Evaluation of Clinical, Radiological Findings and Mortality in Cervical Spine Fractures Associated with Ankylosing Spondylitis: A Cross-Sectional Study

Syed Aamir Shah¹, Shabnam Nawaz², Niaz Hussain Keerio³, Obaidullah⁴, Wajeeha Siddique⁵, Abdul Raheem Gul Mohammad⁶, Syed Shahid Noor⁷

¹Assistant Professor, Department of Neurosurgery, Pakistan Institute of Medical Sciences Islamabad, Pakistan; ²Postgraduate Resident, Department of Neurosurgery, Pakistan Institute of Medical Sciences Islamabad, Pakistan; ³Assistant Professor, Muhammad Medical College and Hospital Mirpurkhas, Pakistan; ⁴Postgraduate Resident, Department of Neurosurgery, Pakistan Institute of Medical Sciences Islamabad, Pakistan; ⁵Postgraduate Resident Neurosurgery, Pakistan Institute of Medical Sciences Islamabad, Pakistan; ⁶Orthopedic Surgeon, Lekhwiya Hospital, Qatar; ⁷Professor Orthopedic, Liaquat National Hospital and Medical College Karachi, Pakistan.

ABSTRACT

Introduction: Ankylosed spine fractures are widespread due to a patient’s gradual lack of mobility and secondary osteoporosis. Difficulties in radiographic evaluation of the spine in patients with AS are due to their osteoporosis that may further obscure the diagnosis. Ossified disc spaces may be poorly defined in certain circumstances.

Aim: To assess the radiological data, clinical findings, and mortality rates in patients with ankylosing spondylitis aggravated by cervical trauma.

Study Design: Cross-sectional study

Place and Duration: Pakistan Institute of Medical Sciences Islamabad, Pakistan from August 2019 to August 2020

Methodology: We looked at 18 individuals who had been hospitalized to the Spinal Injury Unit with cervical trauma and ankylosing spondylitis. All of the patients had long-term ankylosing spondylitis, with a standard of 22 years and a range of 11 to 40 years. A total of eight individuals were fractured as a consequence of minor mishaps. Four patients were hurt by falls from great heights, while five more were injured in traffic incidents.

Results: All patients were suffering from a long-term disease, and half of them had fractures due to minor incidents. Patients with a fracture line that entered the disc space had a less neurological impairment and had a better prognosis. Although horizontal displacement & angulation were not connected to a better outcome, but distraction at the fracture site had better prognosis. Seven patients died due to falls from a sitting or standing posture, while the eighth was killed due to a strike to the face.

Conclusion: According to this study, even minor trauma may cause a cervical fracture with neurological implications in those with ankylosing spondylitis. In patients with ankylosing spondylitis and cervical injury, the location of the fracture in respect to the vertebral bodies & discs seems to be prognostic. All clients with ankylosing spondylitis & cervical injury should have a complete radiographic evaluation performed.

Key Words: Cervical Injury, Ankylosing Spondylitis, Neurological manifestations, Fracture, Cervical injury, Patients

INTRODUCTION

Although ankylosing spondylitis is a rare illness, persons with it are at risk of cervical spine fractures due to mild trauma.¹ These fractures have different radiological features than usual cervical spine fractures.² and there is a significant prevalence of neurological deficits and death.³

Ankylosing spondylitis (AS) is a chronic inflammatory illness first reported by Marie in 1897 and Strumpell in 1898,⁴ the condition is marked by intervertebral disc calcification and ligament ossification, as well as ankylosis of the epiphyseal joints. Immobility and widespread osteoporosis affect axial joints and bones, resulting in a recorded prevalence of 0.02 to 0.23 percent.⁵

Ankylosed spine fractures are widespread due to a patient’s gradual lack of mobility and secondary osteoporosis. Fractures are a significant consequence of AS.⁶; even with mild trauma.
trauma or no trauma, individuals are vulnerable to spinal injury.\(^7,8\) Such fractures might be ignored if there has been a history of persistent neck and back discomfort before the event. Difficulties in radiographic evaluation of the spine in patients with AS is due to their osteoporosis that may further obscure the diagnosis. Ossified disc spaces may be poorly defined in certain circumstances.\(^9,10\)

Despite its rarity, we had the chance to analyze several instances. This research explores the radiological features of cervical trauma in the ankylosed spine, especially in connection to neurological abnormalities and death rates.

