Pattern and Outcome of Management for Traumatic Closed Cervical Spine Injuries at The National Orthopaedic Hospital, Enugu, Nigeria.

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ABSTRACT.

Background: The cervical spine is an area quite prone to trauma due to its mobile character. It is placed under various significant demands during various physical activities which predispose it to various injuries. The knowledge and good understanding of the common patterns of cervical spine injuries and their mechanisms will facilitate accurate assessment, diagnoses and prompt appropriate decisions about specific management. The main thrust of the application of epidemiologic methods to the study of spinal injuries is aimed at identifying injury trends and correlating these trends with definite risk factors and preventive strategies. The aim of the study is to determine the pattern and early outcome of management of closed cervical spine injuries at Enugu.

Methods: A retrospective study was done in which the records of 132 patients admitted for closed cervical spine injuries over a ten year period were analyzed and the following data extracted: demographic indices, mechanism of injury, spinal level of injury, type of vertebral injury, complications, duration of stay in hospital, nature and level of cord injury, residual morbidity at discharge, and duration of follow-up visits.

Results: The age of the patients ranged from 5 - 80 years with a mean of 37 years. More males were involved (93.9%) than females (6.1%). The commonest mechanism of injury is road traffic accidents (66.7%) and the most frequently involved segment is the C6/C7. Fracture subluxation of C6 on C7 occurred in 27.3% of cases. 75.8% of cases had complete cord injury while 24.2% had incomplete lesions. Pressure sores and urinary tract infection were the commonest complications seen in 29.5% and 24.4% respectively. The length of hospital stay for the majority of the patients (47%) was between 4 weeks and 12 weeks. At discharge, 56% of all the patients were wheel chair bound, 22.7% were mobilizing with walking aids and death occurred in 21.2%, mostly high cervical cord injured patients. 93.6% of the patients with incomplete cord injury were mobilizing with walking aids at the point of discharge. 60% and 75% of the patients were lost to fellow-up at one and two years respectively.

Conclusion: Lower cervical spine fracture subluxation is the commonest site of cervical spine injury in our environment. Complete cord injury is commoner than incomplete cord injury. The commonest complications in our environment are pressure sores and urinary tract infection. Prevention of these injuries remains the best management option.

Key Words: cervical spine injury, pattern, outcome, Nigeria.

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INTRODUCTION

The cervical spine is placed under various significant demands during various physical activities which predispose it to various injuries ranging from mild strain, fractures, to paralyzing cord injuries.

Cervical cord injury is a distressing clinical condition which is not an infrequent finding in our accident and emergency department. It is associated with an enormous amount of physical, psychological and financial stress and heralds a number of complications. Spinal injuries are important because of the enormous huge sum of money needed for its prolonged in-patient treatment and rehabilitation which is usually multidisciplinary. Lengthy convalescence and prolonged disability (chronic pain and paralysis) are commonly associated with spinal injuries.

Automobile accidents are the leading cause of cervical spine trauma. Cervical spine injury (CSI) may also be associated with many contact and high speed sporting activities such as football, rugby, horse racing, automobile and motor cycle racing, etc. Other causes of blunt CSI include fall from height, plane crashes and rail accidents.

It is generally accepted that the usual mechanism of injury in sports is hyper extension, hyper flexion or axial compression. Axial compression is thought to be the commonest.

In automobile/vehicular accidents, a whole spectrum of mechanism of injury can be seen affecting different motion segments of the cervical spine.

Torg and associates had suggested that injuries to the cervical spine could be classified into three distinct regions: the upper cervical (c_1 c_2), middle (c_3 c_4), and the lower cervical segment (c_5 c_7) [1]. In their series, injuries to the c3 c4 segments were unique in that bony involvement was uncommon, reduction was difficult and early aggressive treatment led to a favorable outcome.

