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Short clinical case

Entrapment of the basilar artery within a clivus fracture: Case report and literature review

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ABSTRACT

A review of the literature revealed that basilar artery (BA) entrapment is a very rare (17 cases published) and severe pathological condition, which often leads to death. We report the case of a 72-year-old man who presented with a longitudinal clivus fracture associated with a basilar artery entrapment. This entrapment was responsible for a basilar artery dissection, which led to an ischemic stroke in the pons. The patient was managed with medical treatment, mainly to avoid a progression towards an ischemic stroke. It consisted of heparin therapy followed by antiplatelet therapy, which finally resulted in a successful outcome. In BA entrapment most of the patients who had a favorable outcome received antithrombotic therapy. This suggests that antithrombotic therapy might be useful in the first line treatment of post-traumatic BA entrapment.

1. Introduction

Clivus longitudinal fractures are a rare lesion after head trauma, occurring in 0.55% of patients undergoing a cranial CT scan after head injury [1,2]. Clivus fracture can be associated with a prolapse or an incarceration of the vertebro-basilar arteries within the fractured site, but this complication is rarely described. To our knowledge, 14 cases have been reported in the literature, with various management and outcome [3,4]. Here we present a case of basilar artery entrapment within a clival fracture, and discuss our management in the light of the literature.

2. Case report

A 72-year-old man had a head injury due to not wearing a helmet, after a public road accident on a bike.

Neurological examination on admission revealed a left hemiparesis, a complete left ophthalmoplegia, a trigeminal left nerve palsy, an abducens right nerve palsy and a dysarthria. His Coma Glasgow Scale was 13 (E4, V3, M6). A cerebrospinal fluid (CSF) rhinorrhea was also present. Hemodynamic parameters were stable except for a body temperature of 33.5 °C. The patient had no medical or surgical history and was not receiving treatment.

The initial head computed tomography (CT) scan revealed a longitudinal clivus fracture (Fig. 1.a), an occipital fracture under the right jugular foramen, a right styloid process fracture, and an extensive pneumocephalus. The CT angiogram revealed an entrapment of the basilar artery (BA) within the clival fracture (Fig. 1.b). A brain magnetic resonance imaging (MRI) demonstrated an ischemic infarction in the central and right pons (Fig. 1.c), and confirmed the entrapment of the BA. Finally, a digital substraction angiography (DSA) of the vertebrobasilar arteries showed a dissection of the BA, located in the clivus fracture (Fig. 1.d). We then discussed, during a multidisciplinary staff meeting, the best treatment for this type of ischemic stroke due to a BA entrapment within the clival fracture. Initially, we discussed both surgical or endovascular treatment of the BA entrapment, but the risk of these invasive treatments was considered to be too high. Then subsequently medical treatment was decided. Anticoagulation was introduced first in case an endovascular or surgical procedure was necessary. To avoid thrombus formation and occlusion of the penetrating vessels, an intravenous heparin therapy was administered at a curative dose (500IU/kg daily). The goal was an activated partial thromboplastin time between 2 and 3. This anticoagulation procedure was administrated during two days. As the patient remained stable, we then changed and started an anti-platelet therapy treatment, using acetylsalicylic acid at a dose of 75 mg. No additional stroke occurred. CSF rhinorrhea was managed by ten days of bed rest and

