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Pain

Evaluation of platybasia in patients with idiopathic trigeminal neuralgia

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Abstract

Background: Vascular compression of the trigeminal nerve is generally accepted as the primary source causing TN. To date, skull base bone deformity associated with ITN has been reported in only a number of case reports. The aim of the present study was to investigate one such skull base deformity, platybasia, in ITN patients in comparison with a randomized control population.

Methods: Basal angle values reflecting the development of platybasia were measured in 25 patients with ITN and compared with the measurements in 25 control subjects.

Results: Basal angle measured to investigate the existence of platybasia was found significantly wider in the ITN group (t = 3.90; P < .001), although platybasia was present in only 10 patients. Moreover, the average angle was also greater in the study group than in the control group, and the difference was statistically significant. Platybasia was found in 10 patients, whereas it was detected in only 2 control individuals; difference in platybasia incidence between the 2 groups was also statistically significant (χ^2 = 7.01; P < .01).

Conclusion: Our data demonstrated that platybasia affecting the bony walls of the posterior fossa may play an important role in the pathogenesis of vascular abnormalities causing TN.

Keywords: Platybasia; Skull base deformity; X-ray; Trigeminal neuralgia

1. Introduction

In spite of progress in both science and medicine, the cause of ITN has not been explained fully [7,15]. Vascular compression of the trigeminal nerve in the cerebellopontine angle is now generally accepted as the primary source causing TN [6,8]. However, in some cases, the evidence of neurovascular conflict could not be detected during microvascular decompression [5,8,10,14-16,19]. The reported percentages of cases without neurovascular conflict vary from 1.4% [10] to 28.5% [16]. Furthermore, TN associated with deformity at the skull base has been reported in only a number of cases [2,4,12,13,17]. In such cases, so-called crowding of the posterior fossa is thought to be the responsible cause of the neuralgia [17]. It is clear that further investigations are needed to assess other potential causes of TN.

During his experience in the treatment of TN over the last 30 years, the senior author (YK) observed skull base deformity in some of his ITN patients. Nevertheless, a literature search revealed no randomized controlled study focused on association of skull base deformity in ITN patients. Therefore, a prospective randomized controlled study was designed to investigate one such skull base deformity, platybasia, in ITN patients in comparison with a randomized control Turkish population.

2. Patients and methods

2.1. Patient population

The study group consisted of 25 patients (12 men, 13 women; age range, 49-84 years; mean age, 61.88) with ITN consecutively treated in our institute. Other characteristics

Abbreviations: B, basion; BA, basal angle; CT, computed tomography; DS, dorsum sellae; ITN, idiopathic trigeminal neuralgia; MRI, magnetic resonance imaging; N, nasion; O, opisthion; SDs, standard deviations; TN, trigeminal neuralgia; TS, tuberculum sellae.

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Table 1
Characteristics of the patient population

No.	Age/Sex	Location of TN	BA
1	55/F	LV2, 3	128
2	52/M	LV2, 3	126
3	61/M	LV2, 3	138
4	69/M	RV2, 3	143[a]
5	76/M	RV3	133
6	54/F	RV3	148[a]
7	70/F	LV2, 3	152[a]
8	65/F	LV2, 3	135
9	74/F	RV2, 3	146[a]
10	49/F	RV2, 3	135
11	52/F	LV3	142[a]
12	60/M	LV3	138
13	57/M	LV3	132
14	62/F	LV2, 3	142[a]
15	56/M	LV3	146[a]
16	51/M	LV3	141[a]
17	56/M	RV3	146[a]
18	82/F	RV1, 2, 3	142[a]
19	65/M	LV3	136
20	49/F	RV2	138
21	74/M	RV3	132
22	84/M	RV2, 3	140
23	68/F	LV3	135
24	55/F	RV2, 3	134
25	51/F	LV2	130

M indicates male; F, female; L, left; R, right.
[a] Platybasia.

of the patients are shown in Table 1. Patients with electric shock-like, paroxysmal pain without pathological findings on MRI or CT scans were accepted as having ITN. Lateral skull x-rays in which identification of TS, DS, B, O, and N was possible in the scans were evaluated prospectively. Because accurate x-ray techniques are essential for correct angles, true lateral skull x-rays were obtained, in which the central ray is perpendicular to the film and centered over the midportion of the skull [9].

Table 2
Summary of control individuals

No.	Age/Sex	BA
1	45/M	135
2	65/F	128
3	67/F	130
4	74/F	126
5	70/F	128
6	54/M	132
7	68/M	130
8	53/M	140
9	61/M	124
10	49/M	135
11	78/M	135
12	82/M	130
13	59/F	141[a]
14	68/F	143[a]
15	74/M	130
16	77/F	120
17	62/F	128
18	55/F	130
19	64/M	138
20	76/M	126
21	60/M	126
22	52/F	132
23	57/F	130
24	49/F	138
25	53/F	135

[a] Platybasia.