The concept of the spine consisting of three columns [2] is helpful in the classification of the cervical spine injuries because it organizes the injuries into easily recognizable format/ phylogeny of compressive flexion, vertical

compression, distractive flexion, compressive extension, distractive extension and lateral flexion [3].

CSI can also be classified into hyper-flexion injury, hyper-extension injury, burst fractures and flexion rotation injury.
Also certain injuries and mechanism of injuries are commoner in certain parts of the cervical spine. The compressive flexion, distractive flexion, and compressive extention lesions occur in the mid-cervical and lower cervical segments while vertical compression with hyperextension or hyper-flexion are responsible for most of the injuries in the upper segment. Blunt indirect injuries of cervical spine frequently produce translation through a motion segment which is necessarily usually associated with ligament disruption that permits this translation. Thus one of the greatest challenges to the physician is the accurate identification of the ligamentous components of the injury.

The identification of fractures as the most significant injury in the spine is erroneous since fractures serve mainly as markers indicating significant severe injuries. The major stabilizing factors in the cervical spine are the ligaments and muscles. Thus the failure of the ligaments is usually as significant as the failure of the bony architecture. Bony lesions are readily observable through x-rays while lesions of soft tissues are not, thus the tendency for the unwary and inexperienced to emphasize its significance is understandable. This brings to fore the need for more advanced investigations (CT scan and MRI), and the recognition of the concept of motion segments in the assessment of spinal injuries.

The associated neurological injury is of paramount importance as far as the functional outcome for the patient is concerned [4]. The clinical spectrum of cord lesions in cervical spine injuries ranges from complete cord injuries with total loss of spinal cord function below the level of the injury, to incomplete injuries which preserve some degree of function below the injury level. Other neurologic injuries that can occur include isolated nerve root lesions, brachial plexius nerve root neurapraxia or spinal cord neurapraxia with transient quadriplegia. The degree of cord injury cannot be determined until the period of spinal shock is over.

Spinal cord injuries (SCI) in infants and children are rare and the commonest aetiology is sports injury (gymnasts and divers). It is important to note that in these group of patients, SCI may occur without fractures (SCIWORA spinal cord injury without radiographic abnormality) [5]. In the paediatric age group also, SCI may manifest several days after trivial cervical injury and may occur easily after seemingly good recovery [6]. Thus children with trivial symptoms should be immobilized for a long period of time and should not be allowed to return to contact sports until the spine reaches maturity. Spine injuries with or without neurologic deficit are managed according to the well established guidelines of the American College of Surgeons [7] with some modifications as may be necessary.

The understanding of the biomechanics of the spine and pathophysiology of spinal injuries is a great asset in planning a comprehensive treatment and rehabilitation program which is multi-disciplinary in approach.

Patients with acute quadriplegia due to cervical cord injury often have associated head injury and may also have associated life threatening abdominal and chest injury. The diagnosis of these injuries may be extra difficult, though the presence of hypovolaemic shock can be a pointer. Hypovolaemic shock may co- exist with neurogenic shock which usually masks the former. However, the presence of bradycardia and hypotension is the major distinguishing feature of neurogenic shock and the treatment of this with mild vasopressor, preferably dopamine; and probably atropine[8] will reveal the typical signs of hypovolaemic shock.
The roll of drug treatment for SCI remains controversial. Bracken[9] at al had evaluated the efficacy and safety of methyl prednisolone in the management of spinal injuries and concluded that significant motor and sensory improvement was found in patients who were administered with the steroids within 8 hours of injury.

Bohlman in his review of 300 CSI found no difference in the recovery rate of neurologic function between the steroid and non- steroid treated patients [10].

In the light of the failure of controlled clinical trials to convincingly demonstrate significant benefit of methyl prednisolone in conjunction with the increased risk of medical complications associated with its use, this drug is recommended as an option with the knowledge that the experience suggesting harmful side effects is more consistent than the suggestion of clinical benefits [11].

