Emergency management of traumatic spinal cord injury: a systematic review

Othman M. Omair1*, Ahmed A. Awwadh2, Haitham S. Habtar2, Omar A. Awwadh3, Hassan M. Taresh3

ABSTRACT

Globally, trauma is a prominent factor contributing to mortality and impairment. Hemorrhage accounts for up to 40% of fatalities resulting from traumatic injuries. Current approaches to improve mortality rates have prioritized the implementation of effective techniques for the early management of bleeding and the treatment of coagulation disorders. This is an updated systematic review of studies that examined the emergency care of traumatic spinal cord injury (SCI) from 2017 to 2023. A literature search was conducted using Google Scholar, Web of Science, Cochrane, and PubMed databases to find relevant research on our issue. The search terms used were “SCI, Spine trauma, Emergency, management, Traumatic cervical SCI” and were employed in different combinations. Furthermore, an assessment was conducted on original research that examines the emergency care of severe SCI. The inclusion criteria were based on full-text publications. Out of the 85 research that were collected, only nine satisfied the inclusion requirements. Out of the total number of studies, seven were conducted retrospectively, one was a case report, and another was a cross-sectional research. The research population consisted of around 159,982 individuals diagnosed with SCI. Respiratory issues, septicemia, and cardiovascular complications were the leading causes of in-hospital mortality in those with complete acute SCI. Elderly people, physical injuries, paralysis of all four limbs, and reliance on mechanical breathing were all associated with greater death rates. The American Spinal Injury Association grade upon admission was the greatest predictor of morbidity and death. Road traffic accidents were the major cause of SCI among Saudi men. Bomb blasts quickly followed falls, gaining second place. Road traffic accidents are the second most common cause of SCI among females, behind falls. Younger people who suffer spinal cord injuries frequently were found to have a better prognosis for recovery than older people.

Keywords: Spinal cord injury, spine trauma, emergency, management, traumatic cervical.
the highest morbidity and death rates, especially among the older population [3,4,6]. Although efforts have been made to educate people about preventing primary injuries and to provide safety features like airbags and passive restraint systems in vehicles, traumatic spinal cord injury (SCI) still significantly affects the healthcare system. The estimated costs for providing lifetime care to a patient with catastrophic SCI range from $1,600,000 to $4,800,000 [7]. Patients with SCI have a considerably reduced life expectancy and a notably higher yearly death rate when compared to those of the same age without severe SCI [1].

Over the last three decades, there has been significant advancement in the medical care provided to those suffering from catastrophic spinal cord injuries. Spinal instrumentation has revolutionized the surgical treatment of spinal fractures as well as the care of patients with spinal mechanical instability caused by SCI. Meanwhile, there has been progress in the non-surgical treatment of these patients, with special attention on the care delivered in the emergency department, intensive care unit (ICU), and pre-hospital settings [5].

The implementation of trauma networks that include emergency medical services personnel who are skilled in assessing patients with possible SCI has led to the effective sorting and transfer of suitable patients to specialized SCI treatment clinics. Upon arrival at the ultimate treatment institution, prompt and systematic assessment and stabilization are conducted. Subsequently, patients are closely observed in specialized ICUs specifically tailored for the treatment of acute SCIs. Presently, individuals with acute traumatic spinal cord injuries need treatment that strictly adheres to accepted practice standards and makes use of medical evidence-based algorithms [8,9].

Currently, there is no treatment currently available that improves the functional recovery of people with paraplegia or tetraplegia after a traumatic SCI [10,11]. This highlights the need of globally implement preventive policies. While there are publications available on the occurrence and frequency of SCI in various countries and systematic reviews on SCI rates in specific cities, at national, regional, and global levels, there is a lack of comprehensive information on the emergency management of traumatic SCI [12]. Here, in the present systematic review, we aimed to evaluate the emergency management of traumatic SCI. The primary aim of this study is to evaluate the emergency management of traumatic SCI.

