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Anterior single lag screw fixation in Type II Dens fracture – Indian experience

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Abstract: Increased rate of non-union of Type II Odontoid fractures with rigid external orthosis have been reported. Recently technique of direct anterior screw fixation of the odontoid fracture is being advocated. Here we report the results of 13 cases of Type II dens fracture treated by the above method with an age group ranging from 17 to 73 years. An approach identical to the anterior cervical discectomy was used. Guide tube system devised by Synthes®, single image intensifier and Langenberg retractors was used to place a single cannulated screw through the fracture from C2 body into the dens. Among the 13 cases operated, in 11 cases we were successful. In one case while dissecting the fracture site CSF leak occurred and in another case the guide wire broke leading to abandoning to screw placement. There was no other complication due to the surgical procedure. The follow up period ranged between 2 months to 3 1/2 years. There were no neurological complications or screw fracture. In 9 of the 11 cases (82%) either bony union or fibrous unions have occurred. These results indicate that direct anterior single screw fixation has proved to be a very successful treatment.

Keywords: Cervical spine injury, Dens fractures, Atlanto-axial stabilization, Odontoid screw fixation.

INTRODUCTION

Dens fractures are classified into three types[1]. Type I and III fractures do not require any surgical intervention in majority of cases. In type II dens fracture, increased rate of non-union has been observed with conservative treatment[2-8]. Hence surgical intervention is advocated but various surgical options are available[2-9]. The conventional approach to stabilize the Type II odontoid fracture has been a posterior C1-C2 fusion. An alternative technique of direct screw fixation of the odontoid fracture which preserves the normal C1-C2 motion in addition to stabilizing the complex immediately has been recently advocated[7,10-25]. Differing opinion exists regarding the number of screws that should be used to fix the fractured odontoid segment[7,10-15,17,18,24]. Here we report results of our series of 13 cases of Type II dens fracture treated with anterior single lag screw fixation.

MATERIALS AND METHODS

During the period January 2004 to July 2008, twenty cases of acute Type II dens fracture of less than 6 months duration were treated. Among them 13 cases with displacement of odontoid of 6mm or more, were attempted to be treated using single anterior lag screw fixation. The age group ranged from 17 years to 73 years and all were males. The mode of injury in 9 cases were road traffic accident, in 2 cases while training in martial arts and in other 2 cases due to a fall. Among the 9 cases who sustained injury in road traffic accident, 2 sustained neck injury due to their neck caught in the seat belt as their body slid down during the accident. Cases excluded from the study were Type II dens fracture of more than 6 months duration which is classified as chronic[7], Type I and III fractures and other types of C2 fractures.

All the 13 cases presented with severe neck pain. Two cases presented with incomplete type of quadriplegia of grade 2/5 motor power, 3 cases with grade 3/5 motor power. In 8 cases there was no motor deficit. Variable sensory loss was detected in all these patients. Two patients also had retention of urine for which they were catheterized. All these patients had sustained injury within four months before definitive surgical treatment was instituted. Two patients had associated severe head injury, one case had fracture spine at C5-C6. In all these patients x-ray and computed tomography (CT) scan of cervical spine were done. CT brain was done to exclude associated head injury in all these cases. Magnetic

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resonance imaging of cervical spine was done in 7 cases. Blood investigations were done as a part of pre-anesthetic work up in all these cases.

Surgical approach: These patients were operated through the anterior retropharyngeal approach as described by Apfelbaum except for few modifications which are mentioned below[7]. Single image intensifier was only used and anteroposterior (AP) and lateral (LAT) images were taken. The skin incision was made at C2 – C3 level disc space after localising the level under image intensifier in 8 out of 13 cases. After exposing the C2 – C3 disc space discectomy was done for a depth of approximately 10mm. Only hand held Langenberg retractors were used to keep the operative area exposed and no specialized retractors were used. Instrumentation supplied by Synthes® for introducing the cannulated screw was used in majority of cases. About 2mm below the anterior edge of C2 body in midline the 'K' wire was directed towards the tip of the dens under image intensifier guidance. Once the 'K' wire was in correct position high speed drill system was passed over it and drill hole made up to the dens tip. This was followed by enlarging the entry hole in C2 body using the countersink for 10mm depth which makes a dent in the anterior surface of C3 body. The length of the screw needed is measured and appropriate cannulated screw of 3.5mm screw head size was selected and introduced under image guidance. The 'K' wire is removed. Drain was kept in all these cases and wound closed in layers.

