Case Report

Kernohan Woltman notch phenomenon caused by subdural chronic hematoma: Systematic review and an illustrative case

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ABSTRACT

Kernohan Woltman Notch Phenomenon (KWNP) is caused by a supratentorial lesion pressing the contralateral cerebral peduncle against the free edge of the tentorium of the cerebellum. It is manifested by neurological signs of ipsilateral localization; cerebral MRI is the most sensitive examination for KWNP. Our patient is a 50-year-old woman, operated in 2011 for aortic and mitral valve replacement by mechanical prosthesis, under oral anticoagulant, consults for headaches evolving for 20 days without any notion of head trauma with installation of a progressively worsening left hemibody deficit. Glasgow coma scale was 14 (E3 V5 M6) with left anisocoria 4mm left/2mm right with left hemiplegia. CT shows a chronic left hemispheric subdural hematoma 13.5mm thick with subfalcorial and ipsilateral temporal involvement of the deficit. The cardiovascular examination as well as the biological assessment was unremarkable. The patient was operated on with a total recovery in 12 days, the anticoagulant is resumed on day 20 postoperatively, with close monitoring. KWNP may contribute to misdiagnosis in patients with bilateral corticospinal tract lesions, and anticoagulation poses a problem in stopping and restarting treatment due to the risk of bleeding on one side and thrombosis on the other side.

1. Introduction

Kernohan-Woltman notch phenomenon (KWNP) is defined as compression of the cerebral peduncle against the tentorial edge caused by the displacement of the brain tissue at the ipsilateral side of the paradoxically supratentorial localized lesion which produces ipsilateral hemiplegia or hemiparesis [1]. Is usually seen in patients with brain tumors and severe head injuries [2] (see Fig. 1).

Since their original description in 1929 [3], few patients with Kernohan’s notch phenomenon associated with chronic subdural hematoma have been reported in the literature [4].

We report the case of Kernohan’s notch phenomenon in a patient with chronic subdural hematoma on anticoagulant treatment.

We conducted a systematic literature review to aggregate all previously reported KWNP. Finally, we discuss the management of this rare phenomenon at the light of the previously reported cases.

2. Materials and methods

2.1. Systematic review

The PubMed/Medline, Google Scholar, Cochrane library, clinicaltrials.gov, and clinicaltrialregister.eu databases were searched using the following search algorithm: “Kernohan-Woltman notch phenomenon” and “chronic subdural hematoma” taking into consideration all articles up to august 2021. All titles and abstracts were verified by two neurosurgeons (AL and SH) to exclude all non-pertinent studies. Articles reporting pediatric patients, patients with acute subdural hematoma, epidural hematoma and cerebral tumors were all excluded.

Studies involving animals or without available full text were also excluded. The references of the selected studies were subsequently searched to identify any additional related articles.
As though, there is no comprehensive clinical trial concerned with the incidence of KWNP, nevertheless, there is limited number of cases of KWNP secondary to CSH. We have done a literature review of all cases of KWNP including our case and found 12 cases. When the mechanism of Kernohan-Woltman notch phenomenon was considered, we conclude that remarkable brain atrophy was a facilitating factor in development of KWNP secondary to wide subdural hematoma and it was noticeable also in our case. The clinical evaluation is the gold standard in diagnosis of Kernohan-Woltman notch phenomenon.

However, some authors believe that the pathophysiology of KWNP involves the mechanism of cytotoxic edema for which diffusion weighted imaging (DWI) could be more helpful in the initial assessment of KWNP. It shows a hypersignal of the contralateral cerebral peduncle, which is an essential factor to analyze on the imaging and which allows to predict the clinical evolution of the patients. We noticed that the evolution of the patients with a hypersignal of the cerebral peduncles had a slower improvement than those who did not have, which is confirmed by the study of Itoyama and al. The signal change shown on MRI due to Kernohan’s notch phenomenon causing a permanent tissue damage in the crus cerebri, predicts persistent motor deficit. However, with the gradual onset of a chronic subdural hematoma, Kernohan’s notch phenomenon may develop with only transient compression of the crus cerebri. In this situation recovery is more complete than in those patients with signal changes in the crus cerebri identified by MRI.