Method and Search Strategy

This systematic review followed the PRISMA checklist criteria for systematic reviews and meta-analyses [12]. The databases examined were Google Scholar, Web of Science, Cochrane, and PubMed. The two databases were used to conduct a survey for research pertaining to our primary subject, “SCI, Spine trauma, Emergency management, Traumatic cervical SCI.” The investigations were published from 2017 to 2023. The search technique included using several keywords such as “SCI, Spine trauma, Emergency, management, Traumatic cervical SCI.” Furthermore, the pertinent keywords were used to gather all applicable articles. As a consequence of this first research, all titles were revised.

Eligibility criteria

Articles specifically addressing the strategies for managing severe spinal cord injuries in emergency situations were eliminated from consideration after evaluating the titles of articles on this topic published before 2017. In the second step, we specifically chose original studies written in English that reported on the emergency care of traumatic SCI. This selection was made after analyzing the abstracts of the remaining papers. However, review articles, editor letters, and case reports were excluded. The last phase included original English-language publications that discussed and assessed the emergency care of traumatic SCI. The articles underwent further scrutiny to eliminate any duplicates, articles without full text, and articles with unacceptable substance, such as data that was overlapped or incomplete. Figure 1 provides a comprehensive illustration of the search methodology.

Data reviewing and analysis

The entire collection of the papers, including both the complete text and abstracts, was assessed to extract the pertinent data and move it to a pre-existing Excel spreadsheet. The selected data were subsequently modified in the Excel spreadsheet and then consolidated to provide a summary for the purpose of facilitating data analysis.

Results

This systematic review’s inclusion criteria were satisfied by nine studies [13–21] (Table 1). The included studies were published in 2017 [15], 2019 [18,19,20], 2020 [16,17], 2022 [14,21], and 2023 [13]. Seven studies [14–20] were retrospective, while one study was a case report [13] and another study was cross-sectional [21]. The study population was comprised of more than 159,982 patients with SCI. In one study [13], the effects of traumatic spinal cord damage on continuous spinal cord physiologic monitoring were examined. The patient had fallen off of scaffolding and was brought to the hospital. An evaluation of trauma was finished in a nearby emergency department. An analysis of the causes and risk factors for death in patients hospitalized with full acute traumatic SCI (ATSCI) was conducted in an additional study [14]. On the other hand, another study [15] investigated the management of individuals with acute traumatic spinal cord damage in the emergency department and pre-hospital settings. Furthermore, two studies were conducted: one [16] examined the prevalence of acute SCI, the other [17] sought to determine the predictors of spinal injuries.
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Appropriate for immobilization, and the other examined the prescription rates and side effects associated with high-dose methylprednisolone treatment. Furthermore, a study [18] identified the clinical characteristics of ATSCI patients and emphasized the variables influencing early results. Additionally, another study [20] looked into the benefits of highly early surgery for total cervical spinal cord injuries in terms of neurological recovery. In a different research [21], the self-reported frequency of erectile dysfunction (ED) visits, hospitalizations linked to ED visits, and the causes for ED visits were determined for individuals with traumatic SCI and compared with data from the general population in the same region. All patients hospitalized at KKH throughout the research period were the subject of a single investigation [19] that was carried out in Saudi Arabia and looked at the epidemiology and frequency of SCI. The purpose of the study was to assess the etiologies and utilize the data to suggest measures to reduce SCI. To ensure patient safety and minimize suffering after acute traumatic spinal cord damage, a research study [13] on emergency treatment for SCI successfully carried out the first technique of implanting a strain gauge pressure monitor into the subdural space at the injury site. The reliable measurement of spinal cord perfusion pressure was made possible by the use of physiological monitoring.