In all these patients AP and Lateral x-rays of cervical spine were taken after days 1, 7 and at the end of 1, 2 and 6 months. Follow up period ranged from 2 months to 3 ½ years. In 3 cases only postoperative CT scan of cervical spine could be obtained. In view of financial costs in rest of the cases CT scan could not be obtained. Clinically all these patients were followed up during the above periods. Following surgery the first 3 cases were given SOMI brace for 2 months followed by Philadelphia collar. In last 10 cases only Philadelphia collar was given for a period of 6 months.

RESULTS

In 11 out of 13 cases the screw could be successfully introduced crossing the fracture site and engaging the dens. In two cases we deferred placement of anterior screw and opted for posterior occipito-C2 fixation. Among these two cases, in one case while during dissection of fracture site to release the adhesions, cerebrospinal fluid leak occurred from the fractured site. Hence anterior screw placement was deferred. In second case while introducing the cannulated screw the 'K' wire snapped and distal part was lodged within the C2 body. Hence the anterior edge of the C2 body at the entry point was excised using Kerrison's up cutting for a depth of 4 mm to retrieve the broken 'K' wire. Since we felt that the cannulated screw may not properly hold it was decided to go posteriorly and stabilize the patient.

On follow up of 11 cases, in 9 cases (82%) good fusion was achieved.(Fig 1-6) In two cases non-union was observed. In one of these cases it was noted that there was proximal migration of the screw even though the initial x-ray taken at the end of 7 days showed perfect alignment of the screw (Fig 7). Normally in the majority of cases it was noted that there was 2-3mm proximal migration of the screw at the end of one month when the patient assumed erect position and was ambulant (Fig 6). This minimal proximal migration is probably due to narrowing of the gap at fracture site between dens and C2 body. But in one 73-year-old patient the screw tip was lodged in the fracture site at the end of 1 ½ months. This pull out of the screw was probably due to osteoporotic bone. This patient was followed for a period of 3 months and further proximal migration of

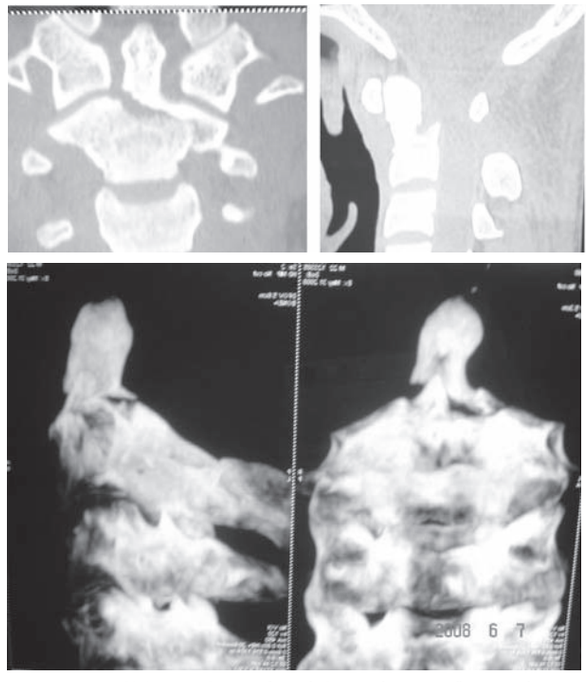

Fig 1 & 2: CT scan Coronal and Sagittal view of cervical spine showing the Type II dens fracture.

Fig 3: Post operative lateral view of cervical spine showing the single lag screw.

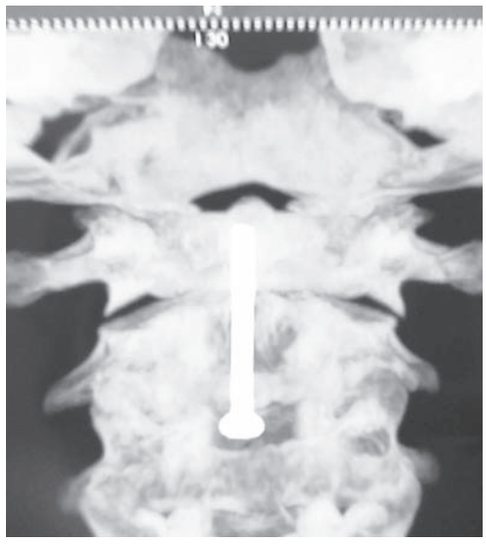

Fig 4: Post operative Antero-posterior view showing the singe lag screw.

