Neurological Sequelae of Spinal Injury*

K. S. MANI**

Spinal injuries are becoming more common what with the increasing tempo of living and the fact that people are becoming more aware of seeking aid at hospitals. While they are not as frequent as head injuries, yet the neurological sequelae of spinal injuries can be as devastating as those of cranio cerebral trauma. Indeed, neuro-surgeons would prefer to deal with surgical complications of cranio-cerebral trauma than a similar situation in the spinal canal, since the results in the latter are not as fruitful as in the other. However, a prompt and early diagnosis of neurological complications of spinal injuries might go to some extent in improving the long-term sequelae of such injuries.

Air Force personnel are prone not only to injuries peculiar to their occupation but also to civilian type of injuries. Spinal injury in Air Force personnel are commonly encountered during ejections, heavy landingsof aircraft, and in para landings, When the chin strikes the chest there ensues flexion of the neck combined with forced extension of the head-an ideal situation for injuries to the cervical spine.[1] It is also well known that improper parachute landing often leads to fracture of DII or LI vertebrae, with or without dislocation.

Injuries to the cervical spine can be caused by different types of accidents. They are often accompaniments of a head injury particularly when there is hyper-extension of the neck. In such instances there is frequent association with brain injury. Heavy objects falling on the head with the neck flexed or extended can lead to damage to the cervical spine and/or cervical cord. Not infrequently pre-existing congenital anomalies of the cervical vertebrae can lead to catastrophic neurological sequelae even with a minor tap or bump on the head. A common source of injury in the dorsi-lumbar spine is fall from a height, as in civilian practice or during faulty parachute landing. Occasionally a heavy object falling on head with the neck in neutral position tends to transmit the force to the dorsal vertebrae with a resultant compression fracture. There are several modifying factors like landing on the feet or gluteal region with or without an axial rotation of the trunk, which may determine the type of injury.

---

* Presented in the Symposium on "Head and Spinal Injury" during the 16th Annual Meeting of the Aero-Medical Society of India.

** Professor and Head of the Department of Neurology, All India Institute of Mental Health, Bangalore-560027.

In this paper it is proposed to deal with neurological sequelae of spinal injuries starting from the cranio-vertebral junction down to the lumbar spine with illustrative case reports in some instances.

Congenital Anomalies around Foramen Magnum :

These have been receiving increasing attention over the last two decades [4 & 5]. It is well known that some of these anomalies like platybasia, occipitalization of the atlas or fused cervical vertebrae can exist without any neurological symptoms. However, these are often associated with soft tissue abnormalities in this region and the effect of minor trauma in producing neurological symptoms should be considered.

The most dangerous of all congenital anomalies around foramen magnum is an atlantoaxial dislocation. Pandya[3] has given an excellent review of this subject. The stability of the atlanto-axial joint is maintained by a long odontoid process which is kept in its position by the transverse ligament of the atlas on its posterior aspect separating the odontoid from the anterior surface of the cord. Sometimes there is a congenital shortening of the odontoid process which can also be involved in trauma, tuberculosis etc. Trauma can also cause rupture of the transverse ligament of the atlas. In such instances, the patient has either a picture of episodic cord dysfunction or may present with an acute torticollis and pain in the back of the neck. These individuals are always in grave danger of sudden death from compression of the upper cervical cord in any untoward movement of the neck. Indeed the pain in the neck and torticollis are the result of protective muscle spasm. One should always avoid passive movements of the neck as an examination procedure in these instances.

A common but not constant clinical accompaniment of congenital anomalies around foramen magnum is the presence of a short neck, low hair line and/or abnormal sloping of the shoulders. Radiological indices have been described which are helpful to a limited extent in the diagnosis of this group of disorders. However, the ultimate answer in terms of diagnosis can be provided only by tomography[4].

It is worth considering whether one should employ routine X-rays of the cranio-vertebral junction for all Air Force personnel even at the time of their *initial* medical examination. This may perhaps be desirable at least in those who have a short neck or low hairline. In such instances, a lateral view of the C-V junction should be taken with the neck flexed, extended and in neutral position-all such movements being carried out only by the patient and not by any one else.

Dislocation of Cervical Spine :

Fracture of the cervical spine with or without dislocation is often associated with damage to the cervical cord. The resultant paralysis can be complete and irreversible or it may be reversible as happened in the following case :

Mr. M. M. R. aged 35 years slipped and fell down while walking on a wet road five days prior to admission. He was unconscious for 30 minutes and since he

was alone, further details of injury could not be obtained. On recovery of consciousness he noticed fairly severe quadriplegia. X-ray of cervical spine showed an anterior dislocation of C4 upon C5 vertebra. The patient was put on traction and the dislocation reduced. The patient has made a limited recovery during the shore follow-up available so far.

Acute Cervival Cord Contusion :

This is a rare condition and the mechanism of cord damage is due to squeezing of the spinal cord from both the anterior and posterior directions causing a central zone of cord destruction surrounded by pericentral edema The clinical picture is one of a sudden onset of paralysis or paresis of all the four limbs with upper limbs relatively more affected, varying degrees of sensory loss below the level of lesion and a tendency towards spontaneous recovery commencing in the lower limbs[1]. This is well exemplified in the following case :

Mr. M. S. aged 45 years was supervising the transfer of his luggage from the top of a bus four months prior to admission when a gunny bag fell on his forehead. He was unconscious for 30 minutes and on recovery found that he was totally paralysed in all the four limbs with acute retention of urine. There were no sensory disturbances. X-rays of the cervical spine and myelography were normal. He was treated conservatively with bed rest and sand bags. He has made a good, though incomplete, recovery. He can now walk slowly without any aid but has fairly marked residual weakness and wasting of the small muscles of the hand.

