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Changes in causes and outcomes of thoracic trauma cases during the COVID-19 pandemic: Literature review

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Abstract

Thoracic trauma refers to injuries affecting the chest area, which can lead to damage to the ribs, lungs, heart, and blood vessels. The most common cause of thoracic trauma is motor vehicle accidents. The COVID-19 pandemic has led to the implementation of various policies that have impacted multiple sectors, including healthcare systems and daily habits. Changes in healthcare systems are not limited to infectious cases but also extend to trauma cases. Various challenges have emerged alongside the increasing number of COVID-19 infections, such as shortages of personal protective equipment, ventilators, and hospital beds. The enforcement of pandemic-related policies has also resulted in alterations to daily routines. Lockdowns and social distancing measures have contributed to a decrease in traffic accidents due to reduced public mobility. Additionally, delays in seeking treatment for thoracic trauma due to fears of contracting COVID-19 have led to changes in outcomes. This literature review aims to identify the changes that occurred during the COVID-19 pandemic, particularly concerning the causes and outcomes of thoracic trauma cases.

Keywords: Thoracic Trauma; Covid-19; Blunt Injury; Penetrating Injury; Outcome

1. Introduction

Thoracic trauma refers to a variety of injuries affecting the chest region, which can significantly impair respiratory and circulatory functions. It is a major contributor to trauma-related mortality, accounting for approximately 35% of such deaths in the United States and up to 25% in Indonesia. Thoracic trauma can be classified based on its etiology into blunt and penetrating trauma. Blunt thoracic trauma is predominantly caused by motor vehicle accidents, which account for up to 80% of all cases. Other blunt thoracic trauma causes include falls from heights and acts of violence. Conversely, penetrating thoracic trauma results from injuries that breach the chest cavity, with the primary causes being stab wounds and gunshot injuries.

Thoracic injuries can lead to several critical conditions, including pneumothorax (which may result in lung collapse), hemothorax (accumulation of blood in the pleural cavity), pulmonary contusions (lung tissue bruising), and rib fractures, which can manifest as flail chest. These injuries can cause respiratory distress, hypoxia, and circulatory instability. Timely assessment and appropriate management can yield satisfactory outcomes in up to 90% of patients with thoracic trauma. In approximately 80% of cases, conservative non-surgical treatment is deemed sufficient. However, surgical intervention and radiological evaluations are necessary in specific scenarios, such as significant hemothorax or pneumothorax. Patient outcomes following thoracic trauma are influenced by the nature of the injuries, existing comorbidities, and patient age. Multiple rib fractures or flail chest, vascular injuries within the thoracic cavity,

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and cardiac injuries are associated with increased mortality rates. In elderly patients, comorbid conditions further correlate with higher mortality.

The COVID-19 pandemic commenced on March 11, 2020, as declared by the World Health Organization (WHO). COVID-19 infection is characterized by a range of symptoms, including respiratory distress, severe pneumonia, and potentially leading to mortality. The pandemic has had a profound impact on healthcare systems globally, resulting in increased demand for healthcare services, adjustments in both medical personnel and equipment resources, the emergence of public health policies, and disruptions to mental health.

The implementation of lockdowns and social distancing has resulted in increased at-home activities and a reduction in travel among the population. These changes in healthcare delivery and outdoor activity levels may have influenced the profile of thoracic trauma cases. This review aims to explore the alterations that occurred during the COVID-19 pandemic, particularly regarding the causes and outcomes of patients with thoracic trauma.

2. Review Content

2.1. Thoracic Trauma

2.1.1. Thoracic Trauma Definition

Thoracic trauma refers to injuries sustained in the chest region, which can be categorized into two main types: penetrating trauma (such as gunshot or stab wounds) and blunt trauma (including injuries from motor vehicle accidents or falls). This form of trauma is a significant contributor to morbidity and mortality, particularly among individuals under the age of 40, with an estimated 140,000 fatalities annually attributed to chest injuries (Caputo et al., 2024). Effective management of thoracic trauma necessitates accurate diagnosis and prompt intervention, often employing imaging modalities such as chest X-rays and computed tomography (CT) scans to detect injuries (Shevchenko et al., 2023).

