.60±17.40years) and median age of 37years. There were 54 (63.5%0) cases of blunt chest trauma and 31 (36.5%) cases of penetrating chest trauma. Thirty-one (36.5%) patients sustained haemothorax, 9 (10.6%) pneumothorax, 14 (16.5%) haemopneumothorax, 21 (24.7%) rib fractures, and 10 (11.8%) chest wall lacerations. Fifty-one (60%) patients had isolated chest trauma while the remaining 34 (40%) had associated injuries in one or more other organ systems. Closed thoracostomy tube drainage was definitive treatment in 48 (56.5%) patients while emergency thoracotomy was done in 5 (6%) patients. The treatment administered in the remaining 32 (37%) patients included intercostal nerve block for chest pain from rib fractures, wound exploration and wound repair. In the series, 75 (88%) had complete recovery, six (7%) patients left against medical advice, and four (5%) in-hospital mortality was recorded.

1.4. Conclusion: The profile of chest trauma in the peri-COVID-19 period in our centre differed from the pre-COVID-19 years with a higher mortality figure. Management protocol also necessitated certain modifications.

2. Introduction

Chest trauma is a significant source of morbidity and mortality [1], and constitutes about 30% of all traumas and contribute 25-50% of trauma-related deaths. COVID-19 has its primary pathophysiologies in the lung, and can worsen the morbidity and mortality of chest trauma if both occur concomitantly [2]. The invasion of the virus to the lung cells, myocytes and endothelial cells leads to lung injury pathogenesis [3], hypoxia-related myocyte injury, body immune response, increased damage of myocardial cells, and intestinal and cardiopulmonary changes, accumulation of oxygen free radicals, changes in intracellular pH, accumulation of lactic acid, electrolyte changes and further cellular damage. Symptomatic COVID-19 patients present with symptoms of respiratory infection and manifestation of viral pneumonitis on radiological imaging of the lung. Both symptoms and investigation findings of COVID-19 can mimic chest trauma and make differentiation difficult when both conditions may coexist in the same patient. However, their differentiation is important because the two conditions have differentiate management protocols.

The diagnosis of COVID-19 is based on the presence of appropriate respiratory features, PCR test results and chest radiological findings. Chest trauma patients also present with the same set of symptoms and signs. Pulmonary contusion is one of the most

common lung injuries in chest trauma and usually occurs at the site of the injury, or on the opposite side through countercoup phenomena. The manifestations in the chest CT are patchy airspace opacities and consolidations with non-segmental distribution and subpleural sparing [4]. The radiological manifestation of contusion and lung opacities in chest CT scan of trauma patients with incidental COVID-19 pneumonia is relatively similar. Patchy peripheral consolidation and GGO are common findings among both groups. Although subpleural sparing was identified in traumatic patients, which is similar to findings of lung contusion [5], some studies reported these findings in COVID 19 pneumonia [6,7]. Also, round central opacities are usually not seen in the first images of trauma patients unless complicated by nosocomial infections or fat emboli during admission; this pattern was visualized in our patients with COVID-19. Associated findings of pneumothorax, pneumomediastinum, and rib fractures are seen in chest injury patients. The diagnosis of COVID-19 in chest trauma patient is necessary since the double pathology is associated with significantly higher mortality rate.

This study examines the profile and outcome of chest trauma across the peri-COVID-19 period.

3. Material and Methods

A retrospective analysis of cases of chest trauma in the peri-COVID-19 period (mid-Nov 2019 to mid-March 2022) in a level-2 trauma centre.

3.1. Peri COVID-19 period stratification

Period I: Pre-COVID-19 era (18/11/19 – 18/03/20)

Period II: COVID-19 era (19/03/20 – 18/03/21)

Period III: Post COVID-19 era (19/03/21 – 18/03/22)

3.2. Assessment of patients [8]

Clinical assessment

Administration of checklist for COVID-19 triage (2nd/3rd periods) (Figure 1).

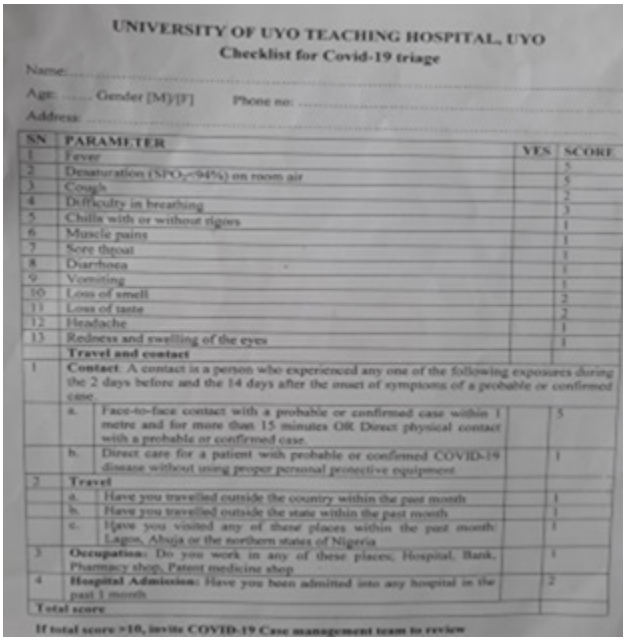
Clinical history and physical examination (Figure 2)

