An Epidemiological Overview of Spinal Trauma in the Kingdom of Saudi Arabia

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Abstract:

Introduction: The World Report on Road Traffic Injury Prevention indicates that by 2020, road traffic injuries will be a major killer, accounting for half a million deaths and 15 million disability-adjusted life years. The Kingdom of Saudi Arabia (KSA) has one of the highest rates of spinal cord injuries in the world, with 62 people injured per 1 million, and the injuries are mostly due to traffic accidents.

Methods: All polytrauma patients associated with spinal injuries admitted to Prince Mohammed bin Abdul Aziz Hospital (PMAH), Riyadh, from January 2017 to June 2018, were included in this study. Patients with old spinal injuries, any previous spinal surgery, spine infection, or concomitant diagnosed malignancies or osteoporotic collapse with or without falls were excluded. All patients underwent whole-spine computed tomography scan and, in selective cases, magnetic resonance imaging of the spine.

Results: Of the 230 patients, 90.0% were male, and 60% were in the second and third decades. Motor vehicle accidents were responsible for 83% of the cases, of which 50% of the victims were the drivers, and 80% were passengers with no seatbelt on. Nearly 50% of the spinal injuries were associated with injuries in the other body parts. Cervical spine injury accounted for 44% of the cases, followed by the lumbar spine injury. Twenty five percent of the patients presented with fixed neurologic deficit in the form of quadriplegia or paraplegia (ASIA-A). The mortality rate was 1.3%.

Conclusions: This study revealed that motor vehicle accidents are a major cause of spinal injuries in the KSA. One-fourth of the spinal Injuries are associated with complete spinal cord injuries. Therefore, in order to prevent lifelong disability in the young population, a nationwide program should be initiated to prevent road traffic accidents.

Keywords:

Vertebra, Fracture, Trauma, Road Traffic Accidents, Paraplegia

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Introduction

Injuries account for a significant proportion of the global burden of disease, causing 9% of all deaths worldwide. By 2020, injuries are expected to exceed communicable diseases globally[1)]. Road traffic accidents (RTA) are the major cause of injuries. An estimated 1.3 million people are killed worldwide due to RTA annually[2)]. More than 90% of injury-related deaths occur in developing countries, where preventive measures are nonexistent and health-care systems are inadequate[3)]. Injury is a major contributor of ill health and disability everywhere. The cost of the resources spent toward its care is estimated to be in the range of 3%-5% of the gross domestic product (GDP) in every country[4)].

Spinal trauma is a global and growing public health concern. Road traffic accident and falls are the most common causes of spinal trauma worldwide[5)]. The true incidence of global spinal trauma is unknown[6)]. However, its annual international incidences varied in the range of 16-64/100,000[5,7)]. The KSA has one of the highest rates of spinal cord injuries worldwide[8,9)]. According to the Global Burden of Disease report, traumatic injuries represent 22.6% of years of potential life lost in Saudi Arabia[1)].

With this background, a prospective study was conducted to determine the real magnitude of spinal trauma and its causes and consequences in the adult population of the

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Table 1. Age Range of the Patients.

Age	Number of patients
1-10	1
11-20	40
21-30	92
31-40	45
41-50	30
51-60	15
61-70	7
Total	230

KSA. This study will also highlight the current trends and practices in the management of spinal trauma in the KSA. The findings from this study would serve as valuable resources for future planning in the prevention of spinal injuries due to RTA.

Materials and Methods

This is a prospective observational study conducted at Prince Mohammed bin Abdulaziz Hospital (PMAH) from January 2017 to June 2018. PMAH is a government hospital under the umbrella of the Ministry of Health in Riyadh with a capacity of 500 beds and is considered as one of the busiest centers for Trauma. All polytrauma patients associated with vertebral fractures or spinal cord injuries were included in this study. Patients with old spinal injuries, previous spinal surgery, spine infection, or concomitant diagnosed malignancies, trivial falls, or osteoporotic collapses were excluded from the study. All patients were assessed and managed by the trauma team in accordance with the Advanced Trauma Life Support (ATLS) protocol. For the first 24 h, these patients remained under the care of the trauma team, either to rule out or to manage any associated body part injuries. Polytrauma patients with life-threatening chest, abdominal/pelvic, or cervical injuries were initially kept in the intensive care unit (ICU). Whole-spine computed tomography (CT) scan and, in selective cases, magnetic resonance imaging (MRI) of the spine were performed in almost all cases. The American Spinal Injury Association Impairment Scale (ASIA) was employed to assess spinal cord injuries upon admission. All patients were kept in Philadelphia collar until cervical injury had been excluded. Thoracolumbar sacral orthosis (TLSO) was applied until either MRI was performed or the decision for surgery was made. After a period of 24-48 h, low-molecular-weight heparin (enoxaparin) was started in all patients, followed by weekly Doppler ultrasound of both lower limbs. Frequent turning of patient positioning along with air mattress beds were employed to prevent pressure sores. Patients who had unstable spinal fractures were operated upon on elective and urgent basis.