2.1.2. Causes of Thoracic Trauma

The causes of thoracic trauma can be broadly classified into two categories: blunt and penetrating mechanisms, both of which significantly influence the severity and outcomes of these injuries. Thoracic trauma, also referred to as chest injury, occurs due to blunt forces such as motor vehicle collisions and falls from heights, or penetrating forces including stab wounds, machinery-related injuries, and gunshot wounds. These injuries can affect critical structures such as the ribs, heart, major blood vessels, and lungs (Sharma et al., 2020). Blunt thoracic trauma pertains to injuries sustained in the chest area due to non-penetrating forces, typically resulting from incidents like motor vehicle accidents or falls. This type of trauma can lead to various complications, including rib fractures, pulmonary contusions, and potentially life-threatening conditions such as tracheobronchial or aortic injuries (Kundu et al., 2024).

Penetrating thoracic trauma, on the other hand, involves injuries inflicted on the chest due to external forces, commonly resulting from stab wounds, gunshot wounds, or impalement. This form of trauma poses significant risks to vital anatomical structures such as the heart, lungs, and major blood vessels, necessitating immediate medical intervention (Shevchenko et al., 2023).

2.1.3. Outcomes of Thoracic Trauma

The outcomes of thoracic trauma encompass a variety of clinical consequences that significantly influence patient recovery and survival. Severe thoracic trauma (STT) is associated with the necessity for interventions such as intubation and chest tube insertion (Grubmüller et al., 2018). Patients exhibiting high Chest Trauma Scores (CTS) demonstrate a notable correlation with respiratory complications and extended hospital stays (Mahaseth et al., 2022). The mortality rate among thoracic trauma cases is particularly elevated in individuals requiring mechanical ventilation and those with severe extrathoracic injuries, reaching as high as 9.9% (Kesieme et al., 2011). Furthermore, combat-related thoracic injuries have been linked to abnormal pulmonary function tests, indicating chronic respiratory issues in nearly one-third of affected service members (Hughes et al., 2020).

The severity of thoracic trauma directly impacts patient outcomes, with higher morbidity and mortality rates observed in patients requiring invasive interventions. A study by Grubmüller et al. (2018) highlighted that STT often necessitates critical interventions, which are indicative of poorer prognoses (Grubmüller et al., 2018). Additionally, Mahaseth et al. (2022) found that patients with elevated CTS are at an increased risk for complications such as pneumonia and longer hospitalizations (Mahaseth et al., 2022).

Delays in treatment or presentation can exacerbate the outcomes for thoracic trauma patients. The need for timely medical intervention is crucial, as delays can lead to increased severity of injuries and complications upon arrival at healthcare facilities. Research indicates that patients who experience delays in seeking care often present with more severe conditions, necessitating more complex management strategies.

Survivors of thoracic trauma during the pandemic may face long-term health consequences, including chronic respiratory conditions and diminished quality of life. Hughes et al. (2020) reported that combat-related thoracic injuries are associated with persistent pulmonary dysfunction in a significant proportion of affected individuals, underscoring the need for ongoing monitoring and rehabilitation strategies for these patients.

2.2. Healthcare System Changes During Covid-19 Pandemic

2.2.1. Resource Allocation

The pandemic necessitated a swift reallocation of healthcare resources to address the surge in COVID-19 cases. A systematic review revealed that healthcare utilization declined by approximately 37% during this period, with significant reductions observed in outpatient visits, hospital admissions, and diagnostic services (Hernandez et al., 2021). This decline was particularly evident among patients with non-severe conditions, leading to missed opportunities for essential healthcare services, including vaccinations and cancer treatments (Hernandez et al., 2021). Conversely, the pandemic prompted a substantial increase in telehealth services, which rose from minimal usage to over 40% of outpatient visits by April 2020 (Koonin et al., 2020). However, the long-term sustainability of telehealth adoption remains uncertain, as utilization rates have decreased since their peak (Koonin et al., 2020).