Radiological assessment

CXR (Figure 3 and 4), e-FAST, Chest USS, Chest CT scan (Figure 5)

Laboratory studies

PCV, GXM, E/U/Cr, HIV screening, COVID-19 screening, Plasma glucose, Urinalysis



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Checklist for Covid-19 triage

Name: .....

Age: ..... Gender [M]/[F] Phone no: .....

Address: .....

SN	PARAMETER	YES	SCORE
1	Fever		5
2	Desaturation (SPO_2<94%) on room air		5
3	Cough		2
4	Difficulty in breathing		3
5	Chills with or without rigors		1
6	Muscle pains		1
7	Sore throat		1
8	Diarrhoea		1
9	Vomiting		1
10	Loss of smell		2
11	Loss of taste		2
12	Headache		1
13	Redness and swelling of the eyes		1
	Travel and contact		
1	**Contact**: A contact is a person who experienced any one of the following exposures during the 2 days before and the 14 days after the onset of symptoms of a probable or confirmed case.		
	a. Face-to-face contact with a probable or confirmed case within 1 metre and for more than 15 minutes OR Direct physical contact with a probable or confirmed case.		5
	b. Direct care for a patient with probable or confirmed COVID-19 disease without using proper personal protective equipment		1
2	**Travel**		
	a. Have you travelled outside the country within the past month		1
	b. Have you travelled outside the state within the past month		1
	c. Have you visited any of these places within the past month: Lagos, Abuja or the northern states of Nigeria		1
3	**Occupation:** Do you work in any of these places; Hospital, Bank, Pharmacy shop, Patent medicine shop		1
4	**Hospital Admission:** Have you been admitted into any hospital in the past 1 month		2
	Total score		

If total score >10, invite COVID-19 Case management team to review

Figure 1: Checklist for COVID-19 triage

Figure 2: Clinical photograph of an assault victim who sustained multiple penetrating chest injury

Figure 3: Chest radiograph of a patient with multiple rib fractures and left tension pneumothorax from blunt chest injury

Figure 4: Chest radiograph of a patient right haemothorax from penetrating chest injury

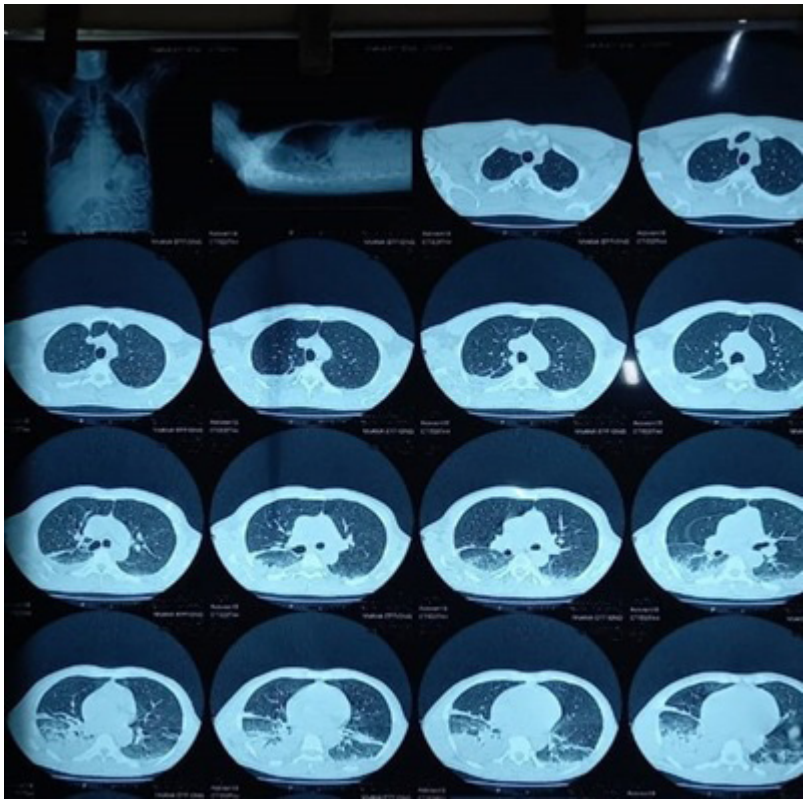

Figure 5: Chest CT scan of a patient who sustained blunt chest injury

3.3. Exclusion and data management

Patients with incomplete clinical or investigative data were excluded.