The excitement of possible use of other pharmacologic therapies in SCI had waned. GM-1 gangliosides were used following the methyl-prednisolone protocol. They are thought to induce regeneration of neurons and restore neuronal function in vivo after injury. Geisler et al [12] reported significant neurologic recovery one year following injury with the use of this drug. They also reported no significant complication attributable to this therapy, but advocated further large scale studies before the routine use of this agent. Other studies had failed to collaborate these findings [10]. The therapies steroids and GM-1 Gangliosides, seem not to be a standard treatment nor a guideline for treatment of acute SCI, but rather a treatment option for which there is a very weak level II and III evidence [13].

Another study is evaluating the therapeutic effects of Tirilazad, a drug with especially potent lipid peroxidation inhibition properties and that lacks any corticosteriodal properties [12].

Naloxone has been studied less extensively and as yet has unclear efficacy in the management of acute spinal cord injury [14].

Most CSI respond to non-operative treatment regimens which involves the use of tongs and halo traction, halo orthosis and Minerva jackets for immobilization in the acute phase. Operative intervention is indicated in cases of significant spinal deformity, instability, or neural element mechanical compression. Surgeries for unstable injuries

allow early mobilization and earlier discharge [14].

Complications associated with CSI are numerous and involve all organ systems. Many of them iatrogenic and can be prevented as long as the physician is aware of them prior to the institution of treatment [12].

Approximately 3% of patients who demonstrate a complete cord injury initially show some recovery within 24 hours. However if no changes are observed after the period of spinal shock, progressive recovery should not be expected.

The incomplete SCI patient with Brown - sequard syndrome has a 90% chance of good functional recovery, the central cord syndrome patient has a 50% chance of good functional recovery; and the anterior cord syndrome patient has only a 10% chance of good functional recovery.

The recent key advance in the management of SCI is found in manipulating stem cells (using stem cell technology) prior to transplantation to repair spinal cord injuries.

The Rochester teams are pioneers in manipulating stem cells to generate nervous system cells, the Astrocytes, that can be used for therapeutic treatment. Here glial restricted precursor cells (stem cells) were induced to make two different astrocyte sub-types using different growth factors that promote cell formation during development. These astrocytes have distinct characteristics and functions and have robustly different effects when transplanted into the injured adult nervous system. One group promotes growth of nerve fibres while the other causes sprouting in pain circuits. However by using the right astrocytes sub-type to repair the SCI, it is possible to have all the gains without the pain; while the other sub-type appear to provide the opposite pain but no gain [15].

Gene therapy is now also employed in the management of SCI. Techniques are available to modify genetic responses of the spinal cord, to promote repair and re-growth of the spinal cord [14]. Scientists can now introduce any gene to the spinal cord and control the expression of the genes to produce genetically manipulated cells for transplantation to the spinal cord to promote survival and growth of cells of the cord.

RATIONALE

The paucity of literature on this common spinal injury in Nigeria informed the desire for this study. The knowledge and good understanding of the common patterns of cervical spine injuries and their mechanisms will facilitate accurate assessment, diagnoses and prompt appropriate decisions about specific management. The main thrust of the application of epidemiologic methods to the study of spinal injuries is aimed at identifying injury trends and correlating these trends with definite risk factors and preventive strategies.

MATERIALS AND METHODS

A retrospective study was done in which the records of 132 patients with closed cervical spine injury that presented over a ten year period (1st January 1999 - 31st December 2008); at the National orthopaedic hospital Enugu, a regional trauma centre in South East Nigeria were analyzed. Patients with incomplete records and those presenting later than two week were excluded. The age, sex, mechanism of injury, spinal (vertebral) level of injury, level of cord injury, duration of hospitalization, complications, residual morbidity at discharge and follow- up visits were extracted and analyzed. Data analysis was carried out using SPSS for windows version 15, P values equal or less than 0.05 were regarded as significant where appropriate.

RESULTS

There were 124 males and 8 females with an age range of 5 - 80 years and a mean of 37 years. Peak ages of involvement were in the 3rd decade and 5th decade.