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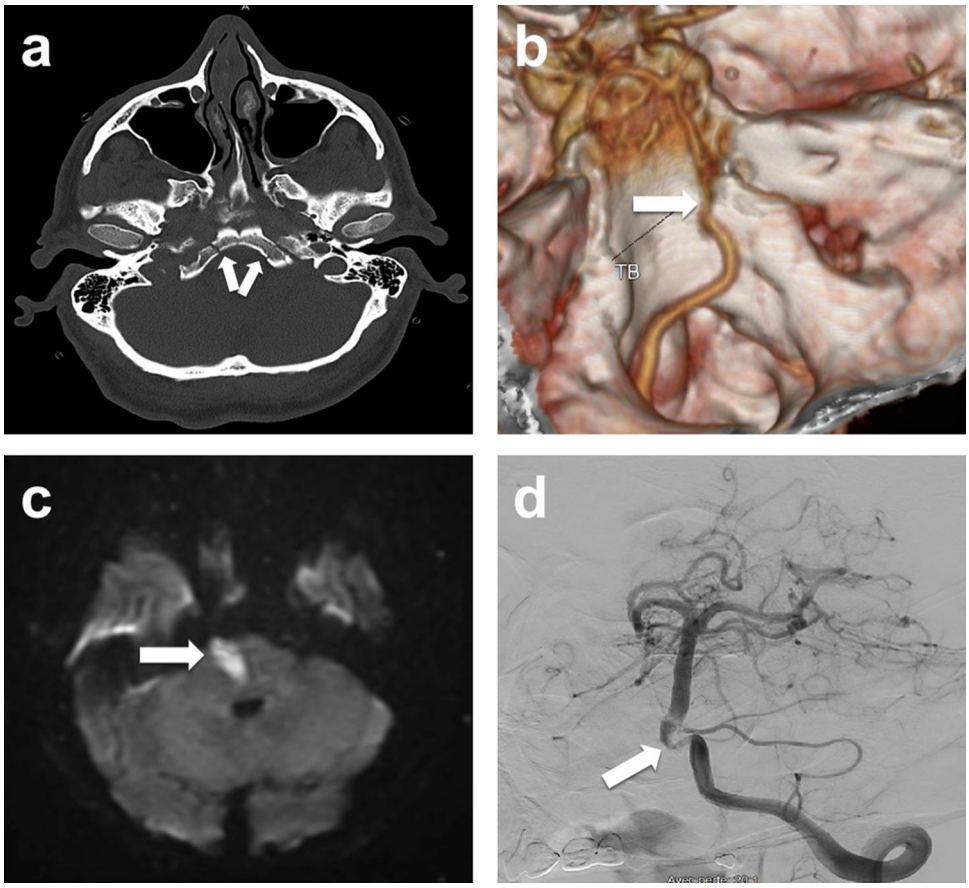

Fig. 1. Description of a basilar artery entrapment in a clivus fracture. (a): this bone window skull CT scan demonstrates a longitudinal clival fracture (Arrow); (b): the 3D CT angiogram reveals a narrowed BA which is incarcerated within the clivus fracture (Arrow); (c): MRI in diffusion sequence shows an infarction in the central and right pons (Arrow); (d): DSA of the VA-BA reveals a dissection of the BA caused by the entrapment (Arrow).

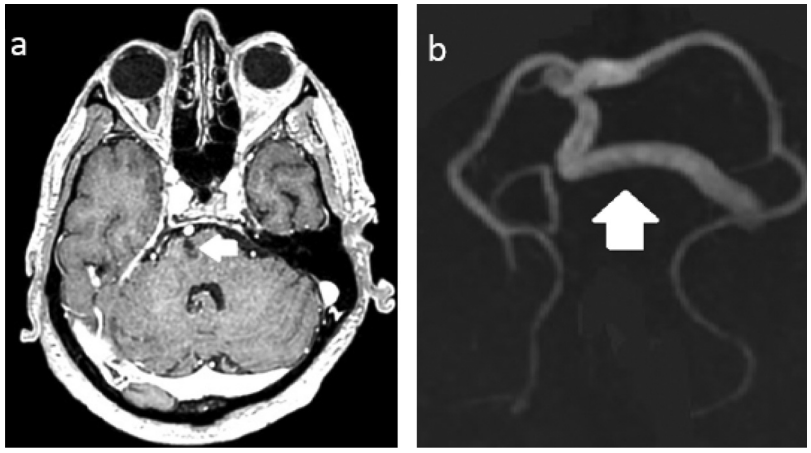

Fig. 2. Follow up MRI at 6 months. (a): MRI in T1 gadolinium sequence shows sequelae in the central and right pons (Arrow); (b): MRI in time of flight sequence shows a normal circulating flow in the basilar artery (Arrow).

spontaneously healed. Six months after the trauma, patients had a good outcome (mRS = 2), with only a trigeminal and a complete oculomotor left nerve palsy. MRI shows sequelae in the central and right pons (Fig. 2.a) and a flow circulating in the basilar trunk (Fig. 2.b).

3. Discussion

A clivus fracture is a rare type of lesion after a head trauma: it has been identified in only 17 patients (0.55%) among 3000 admitted for head trauma [1,2]. These fractures can be classified into three types: longitudinal (26%), transverse (14%) and oblique (60%) [1,2]. Among them, the longitudinal ones are associated with a high mortality (50%) or a poor neurological outcome (35%), mainly due to VA or BA injury or to direct brainstem trauma. Longitudinal clival fracture associated with a prolapse or an entrapment of VA or BA is an unusual entity. About 14 previous cases of traumatic basilar artery entrapment can be retrieved by searching the PubMed electronic database using the keyword “traumatic basilar artery entrapment” (Table 1). Described only in adult male patients, the GCS is most of

Table 1
Cases of Basilar Artery entrapment in a clivus fracture.