Data analysis was done using SPSS (version 20) and summarized as frequencies and percent.

4. Results

Eighty-five patients met the inclusion criteria for this study amongst those that were admitted for treatment for chest trauma during the period. They were 75 males and 10 females (M:F = 7.5:1). Of these, young adults aged 20-29years accounted for 28.2%, 30-39years accounted for 18.8%, middle aged adults aged 40-49% accounted for 20% and 50-59years accounted for 8.2%. Other age groups were less frequently affected (table 1).

Table 2 shows that there were 54 (63.5%) blunt chest injuries and 31 (36.5%) penetrating chest injuries. Haemothorax occurred in 31 (36.5%) of the cases of chest injury. This was followed by iso-

lated cases of rib fractures in 21 (24.7%) cases, haemopneumothorax in 14 (16.5%) cases, soft tissue injuries in 10 (11.8%) cases and pneumothorax in 9 (10.6%) cases. Table 2 also shows that 31 (40%) patients had associated extra-thoracic injuries.

Table 3 shows that closed thoracostomy tube drainage was carried in 48 (56.5%) cases of chest injury during the period, while thoracotomy was carried out in only 5 (5.9%) cases. The remaining 37.6% patients were treated with medications, wound care and chest physiotherapy. Seventy-five (88.2%) patients recovered, 7.1% left against medical advice, and mortality rate was 4.7% (table 3).

Table 4 shows the summary of the profile and treatment outcome of patients with injury during the peri COVID-19 period. Fifteen (17.6%), 41 (48.2%) and 29 (34.1%) of the cases occurred in the pre COVID-19, COVID-19 and post COVID-19 periods respectively. Nine (10.6%), 27 (31.8%) and 18 (21.2%) of the blunt chest injury occurred during the three stratified peri COVID-19 periods. And six (7.1%), 14 (16.5%) and 11 (12.9%) of the penetrating chest injuries occurred in the respective peri COVID-19 periods. There was no mortality or discharge against medical advice amongst patients who sustained chest injury and were treated in our centre with 100% recovery in the pre COVID-19 period. However, during the COVID-19 period, the mortality rate amongst chest injury patient was 4.9% and discharge against medical advice was 7.3% while recovery rate was 87.8%. Also, during the post COVID-19 era, mortality rate amongst our chest injury patients was 7.0%, discharge against medical advice 10.3% and recovery rate was 82.7%. Emergency thoracotomy rate was thrice during COVID-19 period compared to the other periods.

Table 1: Demographic characteristics of patients with chest injury

Variables	Frequency	Percent
Sex		
Male	75	88.2
Female	10	11.8
Total	85	100
Age category		
Less than 10	3	3.6
10-19	4	4.7
20-29	24	28.2
30-39	16	18.8
40-49	17	20
50-59	7	8.2
60-69	6	7.1
70-79	6	7.1
80 and above	2	2.4
Total	85	100

Table 2: Pathological characteristics of chest injury

Variables	Frequency	Percent
Type of chest injury		
Blunt	54	63.5
Penetrating	31	36.5
Total	85	100
Pathological pattern		
Haemothorax	31	36.5
Pneumothorax	9	10.6
Haemopneumothorax	14	16.5
Rib fracture	21	24.7
Soft tissue injury	10	11.8
Total	85	100
Associated extra-thoracic injury		
Yes	34	40
No	51	60
Total	85	100

Table 3: Treatment and outcome of chest injury

Variables	Frequency	Percent
Treatment		
Closed thoracostomy tube drainage	48	56.5
Thoracotomy	5	5.9
Others	32	37.6
Total	85	100
Outcome		
Recovery	75	88.2
Death	4	4.7
DAMA	6	7.1
Total	85	100

