Olgu Sunumu

Hangman Fracture Treated By Posterior C2-3-4 Screw-Rod Construction: A Case Report

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✔ We present a case of highly unstable Hangman's fracture treated by a C2-3-4 posterior screw-rod construction. Hangman's fractures are often treated surgically with a C2-C3 anterior cervical discectomy, fusion and anterior plating. In our case we treated Hangman's fracture by a C2-3-4 posterior screw-rod construction. The patient was operated in the sitting position and Mayfield head holder was used. Posterior C2 screw fixation combined with C3 and C4 lateral mass screw fixation, and rod construction was performed. Posterior stabilization with C2 pars interarticularis screw fixation combined with C3 facet screw fixation and rod construction is the treatment choice for Hangman's fracture, especially associated with severe C2-3 instability.

Key words: C2-3-4 posterior screw-rod construction, Hangman's fracture, traumatic spondilolisthesis

J Nervous Sys Surgery 2008; 1(4):247-250

Hangman Fraktürünün Cerrahi Tedavisinde C2-3-4 Vida-Rod Konstruksiyonu: Olgu Sunumu

✔ Hangman fraktürleri genellikle C2-C3 anterior diskektomi, anterior servikal plak ve füzyon ile tedavi edilebilirler. Biz bu yazımızda C2-3-4 rod-vida sistemi ile konstrükte edilen bir olguyu sunduk. Hasta Mayfield çivili başlıkta oturur pozisyonda C2 pars vidalanması ile birlikte C3-4 lateral mass vidalanarak rodlar ile konstrükte edildi. C3 faset vidalama ve rod konstruksiyon ile kombine edilmiş C2 pars interartikülariz vidalaması ve posterior stabilizasyon özellikle ciddi C2-3 instabilitesi olan Hangman fraktürlü hastalarda cerrahi seçenek olmalıdır.

Anahtar kelimeler: C2-3 posterior vida-rod konstrüksiyonu, Hangman fraktürü, travmatik servikal spondilolistezis

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Traumatic spondilolisthesis of the axis the so called Hangman's fracture, is a common form of high cervical trauma. It is characterized by bilateral C2 pars interarticularis fracture with a variable degree of displacement of the corpus of the C2 on the C3 vertebrae. Although most Hangman's fractures are treated conservatively, surgery is usually preferable in highly unstable cases, and following failure of rigid arthrodesis. In cases in which surgery is indicated, anterior C2-3 fusion with plating is usually preferred [9,12,15,16], although posterior C2 pars interarticularis screw fixation has been reported in limited cases [10].

In this report we present a case of highly unstable Hangman's fracture treated by a C2-3-4 posterior screw-rod construction.

CASE REPORT

A 31 year old man was admitted to our emergency department after being struck by a motor vehicle. On admission the patient was confused and his respiration was superficial. He was intubated and interned to neurosurgery intensive care. On his neurological examination quadriparesia and hypoesteshia of bilateral low extremities were observed. Cervical X ray's revealed a fracture at the level of C2 (Figure 1). Also C2 fracture and spinal contusion at the same level were demonstrated on MR examination (Figure 2). Cervical spine was stabilized with external orthesis, and 5 days after the injury, surgery was performed after the patient stabilized medically. The patient was operated in the sitting position using a Mayfield head holder. Following a midline incision, paravertebral muscles were dissected subperiostally and lateral masses of C2, C3 and C4 were exposed. Posterior C2 pars interarticularis screwing combined with C3 and C4 lateral mass screw fixation and rod construction was performed. Postoperatively the patient's neurological examination was unchanged. On his first monthly follow up he was walking with a walker, and his cervical X ray (Figure 3) and CT (Figure 4, Figure 5) showed healing of the fracture and no spondilolisthesis was observed.

Figure 1. Pre-op cervical X-Ray.

Figure 2. Pre-op cervical MRI.

Figure 3. Post-op cervical X-Ray.