Immobilization was used for 69.9% of patients with traumatic SCI in different research [15]. Forty-seven of the sixty patients with cervical traumatic SCI wore cervical collars. Out of the total of 60 patients, only 34 received complete immobilization. A different study [16] found that the prescription rate for methylprednisolone peaked in 2012 (76%) and then steadily declined, reaching its lowest point in 2017 (41%). The MP group had a greater incidence of urinary tract infection (UTI), GI bleeding, and pneumonia complications [16]. The most prevalent causes of in-hospital mortality among patients with complete ATSCI were respiratory complications, septicemia, and cardiovascular issues. In study [14], advanced age, injury severity, tetraplegia, and reliance on ventilator support were identified as significant risk factors strongly associated with mortality. The average injury severity score (ISS) was 21.8 ± 11.8. The death rate in the hospital was 13.9%. 70% of patients did not have any damage to their spine. 25.9% of patients scored 2–3 on the abbreviated injury scale (AIS), while 4.1% scored 4-6 [17]. Because they could not pay for the procedure, only 42% of the patients who required surgery had surgery. The most critical factor in determining morbidity and death was the ASIA grade at the time of admission. [18] Respiratory care and infection prevention are crucial.
Table 1. List of studies.

<table>
<thead>
<tr>
<th>Author and publication year</th>
<th>Study design</th>
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<tr>
<td>Dhaliwal et al. [13]</td>
<td>Case report</td>
<td>The patient sought medical care after a fall from scaffolding. A comprehensive evaluation of the trauma was conducted in a nearby emergency department.</td>
<td>Continuous surveillance of spinal cord physiology after traumatic SCI.</td>
<td>After a sudden and severe SCI, the first effort to insert a strain gauge pressure monitor in the subdural space at the location of the damage was successfully and uneventfully carried out. The physiological monitoring effectively obtained the spinal cord perfusion pressure. Additional research efforts are necessary to authenticate this approach.</td>
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<td>Chhabra et al. [14]</td>
<td>A retrospective study.</td>
<td>A total of 785 people diagnosed with ATSCI.</td>
<td>To examine the etiology and potential hazards contributing to death in individuals hospitalized with full ATSCI.</td>
<td>The most frequent causes of death after hospitalization in individuals with total ATSCI were respiratory problems, septicemia, and cardiovascular reasons. Mortality was substantially related with advanced age, the existence of concomitant injuries, tetraplegia, and the need for ventilator support. In order to decrease illness and death rates during the first stage, it is crucial to prioritize the management of respiratory function and the avoidance of infections, particularly in individuals with tetraplegia.</td>
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<td>Kreinest et al. [15]</td>
<td>Retrospective cohort study.</td>
<td>A total of 133 people diagnosed with traumatic SCI.</td>
<td>An examination of the provision of medical care in the prehospital setting and emergency department for individuals with sudden and severe damage to the spinal cord.</td>
<td>Immobilization was required for 69.9% of patients with traumatic spinal cord injuries. Forty-seven of the sixty patients who suffered from cervical traumatic SCI wore cervical collars. Of the sixty patients, only thirty-four received complete immobilization. The mean time it took to go from the accident scene to the emergency room was 61.3 ± 28.7 minutes. Of the 133 patients analyzed in this study, 25 had poor circulation or high intracranial pressure, making early surgery impractical. Following the incident, an average of 322.8 ± 254.1 minutes was all that was needed for 108 individuals to get early surgery.</td>
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<td>Choi et al. [16]</td>
<td>Retrospective population-based cohort study</td>
<td>12,137 patients with SCI</td>
<td>The objective of this study is to assess the occurrence of SCI in South Korea, along with the rates of prescribing high-dose methylprednisolone treatment and its associated adverse effects.</td>
<td>Acute SCI has an incidence rate of 26.4 per 1,000,000 people, age-adjusted. The age group in their 50s had the greatest incidence rate. The rate of prescribing methylprednisolone reached its peak in 2012 at 76% and has since declined, reaching its lowest point in 2017 at 41%. The group of Members of Parliament had elevated incidence of complications, namely in relation to pneumonia, gastrointestinal bleeding, and UTIs. Patients who were administered methylprednisolone had a lengthier duration of hospitalization on average.</td>
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### Table 1. Continued.