2.2.2. Treatment Protocols

The pandemic prompted significant changes in treatment protocols across various healthcare settings. Healthcare workers faced unprecedented challenges due to increased patient loads and the need for specialized training in managing COVID-19 cases (Mok et al., 2022). Emergency Department Thoracotomy (EDT) became a critical intervention for severe thoracic trauma cases, while minimally invasive techniques were recommended for less severe injuries (Caputo et al., 2024). The integration of telemedicine into routine care has also emerged as a vital strategy for maintaining continuity of care while minimizing exposure risks (Anthony Jnr, 2021).

2.2.3. Public Health and Government Policy

Governments enacted interventions, including lockdowns and social distancing protocols, to reduce the spread of the coronavirus, which unintentionally hindered access to healthcare services (Mbunge et al., 2021). Research has shown that these constraints not only restricted access to crucial medical care but also intensified existing health disparities among at-risk populations (Fadhlurrohman et al., 2020).

2.3. Correlation of Thoracic Trauma and Covid-19 Pandemic

2.3.1. Causes of Thoracic Trauma During Covid-19 Pandemic

During the COVID-19 pandemic, closed thoracic trauma cases were more prevalent than penetrating thoracic injuries. However, following the conclusion of the pandemic, there has been an increase in the number of penetrating trauma cases. This rise may be attributed to a surge in violence during the pandemic (Gourti et al., 2022; Emigh et al., 2022). The overall incidence of trauma cases was found to decrease during the COVID-19 pandemic; however, there was a significant increase in penetrating trauma cases after the pandemic status was lifted (Emigh et al., 2022).

The implementation of lockdowns and measures to mitigate the spread of COVID-19 resulted in a significant decrease in motor vehicle accidents. In Greece, a study found that during the lockdown period, there was a reduction of approximately 1,226 collisions, 72 fatalities, and 1,426 minor injuries compared to previous data (Gourti et al., 2022). The decrease in traffic volume during lockdowns contributed to safer road conditions with fewer vehicles on the road (Qureshi et al., 2022). However, following the end of the pandemic and the return to normal conditions, there was a notable increase in motor vehicle accidents (Shaik & Samsuddin, 2022). There is also a shift in the leading cause of thoracic trauma injuries, with falls become more prevalemnt during lockdowns (Yorulmaz & Gökçe, 2022). This may occur due to increase at home activities and more accidents happen within homes as people must stay indoors most of the time.

During the COVID-19 pandemic, particularly in the context of lockdown measures, there was a significant decline in the number of patients seeking emergency care for trauma. This decline led to increased severity of injuries among those

who did present to healthcare facilities, as many individuals postponed seeking medical attention due to fears of contracting the virus or due to restrictions on movement. Consequently, patients arriving at hospitals often had more complex conditions requiring urgent intervention (Yorulmaz & Gökçe, 2022).

The outcomes for patients diagnosed with COVID-19 reveal a higher 30-day mortality rate and extended hospital stays compared to those without the infection. Individuals infected with COVID-19 exhibit increased susceptibility to pulmonary embolism and respiratory failure (Wang & Li, 2023). A multicenter retrospective analysis highlighted that trauma patients who tested positive for COVID-19 experienced significantly elevated morbidity and mortality rates relative to their COVID-negative counterparts. Specifically, the mortality rate among COVID-positive trauma patients was 9.4%, in contrast to 1.9% for those without the virus ($p = 0.029$). Additionally, there were increased incidences of pneumonia (7.5% vs. 0.0%, $p = 0.011$) and longer hospital stays (mean duration: 7.47 days vs. 3.28 days, $p < 0.001$) (Huang et al., 2021). These findings indicate that the presence of COVID-19 exacerbated outcomes for patients with thoracic trauma, underscoring the necessity for specialized management strategies during pandemics.

3. Conclusion

The causes and outcomes of thoracic trauma cases have evolved with the COVID-19 pandemic. During the pandemic, there was an increase in blunt thoracic trauma cases compared to penetrating trauma, reverting to pre-pandemic levels post-lockdown. The primary cause of thoracic trauma during this period was falls, attributed to lockdown measures and social distancing. Changes in emergency response led to delayed healthcare access, resulting in complicated cases. Patients with thoracic trauma and COVID-19 exhibited increased mortality rates and prolonged hospital stays due to severe complications such as respiratory failure and multiple organ dysfunction syndrome (MODS).

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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