The commonest cause of injury was road traffic accidents in 88 cases (66.7%), fall from height 28 (21.2%), assault 12(9.1%) and sports injuries in 4(3%).

Fracture subluxation of C_6 on C_7 was the commonest injury pattern and accounted for 27.3% (36 cases), followed by fracture of C_5 16.7% (22 cases). SCIWORA was seen in 14 patients (10.6%). The rest is as shown in the table 2.

Forty-four patients (33.3%) had multiple level vertebral injuries.

Ninety patients, (65.2%) had complete cord injury while 32 (24.2%) had incomplete cord lesion. Ten (7.6%) patients had no associated cord injury.
The commonest complications noted are pressure sores 46(29.5%), urinary tract infection 38(24.4%), and spasms 34(21.8%). Other complications included
Constipation 16 (10.3%), Chest infections 14 (9%), Paralytic ileus 4 (2.6%) and Seizures 4 (2.6%).

The duration of hospital stay in 96 (72.7%) patients was less than 12 weeks whereas 4.5% spent more than 6 months in hospital; mainly as a result of pressure sores compounding their problems.

At the time of discharge 74(56%) patients were mobilizing on wheel chairs, 30(22.7%) with zimmer frames or axillary crutches while 28(21.2%) died. The deaths occurred early (4 weeks) on admission mainly from respiratory failure due to high cervical injuries and over-whelming infection of

Table 1: Age distribution

Age range (years)	No. of patients	Percentage
0-10	2	1.5%
11-20	12	9.1%
21-30	42	31.8%
31-40	22	16.7%
41-50	28	21.2%
51-60	22	16.7%
61-70	2	1.5%
71-80	2	1.5%
Total	132	100%

Table 2: Pattern of injury

Level of injury	No, of Patients	percentage
Fracture C3	6	4.5%)
Fracture C5	22	16.7%
Fracture C6	6	4.5%
Fracture C7	4	3.0%
Subluxation of C1 on C2	2	1.5%
Subluxation of C2 on C3	8	6.1%
Subluxation of C4 0n C5	8	6.1%
Subluxation of C5 on C6	16	12.1%
Subluxation of C6 onC7	36	27.3%
Subluxation of C7 on T1	6	4.5%
SCIWORA	14	10.6%
Fracture C4	4	3.0%
Total	132	100%

pressure sores. All the deaths occurred in patients with complete cervical cord injury. Forty percent of the patients were still having significant neck pain at six months after the injury while sixty percent of the patients were lost to follow-up 12 months after discharge.

DISCUSSION

Traumatic injury to the neck is one of the most common causes of chronic pain, disability and litigation in health care. Cervical trauma is increasing in frequency as our society engages in more recreational pursuits and spends more travel time in automobiles.

From the foregoing, more males sustained CSI than females; the peak age incidence was between 21 30 years (31.8%) and 41 50 years (21.2%). Eighty-six percent of the patients in our series were aged between 21 60 years. The preponderance of males over females in our patient population is not surprising since more males are usually involved in trauma than females. The pattern conforms to works done at Enugu 6 year ago[16] and similar works done in Ilorin[17] and Maiduguri[18]. Between the age of early twenties and late fifties, men are more out-going, adventurous and aggressive about making it in life and thus engage in lots of travels with the attendant possibility of predisposition to trauma.

The commonest cause of the injury was road traffic accident (66.7%). This finding is in consonance with works done by several others[17, 18, 19, 20.]

The second commonest cause of CSI was fall from height (21.2%). No female sustained injury from fall from heights probably because our culture does not permit females to climb tall trees. Fall from Palm trees contributed most to the falls; and females do not climb palm trees among the Igbo of Nigeria.

The pattern of injury showed the lower cervical spine to be the more commonly involved segment. Subluxation of C6 on C7 was the commonest pattern accounting for 27.3%, followed by fracture of C5 (16.7%).