Indications for surgery were judged on the basis of Thoracolumbar Injury Classification and Severity (TLICS) Scale/Sub-axial Cervical Spine Injury Classification System (SLICS) system. Patients with a TLICS of 4 or more points underwent surgical treatment as soon as they were clinically stable. All surgically treated patients were operated through an open posterior approach with transpedicular screw fixation, decompression, and arthrodesis with autologous bone graft. Some of the patients underwent percutaneous minimally invasive surgery. In sub-axial cervical injuries, anterior approaches were employed for fusion and fixation. Most of the upper cervical injuries were managed conservatively. The postoperative CT scan of the spine was performed to check the position of implants. All patients were subsequently mobilized with TLSO. Those who were treated conservatively wore TLSO for 3 months. In the meantime, these patients underwent extensive physical therapy throughout their hospital stay. After the removal of staples, all patients with paraplegia and tetraplegia were transferred to a rehabilitation center, provided they were in stable condition. All patients with spinal fractures without neurologic deficit who were managed either conservatively or surgically were discharged home safely.

Table 2. Level of Spinal Injuries.

Cervical spine	100
Thoracic spine	56
Lumbar spine	74

Results

Of the 230 patients, 90% were males and 10% females. Sixty percent of the patients were in second and third decades (Table 1). The mean age was 32.24 years. Motor vehicle accidents were responsible for 82.56% of the cases. Drivers and front seat passengers were considered to be the most vulnerable. Eighty percent of the passengers didn't were seatbelt. More than 50% of vertebral fractures were associated with injuries in other body parts. Chest injuries followed by orthopedic trauma were the most common.

Cervical spine was involved in 44% of the patients, followed by lumbar spine (30%) (Table 2). In 48% of the patients, 2 or >2 vertebrae were fractured. In the cervical spine, one-third of the fractures were in the C2 vertebrae. Thirty nine percent of the patients had fractures in the thoracolumbar region (D11, D12, L1, L2). Overall, 25% of the patients with vertebral trauma presented with neurologic deficit in the form of quadriplegia or paraplegia (ASIA-A). Complete neurologic deficit was more common than incomplete neurologic injury. Forty percent of the patients underwent surgery according to the TLIC/SLIC criteria, and another 5% either refused surgery or transferred to other facilities. No perioperative complications occurred in any patient. The mortality rates remained at 1.3%. All deceased patients had cervical cord injuries. Patients with quadriplegia and paraplegia after surgical stabilization were subsequently

transferred to different rehabilitation centers for further management.

Discussion

This study clearly reveals that RTAs are playing a great havoc everywhere[9]. The causes of spinal injuries vary from country to country, but falls and motor car crashes are on top of the list[10]. The occurrence of RTAs, being the major cause of spinal cord injuries in the KSA, is increasing despite the government's efforts to decrease motor vehicle accidents[11]. The common causes of RTAs are overspeeding, suspected substance abuse, physical and mental fatigue, use of mobile phones while driving, not wearing seatbelts, drifting, and driving at a very young age[12,13]. Unrestrained victims are more severely injured in multiple body parts because of ejection out of the vehicles. Wearing of seatbelt is mandatory in the KSA. However, more than 80% of the passengers did not wear seatbelt at the time of accident[14].

The young male population in the second and third decades was the main sufferers. Drivers and front seat passengers were more vulnerable to serious injuries. Young males are more prone to spinal trauma worldwide[9]. Many studies reported that males accounted for 82.8% of all spinal cord injuries, with a mean age of 32.4 years. The KSA has the highest male-to-female ratio, which is 9:1, whereas worldwide, the male-to-female ratio is 2:1. This is because females were not legally allowed to drive in the KSA. Although this restriction has already been lifted, the number of female drivers in the KSA is still small. Our findings are also consistent with those of internationally reported literature[12,13].

Falls are usually associated with lumbar fractures, whereas motor vehicle accidents are responsible for cervical spine injuries[15]. In our study, fracture in the cervical spine was more common because the predominant mode of trauma was RTAs. In high-speed trauma, multiple contiguous and noncontiguous areas of the spine were involved[16]. In our study, 48% of the patients suffered from multiple spinal fractures. This multiplicity in fracture levels poses additional challenges and risks both in terms of the management and prognosis of patients.

This study revealed that a quarter of the victims of spinal trauma became permanently paralyzed. These patients had either paraplegia or quadriplegia. The patients with paraplegia outnumbered those with quadriplegia, depending on the level of injuries. Incomplete spinal cord injuries were seen less commonly[10].