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<td>Häské et al. [17]</td>
<td>Retrospective cohort study</td>
<td>The study included a total of 145,833 individuals with SCI, with an average age of 52.7 ± 21.1 years.</td>
<td>To determine the frequency and factors that may be used to predict spine injuries that need immobilization.</td>
<td>Among the 145,833 patients that were recorded, the average age was 52.7 ± 21.1 years. The hospital’s average ISS was 21.8 ± 11.8, and the fatality rate was 13.9%. Of the patients, 4.1% had an AIS score of 4-6, 25.9% had an AIS value of 2-3, and 70% had no spine injury at all. 26.8% of patients who had recently had traumatic brain injury (TBI) also had spinal injuries, with an AIS score between 4% and 6. 44.7% of patients with multiple injuries involving several bodily systems, including TBI, had spinal injuries defined as scoring 4-6 on the AIS. Regression analysis predicted a 5.1% prevalence rate for cervical spine damage and a substantial 10.6% prevalence rate for spinal injuries. It has been shown that blunt trauma is a good predictor of both SI and CSI; however, falls greater than three meters were only linked to SI and not CSI. Being in shock before coming to the hospital was a sign that one would likely have both SI and CSI. Furthermore, a decreased or absent motor response also suggested a possibility of both SI and CSI. The incidence of CSI was greater in patients 65 years of age and older.</td>
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<td>Yusuf et al. [18]</td>
<td>A retrospective examination of the National Trauma Center Abuja’s trauma registry and patient data for each patient who suffered from acute TSCI</td>
<td>A comprehensive study was conducted on a cohort of 133 individuals diagnosed with TSCI.</td>
<td>To analyze the clinical characteristics of patients with TSCI and identify the variables that influence the first prognosis at a trauma center with limited resources.</td>
<td>Car collisions caused the bulk of injuries (72.2%), with the cervical spinal cord accounting for 62.0% of those injuries. No patient got the standard prehospital treatment. A mere 41.4% of the patients were conveyed to the medical institution by ambulance. Approximately 52.6% of the patients were identified by the ASIA as having grade A spinal cord damage. Pressure ulcers were the predominant adverse event, manifesting in 23.3% of the patients. Merely 42% of the patients who needed surgery had the operation, mostly because they couldn’t afford the care. The main indicator of morbidity and death was the ASIA grade upon admission.</td>
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<td>Mehdar et al. [19]</td>
<td>A retrospective study at the King Khalid Hospital</td>
<td>A total of 182 patients were admitted with SCI.</td>
<td>The purpose of this study is to evaluate the epidemiology and prevalence of SCIs in all patients who are admitted to the KKH hospital during the course of the investigation. Furthermore, we want to investigate the underlying causes of SCI and use this understanding to create preventative strategies.</td>
<td>Five-nine percent of incidents of SCI among males were caused by RTA. With 15% of instances each, falls and bomb explosions were the second most common causes. In 13% of instances, falls are the main cause of SCI in females. For females, RTAs account for the second most common cause of SCI. The majority of the juvenile patients had stable conditions and were making progress. However, six patients had paraplegia due to spinal cord injuries sustained in automobile accidents, and four patients experienced quadriplegia. RTA are the leading cause of SCI, with bomb explosions and falls coming in second. Young individuals with spinal cord injuries often have more favorable recovery chances compared to senior people.</td>
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RTA accounted for the majority of SCI cases in Saudi
a motor vehicle collision, the most frequent damage
lengthier hospital stays on average. In [16], Following
of 10.6% [17]. Patients who got methylprednisolone had
have a prevalence of 5.1% and a severe SI with a prevalence
[16], a cervical SI was predicted by regression analysis to
predictive of both SI and CSI. Patients over 65 were more
often affected by CSI [17]. The most significant incidence
of acute SCI occurred in the 50s, with an average age-
adjusted incidence of 26.4 per 1,000,000 individuals. In
[16], a cervical SI was predicted by regression analysis to
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a motor vehicle collision, the most frequent damage
(72.2%) mainly affected the cervical spinal cord (62.0%)
[18]. Another study [19] found that renal tubular acidosis
(RTA) is the most frequent cause of SCI, followed by
bomb explosions and falls.

