RISK OF EXCESSIVE TRACTION ON DISTRACTION-FLEXION-TYPE INJURIES OF THE LOW CERVICAL SPINE

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SUMMARY

This study aims to evaluate the risk/ benefit ratio in the use of traction with cranial halo as an alternative to stabilize fractures-dislocations by Allen & Ferguson's type IV- distraction-flexion mechanism, considering the nature of the injury, its extensive ligament damage and the risk of presenting excessive distraction and resultant spinal cord injury. Thus, we performed a retrospective analysis at IOT-HC-FMUSP comprising a period of 10 years, when 34 cases were diagnosed as fractures-dislocations due to distraction-flexion of the low cervical spine, of which 12 were IV-type. All individuals have been submitted to skeletal traction with cranial halo at an early phase. During sequential X-ray management, an excessive distraction was seen in seven cases, even with initial light weight (4 kg). In two patients, the onset of nistagmus was seen. In all cases, traction was removed, which was followed by stabilization of the clinical picture.

Keywords: Fractures, Spine, Traction, Skull.

INTRODUCTION

According to the classification by Allen and Ferguson, fractures-dislocations of the low cervical spine can be classified according to the mechanism of injury. Distraction-flexion-type fractures can be divided into I to IV, depending on the injuries and the degree of instability that the spine may present, with type IV being the maximum. This injury, affecting the 3 Denis columns, consists of posterior ligament complex failure, bifacetal dislocation with anterior shift greater than 50% of vertebral bodies, with or without detachment of the anterosuperior margin of the lower vertebra, longitudinal ligament injury, and disc ring injury with potential disc herniation [1].

Due to the specificity of these fractures (type IV) and due to its great instability, some special considerations should be discussed about how to handle these patients, emphasizing the mechanism of fracture and its extensive ligament injury, as well as the high rates of related neurological injuries [2].

Still regarding evolution, it is important to remember that a neurological injury can be higher than the level of the musculoskeletal injury, considering the possibility of related vascular injury (vertebral artery injury, vertebral artery thrombosis, stroke) [3].

Upon this context, some authors [4] recommend performing nuclear magnetic resonance for planning a potential bloodless reduction or even the bloody reduction with surgical fixation. Other authors [5] advocate the bloodless reduction attempt without previous imaging studies, alleging improvement of the neurological deficit with early reduction up to two or three hours after trauma. In those cases, nuclear magnetic resonance will only be performed if a successful bloodless reduction is not achieved or if the patient evolves with a worse neurological picture.

The use of skull halo for treating cervical spine fractures-dislocations has been widely recommended since first described by Perry Nickel, in 1953[6]. Regardless of the need to perform a bloodless reduction, the use of skeletal traction with skull halo also comprises the purpose of stabilizing cervical injuries.

The purpose of this study consists on evaluating potential damages caused by the use of skeletal traction with skull halo, in an attempt to provide the early stabilization of those fractures-dislocations, once the nature of such injuries carries an extensive ligament injury, and may cause, in

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Received in: 09/22/05; approved in: 10/14/05

this stabilization modality, further damages to the neurological injury due to strains to which spinal cord may be submitted.

MATERIALS AND METHODS

All subaxial cervical spine fracture cases receiving healthcare at IOT-HC-FMUSP during the period of January 1991 to January 2001 were retrospectively assessed. Taking cervical spine X-ray images at lateral plane as a parameter, cases were classified according to the criteria by Allen and Ferguson, which comprises the following patterns: a) compression-flexion; b) distraction-flexion; c) axial compression; d) lateral bend; e) compression-extension; f) distraction-extension [7]. Thirty four cases of distraction-flexion were identified, with none of type I, 5 of type II, 17 of type III, and 12 of type IV (Table 1).

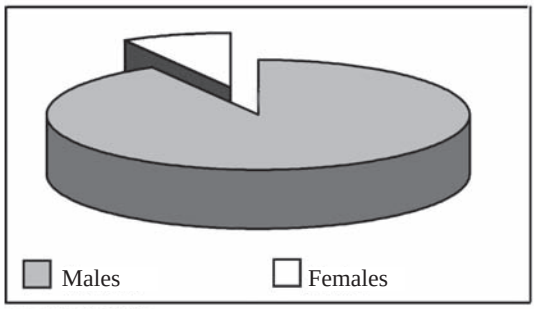
Regarding the distribution of such type-4 injuries by gender, we identified 11 males and one female (Graph 1), with mean age of 44.75 years old (+/- 12.5) ranging from 20 to 58 years old. Among those, 7 presented with complete spinal cord injury, one with incomplete spinal cord injury, one with radiculopathy, and 3 cases with no neurological injury (Graph 2). Still regarding type-IV cases, concerning the mechanism of trauma, 7 resulted from car accidents and 5 resulting from high falls (Graph 3).

All cases were initially treated with skeletal traction with skull halo. After the halo was set, traction began with 4 kg, with increments of 0.5 kg at each 30 minutes, combined to clinical and X-ray monitoring at each traction load increment. Clinical evaluation addressed measurements of respiratory frequency, heart rate, blood pressure, and neurological tests, including nystagmus presence evaluation. Cervical spine X-ray images at lateral plane were taken at each interval (30 minutes).