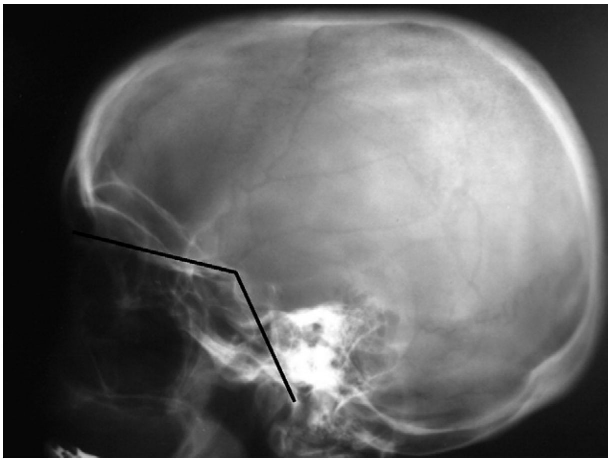

Fig. 1. The figure shows the normal BA measurement. Basal angle is formed by the N, TS, and B.

The control group consisted of 25 healthy Turkish individuals (12 men, 13 women; age range, 45-82 years; mean age, 62.88). Demographics of the control group are given in Table 2. Lateral cervical x-rays were evaluated in the control group as well.

2.2. Angle measurement

Welcher's BA measurements were performed to assess platybasia. This BA is formed by the N, TS, and B. It is obtained by tracing a line from the N to the TS and from there to the B. Any value exceeding 140° was accepted as platybasia [11,18] (Fig. 1).

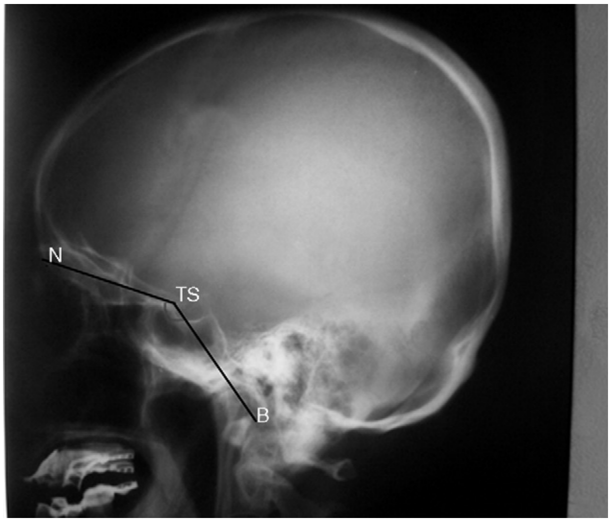

Fig. 2. The figure revealing the platybasia. The BA measurement is obtained by tracing a line from the N to the TS, and from there to the B. Any value exceeding 140° was accepted as platybasia.

Table 3
The results of patients and control individuals

Parameter	TN	Control	P
n	25	25	>.05
Mean age	61.88 ± 10.36	62.88 ± 10.32	>.05
Mean BA	138 ± 6.5	131 ± 5.6	<.001[a]
Platybasia no.	10	2	<.01[a]

[a] Significant.

2.3. Statistical analysis

The average values and SDs of all measurements were calculated. An independent Student *t* test was used to compare repeated measurements and χ^2 test to compare subjects and controls for qualitative measurements. Correlation coefficient was used for the evaluation of the relationship between the measured values. A *P* value less than .05 was considered statistically significant.

3. Results

The 2 groups were comparable with respect to age and sex ($P > .05$). Basal angle measured to investigate the existence of platybasia was found significantly wider in the ITN group ($t = 3.90$; $P < .001$), although platybasia was present in only 10 patients (Fig. 2). Moreover, the average angle was also greater in the study group than in the control group, and the difference was statistically significant. Platybasia was found in only 2 control individuals, whereas it was detected in 10 patients; the difference in platybasia incidence between the 2 groups was also statistically significant ($\chi^2 = 7.01$; $P < .01$) (Table 3). Results of statistical analysis are shown in Table 3.

4. Discussion

In 1857, Virchow coined the term "platybasia" to describe an abnormal flattening of the skull base, a defect which he attributed to abnormal bone development [4]. In general, platybasia is thought to be a trivial bone deformity and usually has no neurological consequences [4,11,17,18]. However, a more dramatic abnormality that Virchow termed "basilar impression" was occasionally seen in association with platybasia. In addition to flattening of the skull base, there was upward displacement of the basilar and condylar portions of the occipital bone. This may cause narrowing of the posterior fossa and may compress its contents, like vascular structures, resulting in various neurological symptoms [4,18].