RTA accounted for the majority of SCI cases in Saudi
Arabia for men (59%); falls and bomb blasts tied for
second place (15%) and third place, respectively. For
females, RTAs are the second most common cause of
SCI, with falls accounting for 13% of cases. Most of
the younger patients had stabilized and made progress.
Nevertheless, after RTA-initiated SCI, six individuals
experienced paraplegia, and four experienced
quadriplegia. [19] Younger SCI patients often have
greater recovery prospects than older individuals. [19]
58.02% of patients had improved neurological function
a year following surgery; the UES group performed
better than the ES group [20]. For the 26 patients with
full cervical SCI (ASIA A), the use of ultra-early surgical
decompression was related to a considerably
better recovery in neurological function compared to
ES. Furthermore, a higher ASIA grade at admission
was associated with younger age, according to both
univariate and multivariate models, and scheduling
surgery within 12 hours. This correlation was seen in both the
univariate and multivariate analysis. However, the correlation between improvement and CCI
was only significant in the univariate analysis (P = 0.005).

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<td>Nasi et al. [20]</td>
<td>A single-center retrospective study</td>
<td>There were 81 individuals who had experienced traumatic spinal cord injuries in the cervical region.</td>
<td>Early surgical intervention in instances of complete cervical SCI results in enhanced neurological recovery.</td>
<td>After 12 months after surgery, 58.02% of patients showed improved neurological function. The UES group had superior results compared to the ES group. Among the 26 patients who had total cervical SCI (ASIA A), undergoing ultra-early surgical decompression resulted in much more substantial neurological recovery than to ES. In addition, there was a strong correlation between greater neurological improvement and younger age, higher ASIA grade upon admission, and undergoing surgery within 12 hours. This correlation was seen in both the univariate and multivariate analysis. However, the correlation between improvement and CCI was only significant in the univariate analysis (P = 0.005).</td>
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<td>Cao et al. [21]</td>
<td>Cross-sectional study</td>
<td>The participants (N = 648) were individuals with traumatic SCI who lived in the community and were at least 18 years old.</td>
<td>This research seeks to determine the self-reported frequency of ED visits, ED-related hospitalizations, and causes for ED visits among patients with SCI, by comparing the findings with data from the general population in the same geographic region.</td>
<td>Out of all the participants with SCI, 37% reported having visited the ED at least once, and 18% reported being hospitalized in the ED at least once in the prior 12 months. Forty-nine percent of those who visited the emergency room at least once were hospitalized. After adjusting for gender, age, and race/ethnicity, persons with SCI had a 151% higher risk of traveling to the ED and a 249% higher chance of having at least one ED hospitalization than the NHIS group. People with SCI went to the ED more often for serious health concerns, said it was the nearest medical institution, and were more likely to come by ambulance. NHIS participants had a higher probability of seeking care in the emergency department due to the absence of other options.</td>
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Within the last year, 37% of patients with SCI sought medical attention at an ED, whereas 18% required hospitalization after their ED visit [21]. Out of the individuals who went to an ED at least once, 49% needed to be admitted to a hospital. Compared to a sample from the National Health Interview Survey (NHIS), after accounting for sex, age, and race/ethnicity, individuals with SCI had a 151% higher likelihood of visiting ED and a 249% higher likelihood of experiencing at least one ED hospitalization [21]. People with SCI said that they sought ED treatment due to its proximity, had a higher likelihood of arriving by ambulance, and visited the ED for more serious health problems at a greater frequency. Individuals included in the NHIS had the option to visit the ED only if they had no alternative available [21].

Discussion

The primary aim of clinical research on traumatic spinal cord injuries has been to achieve early spinal cord decompression and enhance spinal cord perfusion to mitigate further harm. People with SCI have a significant risk of death [1]. Studies have shown that the rates of death inside hospitals for ATSCI vary between 4% and 18% [22–25]. Despite improvements in acute care management systems, the death rate during the first days of hospitalization following ATSCI remains significantly high in low- and middle-income countries (LMICs). In research done by Chamberlain et al. [26], it was shown that the mortality rate inside hospitals in LMIC was almost three times higher than that seen in high-income countries. This systematic analysis assessed the emergency care of traumatic SCI.