**METHODOLOGY**

This cross-sectional study was done at Pakistan institute of medical sciences Islamabad, Pakistan from August 2019 to August 2020. Permission was taken from the ethical review committee of institute. We looked at 18 individuals who had been hospitalized to the Spinal Injury Unit with cervical trauma and ankylosing spondylitis. All of the patients had long-term ankylosing spondylitis, with a standard of 22 years and a range of 11 to 40 years. On the other hand, two of the patients had not been diagnosed with the illness before the fracture. A total of eight individuals were fractured as a consequence of minor mishaps. Four patients were hurt by falls from great heights, while five more were injured in traffic incidents. In a slaughterhouse, one got destroyed by cows.

**Inclusion criteria**

Among the inclusion criteria were the following: cervical spinal fracture occurring in a patient with AS; imaging demonstrating the cervical fracture; clinical examination associated or not with a Frankel neurological score; detailed description of the neurological status; details of the surgery; length of follow-up period; reporting of any peri/post-operative complication associated with surgery; statistical analysis of postoperative outcomes.

**Exclusion criteria**

Technical comments, letters to the editor, case studies, and narrative and quantitative evaluations were all eliminated from the submission process. Those on the conservative therapy of cervical fractures, as well as studies on the surgical management of thoracic and lumbar fractures, were also removed from consideration.

Studies were omitted if they lacked information on the following topics: preoperative diagnosis, surgery, follow-up, imaging evaluation of fracture, clinical examination, clinical outcomes, and postoperative imaging.

**RESULTS**

Fractures mainly occurred at the 6th and 7th cervical levels (As shown in Fig. 1).

The chalk stick fractures were the most common, with the fracture line running horizontally across the spine. Two individuals, on the other hand, had their fractures dislocated. The cervical spine was incompletely fused in these patients. Fractures were seen at two different levels in one instance. The upper region of the vertebral body was the most frequent fracture location (10 fractures). The mid-vertebral body suffered one fracture. The line passed into the disc space in the last eight cracks. The site of these fracture lines was linked to the injury’s neurological prognosis and the patient’s long-term survival. Two of the eight patients in which the fracture line crossed the disc space had no substantial neurological impairment, two had transitory indications that went away quickly, and three had partial tetraparesis. The patient had tetraplegia when the seventh transdiscal fracture was paired with an upper vertebral body fracture.

On the other hand, all patients who burst through the vertebral body were left with complete & permanent tetraplegia from the beginning of their therapy. It has been shown that the much decreased neurological damage induced by trans-discal fractures has a beneficial influence on long-term survival. One death occurred three years and nine months after the shock, but six of the seven single-level cases were still alive when the research was completed. Among this group of seven patients, the average survival duration was seven years and eight months on average. When it came to patients with a vertebral body fracture, there were no survivors, with an average survival duration of six months after their injury. As shown in Table I, several measurements was obtained at the fracture site. The analysis results were used to identify features of trans-discal fractures that might be associated with a better prognosis.

In patients who broke through the disc, the vertical distraction at the fracture site was typically minimal, with just one instance displaying an 8 mm distraction. When the fracture passed through the spinal column, the distraction ranged from 0 to 22 millimeters. At the fracture site, the angulation & horizontal displacement were identical in all three groups, with an equal distribution of anterior and posterior displacements in both groups. (As shown in Table I.)

