Bell’s Cruciate paralysis in a patient victim of a gunshot wound in the cervical region: the radiologic evidence of an anatomic theory

Paralisia cruzada de Bell em um paciente vítima de ferimento por projétil de arma de fogo na região cervical: a evidência radiológica de uma teoria anatômica

ABSTRACT

Bell’s cruciate paralysis is characterized by paralysis of the upper limbs associated with little or no deficit in lower limbs. Its diagnosis is often overlooked, given that its symptoms similarities to that occasioned by the centromedullary syndrome, whose incidence is considerably higher. The present case report describes the case of a 16-year-old male patient victim of a gunshot wound in the anterior cervical region that developed Bell’s cruciate paralysis. The Magnetic Resonance Imaging (MRI) of the cervical spine showed medullary signal change in the cervicomedullary junction, with anteromedial location. A somatotopy of the corticospinal tract was suggested by Bell (1970) at cervicomedullary transition, with the anatomical hypothesis that fibers responsible for the movement of the upper limbs would cross higher and more superficially that the fibers of the lower limbs. This case combines the MRI assessment with the clinical outcome and corroborates with the Bell’s anatomical theory.

Keywords: Cruciate Paralysis, centromedullary syndrome, craniocervical transition, magnetic resonance imaging

Resumo

A paralisia cruzada de Bell é caracterizada pela paralisia dos membros superiores associada a pouco ou nenhum déficit em membros inferiores. Seu diagnóstico é geralmente subestimado, tendo em vista que seus sintomas são semelhantes aos produzidos pela síndrome centromedular, que tem uma incidência consideravelmente maior. O presente relato descreve o caso de um paciente masculino de 16 anos de idade, vítima de ferimento por projétil de arma de fogo em região cervical anterior que desenvolveu paralisia cruzada de Bell. A ressonância magnética (RM) de coluna cervical demonstrou alteração de sinal na transição bulbomedular, com localização anterior. Uma somatotopia do trato corticospinal foi sugerida por Bell, em 1970, na transição bulbomedular, com a hipótese de que fibras responsáveis pelos movimentos dos membros superiores cruzariam mais superiores e superficiais que fibras responsáveis pela movimentação dos membros inferiores. Esse caso associa os achados do exame neurológico com as imagens de RM para corroborar a teoria anatômica de Bell.

Palavras Chave: paralisia cruzada; síndrome centromedular; transição craniocervical; ressonância magnética

INTRODUCTION

Bell’s cruciate paralysis is characterized by paralysis of the upper limbs associated with little or no deficit in lower limbs. In these cases, there is a lesion in the craniocervical transition that affects the midline of the upper portion of the decussation of the pyramids. Its diagnosis is often overlooked, knowing that its symptoms are similar to the symptoms produced by the centromedullary syndrome, whose incidence is considerably higher.

The present case report describes the case of a patient victim of a gunshot wound in the anterior cervical region that developed Bell’s cruciate paralysis. A brief review of the literature on the subject was performed.

CASE REPORT

A 16-year-old male patient, victim of a gunshot wound in the cervical region, whose bullet entry was in the left submandibular...
region, transfixing the cervical spine was presented. The patient was found unconscious by the rescue team with signs of respiratory failure, and underwent endotracheal intubation. On admission, he had flaccid tetraparesis grade II.

A computed tomography (CT) scan of the cervical spine showed fragments of the projectile in the trajectory from the entry wound, to the right side of C1 vertebra, going through the topography of the left carotid artery. The CT also showed fragments of the bullet in the cervical spine associated with fracture of the right C1 lateral mass (Jefferson type III) and odontoid tip (Anderson and D’Alonzo type I) (Figure 1). The patient underwent intensive care under sedation, until achieving clinical and hemodynamic stabilization, using cervical collar to protect the cervical spine.

Diagnostic complementary assessment with angiography showed dissection of the left internal carotid artery in its cervical segment with pseudoaneurysm formation and occlusion of the right vertebral artery in its V2 segment. Magnetic Resonance Imaging (MRI) of cervical spine showed medullary abnormal signal in anteromedial region of cervicomedullary transition, (Figure 2) in the topography of posterior projection of the odontoid fracture.

After sedation withdrawal, a more detailed neurological examination was performed showing predominantly brachial tetraparesis (muscle strength grade IV in the lower limbs and grade I in the upper limbs).

An occipitocervical fusion was indicated. Patient evolution showed improvement of general status, and had partial improvement in muscle strength of upper limbs, reaching grade III.

**Figure 1**: CT scan of the cervical spine showing fragments of the projectile in the cervical spine, associated with the fracture of right C1 lateral mass and odontoid tip (A – scout; B – coronal acquisition; C and D – axial acquisition; E and F – sagittal acquisition).

**Figure 2**: MRI (T2-weighted) of the cervical spine showing abnormal signal in anteromedial region of cervicomedullary transition (A – sagittal; B – axial).

**DISCUSSION**

Bell’s cruciate paralysis was first described by Bell in 1970 as the reduction of muscle strength in upper limbs (ULs) that was disproportionately higher than that in the lower limbs (LLs), after cervical spine injury. A somatotopy of the corticospinal tract has been suggested to explain this syndrome, which would occur in the decussation of the pyramids at the cervicomedullary transition. At this location, the fibers responsible for the movement of upper limbs would cross higher and more superficially that the fibers of the lower limbs. Thus, this...
injury is differentiated from the centromedullary syndrome, which shows a similar clinical presentation, but with injury to the spinal cord center. The etiologies of this syndrome are odontoid fracture and Chiari syndrome, as well as atlanto-occipital dislocation.

The physiopathological explanation for Bell’s cruciate paralysis is questioned due to the absence of evidence of this somatotopy in studies carried out on primates and the small number of cases in which there is radiological evidence demonstrating the injury in the cervicomedullary transition. Dickman et al., in a literature review of 14 patients with suspected Bell’s cruciate paralysis, noted that of the 7 patients who underwent MRI, only 3 had lesions suggestive of bruising or swelling, while 4 showed normal MRI results. In our case, it was possible to locate the lesion in the cervicomedullary transition by the cervical spinal cord MRI.

Levi et al. proposed that Bell’s cruciate paralysis occurs because the fibers of the corticospinal tract are responsible mainly for the fine motor distal muscles, especially of the ULs, while the movement of the LLs is mediated by other independent motor pathways. In this case, however, the patient had more significant weakness in the ULs, which may correspond to both Bell’s cruciate paralysis and the classic centromedullary syndrome. The diagnosis was confirmed by MRI findings, identifying a signal change only in the anterior medullary region, in the cervicomedullary transition, with no apparent damage to other pathways. If the patient had only this lesion, and considering the initial presentation with grade II paresis in LLs, it can be assumed that the corticospinal tract also has a significant importance for the lower limb motor function, contrary to what is suggested by the theory of Levi et al. Therefore, this case report corroborates with the anatomical hypothesis of Bell: the fibers responsible for the movement of the upper limbs would cross higher and more superficially that the fibers of the lower limbs at the cervicomedullary transition.

**CONCLUSION**

The Bell’s cruciate paralysis is an uncommon syndrome and its physiopathology is not well understood. This case combines the MRI assessment with the clinical outcome corroborate with the Bell’s anatomical theory.

**REFERENCES**


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Case Report

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