Dhaliwal et al. [13] assert that their recent findings demonstrate the first successful implementation of a strain gauge pressure monitor into the subdural space at the specific location of injury after an ATSCI, with the procedure being both safe and painless. This physiological monitoring allowed for the successful determination of the spinal cord perfusion pressure. The use of pressure monitoring devices with strain gauges following acute traumatic spinal cord injuries [27]. The subsequent study extensively showed the correlation between the intraspinal pressure waveform and the blood pressure, heart rate, and breathing rate of a patient. The pressures derived from the epidural cavity and the catheters inserted within the spinal cord tissue have been compared to the intraspinal pressures [28]. The difference between intraspinal and mean arterial pressures was used to calculate the spinal cord perfusion pressure [29].

Kreinest et al. (2017) demonstrated that 69.9% of persons with significant SCI need immobilization. Among the 60 individuals who suffered from serious spinal cord injuries in the cervical area, a total of 47 individuals used cervical collars. Just 34 out of the 60 patients were fully immobilized. Current recommendations firmly support the use of spinal immobilization in persons with traumatic SCI, despite the lack of randomized controlled research that provides clear evidence of the effect of immobilization on mortality and patient outcomes [29, 30]. Multiple factors contribute to the decision to not provide cervical collars to trauma sufferers. The use of cervical collars may elevate intracranial pressure if there is a correlation between severe brain damage and trauma [31].

Furthermore, some findings state that wearing a cervical collar might aggravate spinal cord damage in individuals with spinal comorbidities, such as ankylosing spondylitis, which 10.5% of the patients in our research had [32]. According to Choi et al. [16], the prescription rates of the peak of methylprednisolone occurred in 2012, reaching 76%, and thereafter had a gradual decline, reaching a nadir of 41% in 2017. The incidence of complications, such as pneumonia, gastrointestinal bleeding, and UTIs, was greater in the MP group. Multiple investigations were carried out to assess the effectiveness of methylprednisolone after the release of research on the impact of high-dose methylprednisolone therapy for ASCI [33, 34]. Recent research indicates that methylprednisolone is not recommended as the first treatment for people with SCI. This is due to the fact that it has been shown to increase the likelihood of problems without offering any enhancement in neurological symptoms. The Food and Drug Administration has withdrawn its recommendation for the use of Methylprednisolone in the treatment of ASCI [35].

Tetraplegia, advanced age, concurrent injuries, and reliance on ventilator support were identified as risk variables that exhibited a significant connection with mortality. The ASIA grade at the time of admission was the most important predictor for predicting the occurrence of illness and mortality. For patients with tetraplegia, it is crucial to prioritize respiratory treatment and infection prevention to minimize illness and mortality during the acute phase. Although both self-inflicted injuries (SIs) and unintentional injuries (CSIs) were associated with physical damage, falls over three meters were specifically correlated with SI and not CSI. Diminished or absent motor response and pre-hospital shock were indicative of both spinal injury (SI) and cranial-spinal injury (CSI). CSI had a higher prevalence in patients aged 65 and above. Low-energy injuries, low-risk procedures, reductions in overall mobility, and degenerative changes are all described as causal variables in the literature [36].

With an average age-adjusted incidence rate of 26.4 per 1,000,000 people, the 50 seconds had the highest incidence of ASCI. According to the regression analysis, the incidence of a severe SI would be 10.6%, whereas the incidence of a cervical spine injury would be 5.1%. Our study’s depiction of severe cervical spinal injury is consistent with other international investigations [37].

RTAs are the primary cause of spinal cord injuries, followed by falls and bomb explosions. Based on previous research conducted in the German Trauma Register, it has been shown that the majority of spinal cord injuries occur in the cervical spine [38]. The most common cause of SCI in Saudi Arabia among males is RTA, accounting...
for 59% of cases. Falls and bomb explosions are the next most prevalent causes, each accounting for 15% of cases. RTAs are responsible for 13% of SCI occurrences in females, making falls the second most prevalent cause of this kind of injury. Most of the younger patients had enhanced and stable conditions. However, six individuals had paraplegia, while four individuals experienced quadriplegia as a result of spinal cord injuries caused by road traffic accidents. Those with SCI who are younger often have a better chance of recovering than those who are older. These outcomes agree with those of Al-Arabi [39], who noted that most patients with SCI were less than 40 years old.