5. Conclusions
Kernohan’s phenomenon is a rare false localizing sign, which can lead to diagnostic and clinical confusion. We have reviewed pathophysiology, neuroimaging features associated with this phenomenon due to subdural chronic hematoma and demonstrated that, whilst functional outcome is determined by the lesion of cerebral peduncule, motor function can be regained in most cases. Patients affected by KWNP should be counselled on the rehabilitation potential of the affected limbs, however, more data into the reversibility of KWNP can help to further understand rehabilitation potential.

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Table 1
Age varied between 42 and 88 years old with a mean age of 65 years old. A male predominance was noted 67% (8 males, 4 females). Brain CT scan was performed for 10 patients while brain MRI in 2 cases. 0.1 Burr hole in 7 cases, craniotomy in 3 cases, 2 burr holes in 1 case. Favorable development was observed in all patients but with variable duration.

| Author            | Age | Initial GCS | Pupils   | Presentation         | Surgery   | Findings of imaging                                                                 | Outcomes description                  | Outcomes |
|-------------------|-----|-------------|----------|----------------------|-----------|--------------------------------------------------------------------------------------|----------------------------------------|----------|
| Itoyama 1995 [5]  | 69  | NA          | NA       | Left-sided hemiparesis | BH        | Right cerebral peduncle: Deformity, no signal change                                  | Left hemiparesis significantly postoperatively | Improving |
| Yasuyuki 2002 [6] | M   | 8           | Right dilated pupil | Craniotomy | Left cerebral peduncle pressed against the free edge of the tentorium (          | Complete recovery in the next 25 days | Improving |
| Bhatoe 2005 [7]   | M   | 11          | Right dilated pupil | BH         | Right cerebral peduncle: T2: hyperintense                                         | Gradual recovery in 3 months           | Improving |
| Moon30 2006 [4]   | M   | 9           | BH       | No abnormalities at cerebral peduncle                                           | BH        | Complete recovery in the next 2 days                                                | Resolved |
| Moon30 2006 [4]   | M   | GCS 11      | Fixed and dilated right pupil | Mini craniotomy | - Mass effect over the brain parenchyma                                           | Complete recovery in the next 2 days | Partial weakness of third cranial nerve |
| Fareed 2007 [3]    | F   | GCS 9       | Right dilated pupil | BH         | Right cerebral peduncle: T1: hypointense; T2: hyperintense                        | All neurological symptoms immediately resolved | Resolved |
| Derakhshan 2009 [8]| M   | 76          | GCS 15   | Normal                | No surgery | No mass effect                                                                       |                                      | –        |
| Albayrak 2012 [1] | M   | 88          | GCS 14   | Right dilated pupil       | BH        | Narrowing at left cerebral peduncle, no signal changes                               | Complete recovery in early post-operative period | Resolved |
| Sasikala 2014 [9] | M   | 60          | Altered sensorium | Left dilated pupil | Hyperdense collection with layering over left fronto-temporo-parietal region with mass effect and midline shift | Complete recovery in the next 2 days | Resolved |
| Çabalar 2014 [10] | M   | 43          | Right dilated pupil | BH         | Left cerebral peduncle: T2: hyperintense                                          | Gradual recovery 3 months post-operatively, mRS 4 | Resolved |
| Yasuyuki 2002 [11]| M   | 8           | Right dilated pupil | Craniotomy | Hyperdense collection with layering over left fronto-temporo-parietal region with mass effect and midline shift | Complete recovery in the next 2 days | Resolved |
| Panikkath 2013 [12]| F   | Comatose    | Craniotomy | BH         | Shift of the midbrain to the left with hyperintensity in the midbrain in the region of compression | Recovered                           | Consciousness |
| Our patient 2020  | F   | 50          | Left dilated pupil | BH         | Recovery in 12 days resolved                                                       |                                      | Resolved |

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Abdelkouddous LAALIDI: writing the paper. Saad HMADA: Corresponding author. Abdelhakim LAKHDAR: Correcting the paper. Abdessamad NAJA: Correcting the paper.

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Saad HMADA, Abdelkouddous LAALIDI.

Declaration of competing interest
The authors declare having no conflicts of interest for this article.

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