In terms of age, illness duration, mode of injury, or fracture degree, there was no difference between transdiscal and trans-vertebral fractures. In the majority of instances, pneumonia was the cause of death. There was also a urinary tract infection in other cases, and in one case, there was a severe upper gastrointestinal hemorrhage. Fracture recovery was evaluated in 14 individuals who survived one month or longer. Within one to two months, radiographic evidence of...
bone union was seen in five individuals, with florid callus development occurring in two of them. Seven more patients recovered without complications after six months, but the fracture in two of them remained un-united, resulting in cervical spinal pseudo arthrosis.

Figure 1: Distribution of fractures.

Table 1: Displacement at the fracture site

<table>
<thead>
<tr>
<th>Displacement</th>
<th>Angulation</th>
<th>Vertical distraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fracture through disc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1 mm</td>
</tr>
<tr>
<td>0</td>
<td>5 extension</td>
<td>1 mm</td>
</tr>
<tr>
<td>16 mm anterior</td>
<td>45 extension</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20 mm posterior</td>
<td>30 extension</td>
<td>8 mm</td>
</tr>
<tr>
<td>19 mm anterior</td>
<td>0</td>
<td>6 mm</td>
</tr>
<tr>
<td>Fracture through vertebral body</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 mm posterior</td>
<td>10 extension</td>
<td>3 mm</td>
</tr>
<tr>
<td>12 mm anterior</td>
<td>7 extension</td>
<td>5 mm</td>
</tr>
<tr>
<td>0</td>
<td>15 extension</td>
<td>4 mm</td>
</tr>
<tr>
<td>0</td>
<td>30 extension</td>
<td>10 mm</td>
</tr>
<tr>
<td>6 mm anterior</td>
<td>0</td>
<td>2 mm</td>
</tr>
<tr>
<td>0</td>
<td>30 flexion</td>
<td>0</td>
</tr>
<tr>
<td>4 mm posterior</td>
<td>10 extension</td>
<td>7 mm</td>
</tr>
<tr>
<td>0</td>
<td>40 extension</td>
<td>22 mm</td>
</tr>
<tr>
<td>5 mm anterior</td>
<td>15 extension</td>
<td>3 mm</td>
</tr>
<tr>
<td>18 mm anterior</td>
<td>40 extension</td>
<td>12 mm</td>
</tr>
<tr>
<td>5 mm anterior</td>
<td>15 flexion</td>
<td>0</td>
</tr>
</tbody>
</table>

DISCUSSION

Cervical fracture in ankylosing spondylitis accounts for a relatively tiny percentage of individuals with spinal injuries.\(^1\) In individuals with ankylosing spondylitis, the risk of spinal fracture seems to be low.\(^2\) However, the inability to recognize cervical fracture may lead to an underestimation of the frequency. When Duncan and Simmons (1977) examined patients with severe ankylosing spondylitis treated for deformity, they discovered a previously undetected cervical fracture in 36% of them. Trauma to the cervical spine, on the other hand, may lead to the discovery of concealed long-term ankylosing spondylitis, as in two of our patients. Others have documented this form of presentation, which is unexpected given the disease’s lengthy and terrible natural history. Such a case also makes determining the fundamental frequency of cervical fracture challenging. We know that long-standing fused spines that have become osteoporotic are the most vulnerable to trauma, as seen by our patients’ high mean age. Because it is the most exposed portion of the spine, the fused cervical area is the most susceptible to fracture.

Hunter and Dubo (1978) studied the literature, including eight of their cases, and discovered that approximately half of all fractures were caused by slight trauma. If the traumatic event is minor, the diagnosis of a spinal fracture is more likely to be disregarded until neurological impairment ensues. In our instances and the literature, the chalk stick kind of fracture is the most prevalent. However, based on our findings, the particular location of this fracture seems to be essential for prognosis. According to Woodruff and Dewing (1963), all fractures happened in the interspace between the discs rather than in the body’s substance. According to Guttman (1966), the damage mechanism in these instances included ahead retroversion. The lower cervical area is most often affected by rapid hyperextension, which is the most frequent damage location. According to Rand and Stern (1961), four of the six instances had fractures predominantly through the body. They postulated that flexion injuries resulted in comminuted vertebral body fractures, while hyperextension injuries resulted in intervertebral space fractures.