An extensive literature on the epidemiology of spinal cord injuries is available[17]. Data pertaining to exclusive vertebral fractures is nonexistent. The management and outcome of spinal trauma and spinal cord injuries are altogether different. Although the causes are the same, the consequences are different. In spinal cord injuries, neurologic deficit is usually fixed and irreversible, whereas vertebral fractures may or may not be associated with neurologic deficit[10].

Though most of the vertebral fractures are treated conservatively, a significant number of the fractures require surgical intervention in order to restore spinal stability and prevent future complications[18]. On the other hand, available therapies for spinal cord injuries are neither evidence-based nor successful, but new surgical techniques with advancement in technologies and instrumentations have revolutionized the outcome of spinal fractures[19].

Cervical injuries consume a huge amount of budget due to prolonged ICU stay, complicated by scores of medical and surgical problems[20]. Patients with cervical cord injuries usually remain hemodynamically unstable for a couple of weeks, which necessitates continuous monitoring and mechanical ventilation for a considerable time, and a small subset requires cardiac and diaphragmatic pacemakers. Therefore, care for spinal trauma is expensive and needs prolonged intensive care[21].

The real management of spinal trauma is also controversial and difficult[22]. Nearly 50% of the patients with unstable spinal fractures require fusion and fixation. We performed surgeries in more than 40% of cases on an elective basis. The ideal time for decompression is the first 24 h after trauma, but usually, it is not practiced due to the delayed arrival of patients and unavailability of ready operation theaters[23]. There is a convincing preclinical evidence that early decompression improves neurologic outcomes, but the real benefits of early surgical decompression in patients with acute spinal cord injury remain uncertain[24-26].

Spine fixation has been advocated for spine stabilization, shorter hospital stay, and early rehabilitation[18]. A prospective study from Pakistan revealed contradictory results: long rehabilitation time for patients in the operative group, prolonged ICU stays, and association with more complications. The treatment cost was 6,500 USD in the operative group as compared with 1,490 USD in the nonoperative group. Moreover, surgical stabilization was also associated with persistent back pain on follow-ups[18]. There is no class one evidence that surgery is superior to conservative treatment. For fixed neurologic deficit, several studies proved that there was a marginal benefit in neurologic outcome, provided that the patient was operated within the first 24 h[27,28]. Therefore, it is a time to revisit an evidence-based indication of surgical interventions in spine trauma, particularly with fixed neurologic deficits.

After the spinal trauma, majority of the patients remain in denial phase and psychological shock for a long time[29]. Therefore, as soon as acute care and surgical interventions are completed, these patients need urgent and holistic rehabilitation[30]. Unfortunately, there are a limited number of dedicated rehabilitation centers in the KSA mainly situated in the metropolis; moreover, these centers are experiencing shortage of beds. The long waiting list causes an inadvertent delay in the rehabilitation process and jeopardizes the clinical outcome.

Spinal trauma causes significant morbidity, disability, and death[31]. Since there is no curative treatment for spinal cord

injuries, it is prudent to take some measures to prevent the incidence of spinal injuries. More strict traffic rules are needed to stop this horrific epidemic[32]. The World Health Organization (WHO) predicts a phenomenal increase in motor vehicle accidents in the coming decades if preventative measures are not taken. WHO recommends 6E for the prevention of injuries, namely, Education, Enforcement, Engineering, Emergency care, Evaluation, and Economic[3].

Our study is neither comprehensive nor an ideal one. Although one-fourth of the population in the KSA lives in the capital Metro city, this data is not the true reflection of the total population. The lack of pediatric trauma data is another major drawback in this study. Similarly, due to poor follow-up, it was difficult to measure any neurologic outcome or surgical complications. There may be some selection bias among treating surgeons due to the gray zone in TLIC and SLIC scoring systems[33].

It is suggested for the future that a nationwide campaign be started to prevent RTAs and national data bank for spinal trauma be established without any further delay[34]. Professionals, policymakers, politicians, the press, and the public should translate these concepts from dreams to realities[3].

Finally, it is important to determine the difference between vertebral injuries and spinal cord injuries. Not only this but also comprehensive spinal rehabilitation centers should be established to reduce the time of rehabilitation, prevent potential complications, and optimize the outcome.

Conclusion

This study clearly reveals that the magnitude of trauma in this country is enormous, and motor vehicle accidents are a major cause of spinal injuries in the KSA. One-fourth of the spinal injuries are associated with permanent disabling spinal cord injuries. The steep rise in the prevalence of paraplegia and quadriplegia in society is a huge shock for caregivers and families. A nationwide program should be initiated without fail to prevent lifelong disability in the young population.

Conflicts of Interest: The authors declare that there are no relevant conflicts of interest.

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