Classification by Allen – Ferguson (distraction-flexion mechanism)	Cases	Percentage
Type I	0 cases	0
Type II	5 cases	14.7%
Type III	17 cases	50%
Type IV	12 cases	35.3%

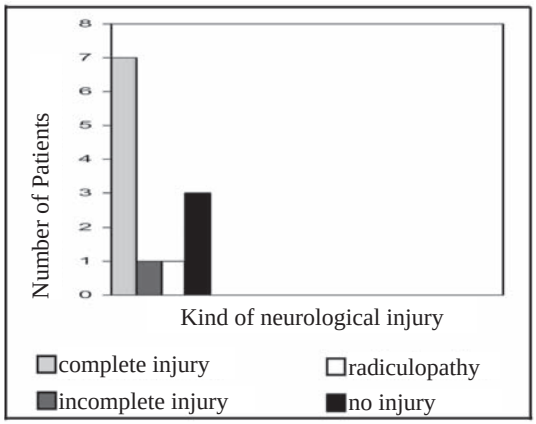
Source: IOT HC-FMUSP

Table 1 - *Distribution of distraction-flexion fractures-dislocations, according to the classification by Allen-Ferguson*

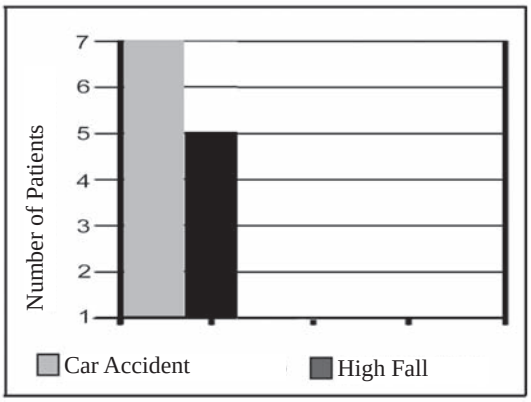


Source: IOT HC-FMUSP

Graph 1 *- Distribution of Allen-Ferguson's type IV distraction-flexion fractures-dislocations by gender*



Graph 2 - *Distribution regarding neurological injury severity presented in cases of Allen-Ferguson's type IV distraction-flexion fractures-dislocations*



Graph 3 - *Distribution regarding the mechanism of trauma in Allen-Ferguson's type IV distraction-flexion fractures-dislocations.*

RESULTS

In 7 of the 11 patients diagnosed with type-IV fracture-dislocation by mechanism of distraction-flexion (Figure 1) and treated with skull traction, an excessive traction was seen, even with loads as light as 4 – 5 kg. Among those 7 patients, 2 were diagnosed with excessive traction upon clinical criteria, both presenting with nystagmus even with the 4-kg load, which indicated the immediate withdrawal of traction, followed by collar immobilization. The remaining 5 patients were diagnosed with excessive traction after the first X-ray control performed 30 minutes after the halo was set and under 4.5-kg traction, with excessive separation being visualized at the injury site (Figure 2). Accordingly, traction withdrawal and collar placement were recommended to those patients. After traction was removed, in all 7 cases, none of them presented with any degree of neurological or vital signs worsening, and the two patients presenting nystagmus evolved with regression. No complications related to halo placement or to progressive traction application were identified in patients diagnosed with cervical fracture-dislocation grades II or III according to Allen and Ferguson's classification (distraction-flexion) within the period studied.

DISCUSSION

Complete cervical dislocations are commonly the most dramatic

cervical injuries, involving high energy and are frequently related to multiple trauma and major spinal cord injury [3]. Furthermore, many patients initially described as having a clinical picture with no neurological deficit present with a worse neurological status after arriving at a healthcare service. The severity of related injuries is associated to the fact that those fractures-dislocations present an extensive ligament injury resulting in a significantly unstable spine, featuring an aspect known as "floating vertebra"[8]. Patients presenting with such changes must be identified and protected during initial evaluation since they are submitted to multiple diagnostic tests and occasionally required emergency surgical procedures [9]. The formal evaluation of a cervical spine must be performed before, during or after those emergency procedures, and should comprehend physical and X-ray images examination of the cervical spine (at least a lateral plane must be performed). Usually, an Allen & Ferguson's type-IV, distraction-flexion-type cervical spine injury is evident at X-ray images [9]. Severe bilateral facet dislocations with more than 50% or even 100% translocation, or those appearing as an intervertebral distraction, require careful analysis. Traction is potentially dangerous to those cases, because all ligament structures are lacerated, imposing a load on a previously injured muscle and on neural elements that cannot resist much to tension. A complete dissociation of the cervical spine makes it unable to resist to flexor or extensor moments, without causing distraction at the injury core [10].

***Figure 1** - Distraction-flexion-type cervical spine fracture, classified as IV by Allen-Ferguson*

***Figure 2** - A case of floating vertebra after traction with skull halo*

Patients followed up in our services suspected of cervical fracture-dislocation and confirmed upon clinical and radiographic evaluation are routinely submitted to skull halo placement. Dislocation cases are sequentially assigned to progressive traction in an attempt to obtain a bloodless reduction, being monitored for vital and X-ray parameters, as previously mentioned. Skull traction, even with a light load, was shown to be deleterious for the majority of patients with Allen's type IV distraction-flexion injury, characterizing that those cases suspected of "floating vertebra" should not be candidates to this kind of treatment. Although we have seen in this study that all patients presenting changes (either neurological or radiographic) during the use of skull traction recovered their previous condition after its removal, we cannot generalize that such recovery is a rule to every case.

CONCLUSION

We highlight the importance of recognizing the cases of fracture-dislocation due to type IV distraction-flexion to warn that the use of skeletal traction with skull halo is contraindicated in this subgroup because of the risk of excessive distraction, even with light loads, due to the massive ligament rupture and instability of the segment.

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