DISCUSSION

In 1913, Wood Jones described the cervical injury caused by legal hanging [17]. He examined 5 executed prisoners hung with a knot placed in a submental position. Death was due to hyperextension and distraction of the cervical spine causing bilateral symmetrical fractures of the

Figure 4. Post-op cervical CT (coronal images).

arch of the axis and the tearing of the intervertebral ligaments and the disc of C2-C3 the complex. In 1954 Gragavo was the first to mention the similarity between a cervical trauma caused by a motor vehicle accident and the injury described by Wood Jones. Garber also classified fracture as traumatic spondylolisthesis of the axis [7]. However in 1965, Schneider and colleagues described bilateral pars interarticularis fractures of axis as "Hangman's Fracture" and since then the term Hangman's fracture and traumatic spondylolisthesis have been used interchangeably [14]. Hangman's fractures usually occur associated with hyperextension injuries combined with axial loading. Hyperextensive and axial forces passing through the weakest part of the axis; the pars articularis, cause the pars interarticularis fractures. If extension continues, anterior longitudinal ligament and disc rupture and a severe fracture- dislocation occurs. However hyperflexion followed by hyperextension has been also described as a rare mechanism of this type of injury [6].

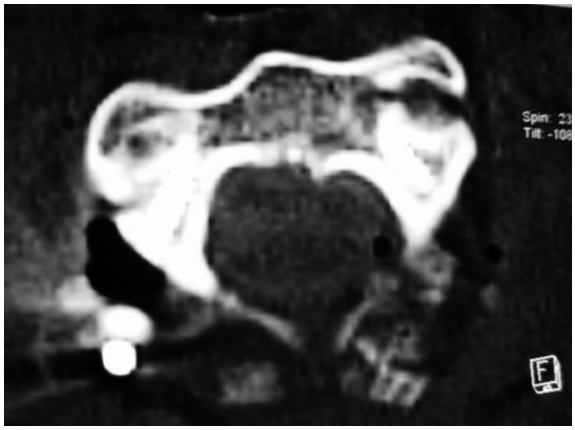

Figure 5. Post-op cervical CT (axial images).

Table 1. Levine and Edwards recently modified a classification system that was proposed by Effendi. This classification system categorizes these fractures based on the degree of displacement on lateral C-spine radiographs and on mechanical stability.

Fracture	Feature
Type I	Fracture of the pars interarticularis with <3 mm displacement and no angulation
Type II	Fracture of the pars interarticularis with >3 mm displacement and significant angulation
Type IIA	Fracture of the pars interarticularis with <3 mm displacement and significant angulation
Type III	Fracture of the pars interarticularis with unilateral or bilateral facet dislocation at C2-3

Several classification systems have been purposed for Hangman's fracture [1,2,6,7,10,13]. Levine and Edward's [6] modification of the Effendi classification is the most commonly used (Table 1). According to this classification fractures are divided into categories in terms of displacement (more or less 3 mm) and angulation. Most of the Hangman fractures could be treated conservatively. A rigid halo orthesis is considered as the first treatment option for displaced or angulated fractures. A Philadelphia cervical collar is usually sufficient in less severe cases [4]. The rates of the failure of conservative treatment ranges from 5.6 % to 32 % [8,6]. However some authors advocated early surgical stabilization for Hangman's fractures. Anterior approach involving C2-3 interbody fusion with plating is the most preferable surgical approach for Hangman's fractures.

This approach has several advantages such as being easy, safe and needing short fusion construct. However it cannot repair the detached posterior arch. Posterior approaches including occipitocervical fusion and C1-3 wiring has been abandoned [3]. Direct screw fixation of the pars interarticularis is a recently popular approach although it was described as early as 1964 [11]. Several authors reported favorable clinical outcome in their series. The main advantage of this technique is not sacrificing any normal motion of the C2 segment and fixating only the fractured bones of C2. However it can be used only in cases with minimal or no C2-3 disc injury. It is ineffective in the instability at C2-3 level. Recently Duggal et al [5] reported the biomechanical comparison of stabilization techniques on Hangman's fracture and posterior C2-3 screw and rod construction was found to be more effective on stabilization of Hangman's fracture than anterior cervical plating and C2 pars screwing. In the same cadaver study this technique provided significantly better biomechanical stability, especially during lateral bending and axial rotation, than an anterior C2-3 plating [5]. However, screw fixation of C2-3 has two advantages. First, it provides C2-3 stabilization and restoration of the posterior elements of the axis. Second, the construct behaves similarly to the tension bands against flexion, lateral bending and axial rotation.

CONCLUSION

Most Hangman's fractures can be treated conservatively, although surgical treatment became popular recently. Posterior stabilization with C2 pars interarticularis screw fixation combined with C3 facet screw fixation and rod construction is an alternative treatment modality for Hangman's fracture, especially those associated with severe C2-3 instability.

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