Although there are several factors that may lead to SCI, RTAs, explosives, gunfire, and falls are often considered as major causes. According to retrospective research carried out at the military hospital in Riyadh, falls were the second most prevalent cause of SCI among 307 patients, with RTAs accounting for 85% of cases [40]. According to a retrospective single-center assessment of medical data, motor vehicle accidents were responsible for 88.4% of SCIs among 1,128 patients from 2001 to 2016 [41]. Among the 26 patients with full cervical SCI, ultra-early surgical decompression resulted in a considerably better recovery in neurological function as compared to ES in patients classified as ASIA A. Furthermore, younger age, a higher ASIA grade at admission, and surgery planned within 12 hours of admission were linked to a faster neurological recovery. Nevertheless, CCI was only linked to enhancement. Out of the individuals who visited the emergency department at least once, 49% required hospital admission. After adjusting for sex, age, and race/ethnicity, persons with SCI had a 249% higher likelihood of experiencing at least one hospitalization for ED and a 151% higher likelihood of visiting the ED compared to the NHIS population. Individuals with SCI said that an ED was the nearest healthcare facility for them. They were more prone to arriving at the ED by ambulance, and a greater proportion of their visits were associated with substantial health concerns. In the absence of other choices, NHIS members may have resorted to seeking medical care in the emergency department. The findings of our research align with a previous investigation, which found that 50% of visitors to the emergency department were classified as high acuity and required emergency department treatment [42]. Alternatively, some discrepancies may arise due to issues pertaining to transportation and the availability of healthcare services. Individuals with SCI may lack the ability to operate a vehicle themselves or have someone readily accessible to transport them to the emergency room, hence necessitating the use of an ambulance. Previous studies have shown that the intricate nature of SCI may lead to healthcare providers referring patients to other experts who may not feel confident or well-informed enough to address the challenges associated with SCI. [43] This underscores the need for enhanced healthcare practitioner instruction, improved availability of information about the distinct requirements of persons with SCI, and education of individuals with SCI to enable them to better communicate their needs to healthcare providers.

**Strengths and Limitations**

This systematic review was constrained due to the scarcity of publications that met the criteria for inclusion. Our investigation has several limitations, including a restricted search capability. We only looked for English papers that were indexed in Google Scholar, Web of Science, Cochrane, and PubMed. Another clear constraint is the uncertain outcome of the variety in the application of treatment by this skilled group of practitioners on the patients they were attending to. Nevertheless, the findings of this research have facilitated the identification of areas of disagreement and ambiguity in the first therapeutic treatment of patients with SCI.

**Conclusion**

For patients with acute SCI, septicemia, cardiovascular problems, and respiratory difficulties are the main causes of death inside the hospital. Injuries, tetraplegia, advanced age, and dependence on a ventilator were all highly correlated with higher death rates. Vertical falls beyond a height of 3 meters were linked to severe injuries, rather than critical spinal injuries, but blunt trauma was linked to both types of injuries. Road traffic accidents were the primary cause of spinal cord injuries in Saudi Arabia among men. Falls ranked second, closely followed by bomb blasts. Road traffic accidents are the second most common cause of spinal cord injuries among females. Younger persons with spinal cord injuries frequently have more favorable chances for recovery compared to older ones. This underscores the need for enhanced healthcare practitioner instruction, improved availability of information about the distinct requirements of persons with SCI, and education of individuals with SCI to enable them to better communicate their needs to healthcare providers.

**List of Abbreviations**

- CSI: Cranial-spinal injury
- LMIC: Low- and middle-income countries
- SI: Inflicted injuries

**Conflict of interest**

Not applicable.

**Funding**

None.

**Consent to participate**

Not applicable.

**Ethical approval**

Not applicable.
References


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