Recently, Sindou et al [15] reported their anatomical observations made under the operating microscope in 576 patients with TN who were treated with microvascular decompression. Interestingly, they found that in 3.9% of the patients, the nerve was compressed between the pons and petrous bone because of the small size of the posterior fossa. In the final analysis, the authors concluded that neurovascular conflict is clearly one, but not the sole, etiology of TN.

Takada et al [17] reported a 59-year-old man with a history of TN associated with skull base deformity. During surgery, they found that the posterior fossa was extremely narrow; the trigeminal nerve was compressed and stretched by the tortuous vertebral artery and the anterior inferior cerebellar artery. Similarly, Hayes et al [4] presented a case with basilar impression resulting in TN. They hypothesized that the TN was related to compression of the nerve root by a branch of the basilar artery.

Various neurological deficits have been reported in patients with skull base deformity like basilar impression [1,4,17]. The most frequent symptom is headache, which is characteristically located in the neck and occipital region. Cranial nerve involvement has been described but seems to be relatively uncommon. Among them, the trigeminal nerve is commonly involved [4,17]. Caetano de Barros et al [1] reported that 30% to 50% of patients with basilar impression showed sensory symptoms of the trigeminal nerve. Gardner and Dohn [3] found a high incidence of basilar impression in elderly women with TN, whereas Obrador et al [13] stated that the presence of TN was less than 1% in 200 reported cases of basilar impression and other occipitocervical malformations.

Our study and control groups consisted of middle-aged individuals. As stated in the Patients and methods section, the mean ages were 61.88 and 62.88 years, respectively.

It seems that there is no consensus on the incidence of TN related to skull base deformities such as platybasia, nor is there any prospective study researching this association. Our results showed that the BA is wider in ITN patients when compared with the normal population. Moreover, the incidence of platybasia is higher in ITN patients than in those with no TN. Platybasia was found in 10 of 25 ITN patients, whereas it was detected in only 2 of 25 control individuals.

To the best of our knowledge, the present prospective randomized controlled study is the first research evaluating platybasia in ITN patients.

5. Conclusions

Our data demonstrated that platybasia affecting the bony walls of the posterior fossa may play a role in the pathogenesis of TN. Volumetric evaluation of the posterior fossa and cerebellopontine angle might be helpful in explaining the pathogenesis of ITN.

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Commentary

The authors reported an interesting study to demonstrate the correlation between platybasia and TN. They used the Welcher's basal angle measurements on the lateral view of plain skull x-ray to define the platybasia, the normal upper limit being 140°. They measured basal angle in 25 patients with TN and compared the data with those from 25 normal subjects. The results showed that the average basal angle was significantly wider in the TN group than that in the control group. Moreover, platybasia was found in 10 patients, whereas it was found in only 2 subjects from the control group. Obviously, the incidence of platybasia in the 2 groups was markedly different. Consequently, they concluded that platybasia affecting the bony wall of posterior fossa may play an important role in the pathogenesis of vascular abnormalities causing trigeminal neuralgia.

Basilar impression or platybasia is the most common craniovertebral junction abnormality, wherein normal relations between the skull base and cervical vertebra are altered. The terms basilar impression and platybasia are commonly used interchangeably; platybasia is solely restricted to a widening basal angle, the upper normal limit being 143° [3]. Although various neurological disturbances may arise, the reports regarding platybasia associated with trigeminal neuralgia are rare.

There are 2 methods to define the basilar impression on the lateral view of the skull x-ray: Chamberlain's and McGregor's. McGregor's line is the line drawn from the posterior end of the hard plate to the lowest portion of the occipital bone; normally, the tip of the odontoid process should not exceed 5 mm above the line. The accuracy of the measurement of the basal angle depends on the correct x-ray techniques to obtain a true lateral skull view. In this article, the quality of the lateral view in Fig. 1 was not as good as that in Fig. 2. On the other hand, if the authors used the other reference line, such as McGregor's line, to evaluate the platybasia and compared it with the present study, the conclusion might be more informative.

Since the introduction of CT and MRI imaging, the reference landmarks used to measure the basal angle became more clearly identifiable, and hence, the measuring results are more consistent and perhaps more reliable.

Based on the study of basal angle of normal Chinese subjects measured by standard MRI technique, the average basal angle is 121° ± 5.8° [2]. The angle is relatively smaller than that of normal subjects from the United States (129° ± 6°, from Koenigsberg et al [1]). The relatively smaller basal angle is presumed because of the habit of supine sleeping posture of Chinese people who have relatively wide face and flat posterior head.

It would be interesting to know whether evaluation of platybasia using MRI technique in patients with TN and in normal subjects might have the same conclusion as that of the present study.

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