Authors (years)	Age/sex	Initial GCS,/15	Entrapped artery	Antithrombotic therapy	1-CSF Leakage 2-Brainstem infarct	1-Outcome 2-mRS
Loop et al., 1964 [3]	59/M	3	Basilar	No	1 - Yes 2 - Yes	1-Death on day 2-mRS = 6
Linderberg et al., 1966 [4]	42/M	15	Vertebral	No	1 - No 2 - Yes	1-Death day 14 2-mRS = 6
Sights et al., 1968 [5]	23/M	3	Basilar	No	1 - No 2 - Yes	1-Death day 35 2-mRS = 6
Shaw et al., 1972 [6]	59/M	3	Basilar	No	1–No 2 - Yes	1-Death day 3 2-mRS = 6
Anthony et al., 1987 [7]	70/M	3	Basilar	No	1–No 2–Yes	1-Death day 5 2-mRS = 6
Guha et al., 1989 [8]	27/M	3	Basilar	No	1 - No 2 - Yes	1-Vegetative 2-mRS = 5
Sato et al., 1990 [9]	80/M	3	Basilar	No	1 - No 2-Yes	1-Death day 1 2-mRS = 6
Taguchi et al., 2000., [10]	52/M	3	Basilar	Aspirin	1 - No 2 - Yes	1-Quadriparesis 2-mRS = 4
Sato et al., 2001., [11]	86/M	3	Basilar	No	1 - No 2 - Yes	1-Death day 4 2-mRS = 6
Bala et al., 2003., [12]	46/M	15	Basilar	Aspirin	1 - Yes 2 - Yes	1-Mild left hemiparesthesis 2-mRS = 2
Cho et al., 2008., [13]	54/M	8	Vertebral	No	1 - Yes 2 - No	1-Dependant 2-mRS = 4
Garcia et al., 2012., [14]	37/M	15	Basilar	3 weeks of Heparin followed by Aspirin	1 - No 2 - Yes	1-Mild left hemiparesis 2-mRS = 4
Yamamoto et al., 2015 [15]	62/M	15	Vertebral	No (subdural hematoma)	1 - No 2 - Yes	1-Slight disorientation 2-mRS = 1
Metayer et al., 2018	72/M	13	Basilar	2 days of Heparin followed by Aspirin	1 - Yes 2 - Yes	1-III and V nerve palsy 2-mRS = 2

the time equal to 3 [1,5–12]. In these cases, no specific treatment was performed, and the outcome was dramatic in all cases. Autopsy studies have demonstrated either a complete occlusion of the prolapsed artery within the fracture or a thrombosis of the proximal BA. Moreover, ischemic foci within the brainstem, mainly in the pons, was a consistent finding.

For the other patients, the majority of reported cases had an elevated GCS [2–4,13,14] except one who had a GCS of 8 [3]. In these cases, there were other skull fractures associated to the clivus fracture. Bala et al. [14] suggested that the associated fractures reduced the transmitted forces to the clival and brainstem region, which might explain the better outcome. Four cases have been treated with an antithrombotic agent: two received immediately an anti-platelet therapy (acetylsalicylic acid) and two received an anticoagulation therapy during the first days, then followed by an anti-platelet therapy. It appears to be safe, and might improve the outcome: in our literature review (Table 1), all the patients alive with an acceptable neurological outcome, except one, received antithrombotic therapy. We believe that it should be the first line treatment for these patients, as it prevents progressive thrombosis and distal embolism [4]. In our case we first chose to treat the patient with an anticoagulant in order to be able to reverse the treatment if an intracranial hemorrhage occurred, and then to administer an anti-platelet therapy. In no cases was surgery or endovascular treatment performed: if there is no major intracranial hemorrhage, it does not seem to be indicated.

4. Conclusion

BA entrapment in a clivus fracture is a rare pathological finding. Early identification is fundamental to start an antithrombotic treatment to avoid massive brainstem infarction, even if we acknowledge that there is no standard treatment because of the lack of data available. In the acute phase, it might be safe to treat the patient with heparin therapy and then to switch to an anti-platelet therapy. Additional research data are needed to improve the management of this rare injury.

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Disclosure of interest

The authors declare that they have no competing interest.

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