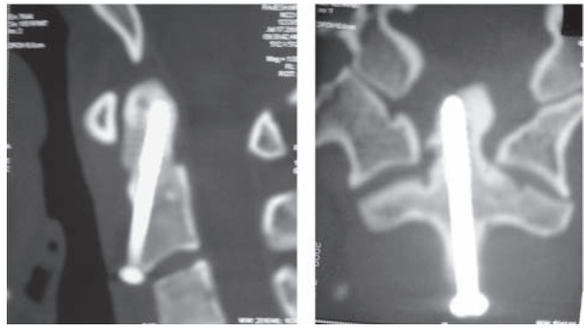

Fig 5: CT scan of cervical spine (Sagittal and Coronal section) showing good fusion at the fracture site.

screw did not occur. This patient had improved neurologically and postoperative CT scan showed fusion

Fig 6: X-ray cervical spine showing minimal 2mm proximal migration of the screw which is normally seen.

Fig 7: X-ray cervical spine taken at the end of 1 ½ months showing delayed proximal migration of the single lag screw. Patient also had C6 over C7 fracture dislocation which was stabilized using anterior cervical plate.

of the dens with anterior arch of atlas and there was no severe instability. Since dens was found to have fused to the anterior arch of atlas again repositioning of the anterior screw was not indicated[7]. Hence this patient was given Philadelphia collar for 6 months. The second case of non-union was advised to undergo posterior cervical fusion but he refused and hence he was managed

conservatively with cervical collar.

There were no major neurological complications. None of the patients developed operative site infection, CSF fistula, esophageal tear, submandibular fistula or hypoglossal nerve paresis. There was no screw breakage. Transient dysphagia was present in 4 cases which improved. All these patients were treated with 12mg injection dexamethasone in 3 divided doses for 3 days and then tapered and stopped by 5th day. The purpose of giving the steroid was to reduce the esophageal and tracheal postoperative oedema rather than for spinal cord oedema. Patients with preoperative motor power of grade 2/5 in the limbs with incomplete transverse myelopathy also improved over a span of 5 months and were independently ambulant. In our series we did not have any patient with complete transverse myelopathy.

DISCUSSION

Type II Odontoid fractures with displacement of dens more than 6mm, transverse ligament injuries should be considered for early surgical stabilization because this combination of injuries is unlikely to heal non-operatively[6,7,15]. Nakanishi in 1980 first described the surgical procedure of osteosynthesis using anterior lag screw fixation for type II odontoid fractures followed by Bohler J in 1982 who presented his first series[10,11]. Dickman et al described the usefulness of cannulated screw system for treatment of upper cervical spine fixation[14]. Apfelbaum reported the use of a specialized retractor system. During its usage in 44 of his cases, he had one case that developed esophageal tear. He used two image intensifiers during the whole procedure to image the passage of the screw[7].

The placement of two screws for these fractures was proposed by few authors[7,8,10-14]. But Sasso et al in their biomechanical studies have found no significant differences between one and two screw placements[26]. Single screw technique was used by various other authors with good fusion in nearly 80% of their cases[17,18,20,23,24,27]. Our results also support the above technique of single screw fixation with 82% fusion rate. It stabilizes C1-C2 complex, prevents loss of normal C1-C2 rotary motion and also achieves bony union. Anterior odontoid screw fixation should be avoided when the transverse atlantal ligament is disrupted[28].

Set of instrumentation to introduce the cannulated screw is available with various companies which manufacture spinal implants. Our surgical technique proves that with hand held Langenberg retractors, the cannulated dens screw could be successfully introduced and it is not necessary to have specialized retractor system to retract the vital structures. Langenberg retractors also prevented complications like esophageal tear which was reported by Apfelbaum using specialized retractors[7]. It also reduced the incidence of tracheal and esophageal edema, since intermittently it was removed while using the image intensifier. Concomitant administration of steroids also reduced the above complications.

Breakage of 'K' wire during surgery could be avoided by using new 'K' wire that is locally available, after selecting the exact thickness of the wire and cutting it to the appropriate length rather than using the 'K' wire supplied with the instrumentation set supplied by the company. Since this company supplied 'K' wire is repeatedly used by various surgeons during surgery it breaks. The phenomenon of minimal 2-3 mm proximal migration of the screw has not been reported by the above authors in their study (Fig 6). Proximal screw slippage in osteoporotic individuals which occurred in one of our cases (Fig 7) can be prevented by applying the washer as proposed by Apfelbaum but we have not had a case to try it[7]. Similar to our case Fountas et al had reported one case where there was instrumentation failure without instability[19].

CONCLUSION

Direct osteosynthesis using single anterior cannulated screw can be considered as the choice of surgical treatment in selected cases of acute (<6 months old) Odontoid Type II fractures. Good fusion rate of around 80% without significant major complications could be achieved using this technique. Early mobilization could be achieved which prevents various complications due to prolonged bed ridden state.

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