The transverse fracture line commonly goes over the top portion of the vertebral body right below the end-plate, according to a thorough examination of the radiographs in our patients. Even though some of these lesions had a discernible hyperextension mechanism, our research discovered no correlation between the kind of fracture and the means of injury. According to our findings, the cases described in the literature were analyzed, and 42 of them had sufficient information to discriminate between transdiscal and trans- vertebral fractures. The transdiscal fracture is the most prevalent, with 27 occurrences reported. Trans-vertebral fractures had a higher prevalence than transdiscal lesions in our study. Still, since most trans-vertebral fractures travel through the top portion of the vertebral body, a thorough inspection is necessary to distinguish between the two types of lesions.

The significance of the fracture location seems to be determined by its association with neurological complications. All of our vertebral body fracture patients exhibited significant neurological deficits. The transdiscal fractures, on the
other hand, caused little or no neurological injury. In the international literature, 18 (66 percent) of the 27 transdiscal fractures had no neurological symptoms, and all but two of them lived. On the other hand, 13 of the 15 people who had a trans-vertebral fracture (85.8%) suffered severe neurological abnormalities, with 48 percent dying. These results seem to back up the significance of this finding. Woodruff and Dewing have emphasized the vital link between neurological impairment and death (1963). Only one of the authors’ 20 instances had survived, and only ten of them had a substantial neurological disability. The most common cause of death was pneumonia, which is predisposed to by the impact of muscle paralysis and immobility piled on the narrow thoracic cage. On the other hand, treatment methods have vastly improved, and mortality from these consequences has decreased dramatically in recent years. It is not apparent why trans-vertebral fractures seem to cause more neurological damage versus transdiscal lesions, although this is the case. Although it may seem straightforward, a fracture through the bone requires far more work than a fracture through the disc. There was, however, no correlation found between the kind of injury and the bone anomalies. This study showed no correlation between the degree of anterior-posterior displacement or angulation and the severity of neurological impairment. It appears that Woodruff and Dewing (1963) were correct in their conclusion that the degree of bone displacement or dislocation was connected with the severity of spinal cord damage in broad. However, they uncovered that significant radiographic misalignment was linked with little or no cord impingement in the majority of cases. On the other hand, the degree of distraction was linked to cord damage in this study.

Finally, it is likely that the increased neurological damage is due to vascular stress and bleeding induced by trans-vertebral fractures. Ankylosing spondylitis fractures are more likely to cause spinal epidural hematoma than fractures through a normal cervical spine. Extra bleeding from the shattered cancellous bone and the perivertebral and epidural veins is expected, resulting in further neurological injury, which is a risk of the broken ankylosed spine. The association between trans-vertebral fracture, hemorrhage, and neurological damage, on the other hand, cannot be proved without establishing a pathogenic connection.

**CONCLUSION**

In conclusion, our data shows that even minor trauma may result in substantial cervical fractures & neurological damage in individuals with ankylosing spondylitis. Therefore, all individuals with ankylosing spondylitis and a cervical fracture must have a complete radiographic evaluation to see how the fracture is related to the vertebral bodies & discs. Cervical injury and ankylosing spondylitis are two disorders that should be treated similarly.

### Consent and Ethical Approval

Permission was taken from the ethical review committee of University. Written and verbal informed consent was taken from the patients after explaining them the purpose and procedure of the study in detail and ensuring the confidentiality.

### Conflict of Interests

Authors have declared that no competing interests exist.

### Source of Funding

Nil

### REFERENCES