Acute Extradural Haematoma :

This is an extremely rare condition, but must be recognised if a tragedy has to be avoided. A minor injury to the dorsal spine can cause an acute extradural haematoma with resultant rapid Compression ~~sum~~ of the cord. It is believed that such instances must have a pre-existing vascular anomaly in the epidural space. The rapidity of the paraplegia is well exemplified in the following case :

Mr. P. R. P. aged 42 years was driving a car behind a string of others, when he had to apply the brake suddenly to avoid collision. He got down from the car talked to the people ahead for sometime and drove on for another 30 miles with no difficulty. Six hours later he noticed pain behind the sternum and transient numbness in one lower limb, followed a few hours later by weakness of the opposite lower limb. Over the next 36 hours he developed a picture of a rapidly progressive total transection of the cord. Unfortunately the party did not avail of the neuro-surgical facilities available in a nearby hospital but preferred to go all the way to their home town thereby losing another valuable 36 hours. Myelography disclosed a total block extending between D1 and D3 segments of the cord. On exploration an extradural clot was found pressing on the cord from behind, and the compression was duly relieve. But unfortunately the patient's condition remains as it was at the time of admission He is leading a wheel-chair existence today. The important lesson from this can is that paraplegia, especially of an acute type, is to be treated as an emergency. Delay in diagnosis and/or surgical

treatment as happened at this instance, would lead to tragic consequences. Surgery within 24 hours of even a total transection of the cord can result in complete cure. It is also worth emphasising that a diagnosis of transverse myelopathy should not be entertained unless careful myelography has ruled out any compression of the cord.

Compression Fracture of Mid-dorsal Spine :

This may occur with or without any cord involvment. The cord involvement can occur as a result of fracture dislocation or from edema. In those cases without dislocation the chances of spontaneous recovery are quite high. Pain in the back at the level of the fracture is a common symptom.

Fracture Dislocation-D11 or L1 vertebra :

This is one of the common sites of spinal fracture resulting from injuries as in fall from a height. The fracture may be of a compression type and is often associated with dislocation. In the latter instance there is considerable cord damage. The following is an example of such a case :

Mr. C. B. G. aged 21 years fell from the branch of a tree 6 feet above the ground five months prior to admission. He fell flat on his back and experienced a total paralysis of both lower limbs immediately. During the next five months there was a very slight, but definite, recovery in the weakness of his lower limbs. The patient was not operated upon and yet six years later he is able to walk with aid of a stick.

There was another instance of fracture dislocation this time of L1 vertebra, wherein the long-term result was not satisfactory. Mr. Y. N. S. aged 25 years was knocked down by a bus from behind, 18 months prior to admission, when he was thrown out and fell on his back. He sustained an immediate total paralysis and total loss of all sensations in both lower limbs and true incontinence of urine. At the time of admission, 18 months later, his condition remained the the same and he was not operated. He died at home 3 years after the onset of injury.

Acute Herniated Nucleus Pulposus :

Acute disc protrusion is often the result of spinal injury and may involve the cervical or lumbar discs. The protrusion can be posterior or central when it presses on the entire cauda equina or the cervical cord depending on the level. Much more common, however, is a postero-lateral protrusion with pressure on one posterior nerve root. The clinical picture of acute H N P is too well known to be reiterated. It is worth emphasising, however, that a central disc prolapse must be considered an emergency.

Conclusion :

It can thus be seen that the neurological sequelae of spinal injuries can result from minimal to severe trauma. They tend to occur from both civilian and aviation type of injuries. Quite commonly, particularly with reference to lesions in the cervical spine, they are associated with injury elsewhere, especially the brain. Congenital anomalies around the

foramen magnum should always be kept in the back of one's mind more so when an individual has a short neck and low hairline. An acute torticollis is sometimes the result of an atlanto-axial dislocation and passive movements of the cervical spine, is then, contra-indicated. An acute paraplegia should be considered emergency and should be tackled accordingly. It is suggested that routine radiography of the C-V junction be carried out at the time of entry into service atleast in those who have a short neck and low hairline.

Acknowledgement

My grateful thanks are due to Miss D. Rajalakshmi for secretarial assistance and the Director of our Institute for permission to publish.

REFERENCES :

1. KRISHNA, A. G., K. S. MANI and R. M. VARMA : Acute cervical cord contusion. *Transac. A I I.M H.* 4: 37—41, 1964

2. MASON, J. K. : Aviation Accident Pathology : A Study of Fatalities. p. 309 Butterworths, London 1962

3. PANDYA, S. K. : Atlanto-axial dislocation: *A Review of Neurology* (India), 20 : 13—48, 1972

4. SPILLANE J. D. C. PALLIS and A. M. JONES : Developmental abnormalities in the region of the foramen magnum. *Brain*, 80 : 11—58, 1957

5. WADIA N. H. : Myelopathy complication in congenital atlanto-axial dislocation. *Brain* 90 : 449—471, 1967.