Table 4: Peri-COVID-19 period distribution of chest injury

Variables	Pre-COVID-19(%)	COVID-19 era(%)	Post COVID-19(%)	Total(%)
Types				
Blunt chest injury	9 (10.6)	27 (31.8)	18 (21.2)	54(63.5)
Penetrating chest injury	6 (7.1)	14 (16.5)	11 (12.9)	31(36.5)
Total	15 (17.6)	41 (48.2)	29 (34.1)	85 (100)
Treatment				
Tube thoracostomy	6 (7.1%)	23 (27.1)	19(22.4)	48 (56.5)
Emergency thoracotomy	1 (1.2)	3 (7.3)	1 (1.2)	5 (5.9)
Others	8 (9.4)	15 (17.6)	9 (10.6)	32 (37.6)
Total	15 (17.6)	41 (48.2)	29 (34.1)	85 (100)
Outcome				
Mortality	0 (0.0)	2 (4.9)	2 (7.0)	4 (4.7)
LAMA	0 (0.0)	3 (7.3)	3 (10.3)	6 (7.1)
Recovery rate	15 (100)	36 (87.8)	24 (82.7)	75 (88.2)
Total	15 (100)	41 (100)	29 (100)	85 (100)

5. Discussion

The current study corroborates male preponderance (M:F= 7.5:1) in chest trauma [2,3,9]. This is globally explained by the fact that men engage more in risky activities (legitimate and illegitimate) than women. Majority (67%) of victims were in productive age groups [2, 3] (20-29yrs=28%, 30-39yrs=19% and 40-49yrs=20%) with mean of 38.6±17.4 yrs. The wide age range (youngest 3years old and oldest 80years old) supported non-immunity of any age group to chest trauma [3].

There were more blunt chest injuries than penetrating chest injuries (63.5%vs36.5%) which is in keeping with global trend and our earlier institutional findings [10-17]. This trend was maintained across the three stratified periods of pre-, peri-, and post-COVID 19 periods. This majorly reflected the aetiopaothogenesis and mechanism of chest injury in civilian setting which are dominated by road traffic injuries and falls.

The pathologic entities encountered in our patients' population were same as in earlier studies in the institution [10,12,13]. These included haemothorax (36.5%), pneumothorax (10.6%) and pneumo-haemothorax (16.5%) occurring in association with rib fractures or in isolation, and isolated rib fractures in 24.7%. About 12% of the patients sustained various degrees of chest wall lacerations. Some series may exclude chest wall lacerations from chest injury data. However, the broad definition of chest injury as disruption of tissues of the chest wall and or intrathoracic organs allows inclusion of soft tissue chest wall injuries. Diaphragmatic rupture was not sustained by any patient during this period, as opposed to previously [13].

This series had associated extra-thoracic injuries in 40% of cases which are known to worsen mortality index in chest trauma [2,10,13]. All recorded mortalities in the series were in patients with associated severe traumatic brain injury and massive haemoperitoneum. Related studies have discovered major associated injuries and worse categories of injury severity scores as some of the determinants of mortality in chest injury [2,10,13,18].

Management followed the set protocols with additional infection prevention control guidelines re-amplified during the COVID-19 era. Pre-administration of the checklist for COVID-19 triage often resulted in suspiciously high score in many of our patients who presented with low values of peripheral arterial oxygen saturation (SpO2). However, no patient tested positive to COVID-19 test.

This was explained by the fact that the impact of chest injury manifests pathophysiologically as cardiopulmonary dysfunction same as COVID-19 [1-3,9,19].

About 56% of the patients were successfully treated with closed thoracostomy tube drainage, 5.9% underwent thoracotomy as part of their treatment, while the remaining 37.7% of patients were treated non-operatively. These included wound care, chest pain control with intercostal nerve block and/or systemic analgesia and empirical antibiotic and deep vein thrombosis prophylaxis in selected patients. These chest pain control modalities and thoracic epidural analgesia have been in use for chest pain management in the centre [11,15,16,20]. Of the 53 patients that underwent surgical procedures, closed thoracostomy tube drainage was successfully used in 48 (90.6%) of the cases while thoracotomy was needed in only 5 (9.4%). This corroborates global best practice [12,13]. All patients additionally underwent chest physiotherapy.

Although the pre-COVID-19 period reviewed was shorter, across-period analysis seemed to show higher incidences of chest trauma during the COVID-19 and post COVID-19 eras with higher incidence of penetrating chest injuries, higher level of discharge against medical advice and higher mortality rate. Reason attributed to the higher incidence of chest injury in the COVID-19 era include the effects of lockdown which included long periods of social aggregation of persons who could not go to work but also refused to remain at home. Such aggregations, often with substances abuse end in physical fights and assaults. The high mortality rate and discharge against medical advice rate were due to inability to pay for treatment because of the economic hardships occasioned by the lockdown. This is common in Nigeria where health insurance coverage is abysmal.

6. Conclusion

The profile of chest trauma in the COVID-19 period in our centre differed from the pre-COVID-19 era and was characterized by higher incidence of discharges against medical advice and a higher mortality figure. Management protocol also necessitated certain modifications including use of checklist for COVID-19 triage aimed at protecting healthcare workers, other patients and the general population against the COVID-19 pandemic.

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