In a work by Goldberg et al, they noted that the atlanto-axial region is the most common site of injury, and the sixth and seventh vertebrae (lower segment) are involved in over one third of all injuries[21]. Other workers, including Hasue and associates[22] and Henry et al[23] had documented that injuries of the cervical spine are rare in children and are most common from the occiput to C_3; as against the commoner lower segment injuries in adults. Hasue and associates had only 10 cases under the age of 15 out of the 228 cases reviewed. This compares closely with the 6 cases aged 15 years in our series of 132 cases.

Atlanto-axial injuries were not recorded in our series. The reason is not clear. However, we believe the low number of upper CSI in this series is because most of such patients do not make it to the hospitals as a result of the poor ambulance services in our environment. The extrication and transportation of these victims are far more demanding, since they are at a greater risk of suffering from skull base fractures and severe intracranial haematomas than those with lower CSI.

In 10.6% of the cases, there were no radiological evidence of cervical spine injury but they presented with varying degrees of cord damage (SCIWORA).

Forty-four patients (33.3%) had more than one vertebral level of injuries.

About 65.2% (90 patients) had complete cord injury while 24.2% (32 patients) had incomplete cord injury. Out of the 32 patients with incomplete cord injury, thirty (93.8%) recovered remarkably to mobilize with a walking aid.

Only 7.6% of cases had no associated cord injury while 92.4% had cord injury. Other studies had reported that injuries of the cervical spine produce neurological damage in approximately 40% of patients[24]. The high figure observed in this study may be because of the peculiarities in our environment. A good percentage of those without neurological deficit will not present at the regional trauma center as our study center (tertiary health institution) but will prefer to be treated at smaller nearby health facilities. Also we do not have functional pre- hospital emergency services; and the victims are transported from one place to the other by a grossly inappropriate means that could worsen the cord damage or produce secondary injuries on the cord.

The commonest complication was pressure sores seen in 46 (29.5%) cases and urinary tract infection seen in 38 (24.4%) cases. This is similar to findings in Maiduguri[18] and Calabar[25]. The primary reason for the high incidence of pressure sores in our environment arises from the fact that the patients do not present early to the hospital. They either stay at home or in a small clinic close to the site of accident where they acquire the sore from improper nursing care and use of inappropriate mattresses before they present in our hospital. Some of the patients are transported from far distances over several hours through bad roads; lying on hard surfaces in the often inappropriate motor vehicles. Also, some of the patients and their relations exhibit negative behaviors and beliefs that may preclude the implementation of preventive program.

Twenty-eight patients (21.2%) died within the period of admission. Most of the mortality occurred within the first 4 weeks of admission. Majority of them were those with

complete high CSI (above C4) or multiple injuries. The apparently high mortality rate basically arose from our inability to cope with the respiratory insufficiency occasioned by these injuries. Also, over-whelming infections of sacral pressure sores contributed significantly.

Majority of the patients were treated and discharged within 12 weeks. This is similar to other reports[19,20,] . At the point of discharge, 30 (22.7%) had been mobilized with either a Zimmer frame or bilateral crutches (mainly those with incomplete cord injury) while 74 (56%) were wheel chair bound. These were mainly those with complete cord injury.

CONCLUSION

The commonest pattern of CSI is a lower segment fracture subluxation (hyper-flexion injury) and is commonly associated with neurological deficits in our environment contrary to what is seen in the Western world. Complete cord injury is commoner than incomplete cord injury. The outcome of treatment for the patients with incomplete cord injury is usually good as against those with complete cord injury. The commonest complications in our environment are pressure sores and urinary tract infection. Prevention of these injuries remains the best management option.

The provision of well equipped regional spinal centers and well trained man power in this nation is mandatory for the management of these patients to reduce the incidence of complications. A good and functioning pre-hospital care services is needed to reduce the incidence of possible secondary cord damage following CSI.

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