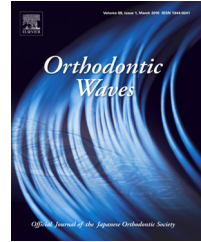




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Original article

Evaluation of prevalence and characteristics of ponticulus posticus among Japanese adults: A comparative study between CBCT imaging and lateral cephalogram

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ARTICLE INFO

Article history:

Received 28 December 2017

Received in revised form

31 March 2018

Accepted 3 April 2018

Available online xxx

Keywords:

Ponticulus posticus

CBCT

Cephalogram

Japanese

ABSTRACT

Purpose: Purpose of the study was to evaluate the prevalence and precise characteristics of ponticulus posticus (PP) among Japanese adults using CBCT, and to evaluate the accuracy of PP by using the lateral cephalogram.

Materials and methods: This retrospective study consisted of lateral cephalogram and CBCT scans of 204 subjects (46 Males and 158 Females) above the age of 20 years. Prevalence and characteristics of PP was assessed. Chi-square test was used for statistical analysis.

Results: 30 PP positive cases (14.7%) were defined by using CBCT. 12.7% subjects were assessed PP positive cases on lateral cephalogram. The accuracy of PP by using cephalogram was 0.89, sensitivity was 0.56 and specificity was 0.95. On CBCT assessment, there were 16 PP (7.8%) present on right side of Atlas whereas 23 PP (11.2%) were present on left side. Statistically significant difference was seen in the prevalence of left side PP. Among the 158 females 25 (15.8%) had PP whereas out of 46 males 5 (10.8%) had PP. No statistical significant differences were seen in gender and age groups.

Conclusion: PP is quite a common finding in Japanese adults. There were cases in which PP was not detected on lateral cephalogram compared with CBCT.

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<https://doi.org/10.1016/j.odw.2018.04.001>

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1. Introduction

Ponticulus posticus (PP), in Latin known as “Little posterior bridge”, is an anomaly seen on first cervical vertebra, Atlas. It is a bony bridge between the posterior portion of the superior articular process and the posterolateral portion of the superior margin of the posterior arch of the Atlas [1].

Ponticulus posticus has various synonyms which includes foramen sagittale, foramen atlantoideum posterior, Kimmerle's anomaly, foramen retroarticulare superior, canalis vertebralis, retroarticular vertebral artery ring, retroarticular canal, foramen arcuale, and retrocondylar vertebral artery [2-6]. Currently ponticulus posticus is the most accepted terminology.

Paraskevas et al. reported that prevalence of ponticulus is slightly higher in males compared with females and its prevalence is associated with age [7]. In contrast, Schilling et al. suggested slightly higher prevalence in females compared to males and the presence of PP is a condition independent of age [8].

The origin of PP is contentious. It was stated that PP could be congenital [9-11], a genetic trait [12], result of ossification due to ageing [2,13-15] or due to external mechanical factors [16].

The clinical importance of PP is controversial. Most of the patients with PP are symptom free [17]. Some of the studies have reported that PP may lead to tension-type headache, neurosensory hearing loss [5], vertigo, shoulder-arm and neck pain [18], vertebral artery compression, vertebrobasilar insufficiency, or vertebral artery dissection [17].

Presence of PP should be taken into consideration during the cervical spine immobilization with lateral mass screw fixation. It was reported that Proper identification of this anomaly should alert the surgeon to avoid using the ponticulus posticus as a starting point for a lateral mass screw in order to not injure the vertebral artery [6].

PP can be partial or complete, unilateral or bilateral. Although it can be assessed using lateral cephalogram [6,8,19,20], precise characteristics can only be evaluated by three dimensional study using computed tomography (CT) or cone beam computed tomography (CBCT) [20]. CBCT is currently used as one of the major investigating tool in dentistry and has many advantages over CT including lower radiation dose, less exposure time, lesser cost while providing outstanding image quality.

In keeping view of importance of identification of PP, this study was conducted to evaluate the prevalence and precise characteristics of PP among Japanese adults using CBCT, and to evaluate the accuracy of assessment of PP by using the lateral cephalogram.

2. Materials and methods

Ethical approval for this retrospective study was granted by the institutional review board, and patient consent was not required.

The study population was recruited from the Department of Orthodontics at Showa University Dental Hospital from March 1st 2014 to December 15th 2015. Out of 1130 cases, CBCT

and lateral cephalographic data of Japanese origin with age of 20 years and above were selected. Non-Japanese and syndrome cases were excluded.

Finally, data consisted of 204 subjects (46 Males and 158 Females) above the age of 20 years were assessed (Table 1). The age range of the subjects was 20-66 years. The mean chronologic age of the subjects was 31 years with a standard deviation of 11.1.

2.1. Radiographic imaging protocols

Lateral cephalogram was taken using Rotanode TM DRX-3724HD (Toshiba Medical Systems Co., Ltd.) with exposure parameters of 80kV, 320mA, 0.3ms.

CBCT was taken on KaVo 3D eXam (KaVo Dental GmbH, Biberach, Germany) with exposure parameters of 120kV, 5mA, 7s (pulse exposure). The FOV used in CBCT was 23 × 17 cm (height and diameter) with voxel size of 0.4mm and scan time of 17.8s.

2.2. Image observations

All the images were evaluated independently by two oral and maxillofacial radiologists. To avoid errors, all the images were re-evaluated individually by both the examiners on different days. In few cases, there were conflicts between the two examiners regarding the presence of PP and these cases were not considered for the study. Images for which both the examiner's affirmation regarding the presence of PP was there were taken into consideration for the study.

The presence of PP and its forms were assessed following criterion given by Hong et al. (Fig. 1) [21]: Type I (incomplete upper PP), a partial PP is noted as a bony spicule extending only from the superior articular facet; Type II (incomplete lower PP), a partial PP in which a bony spicule projects from the posterior arch of the Atlas toward the superior articular facet; Type III (incomplete both upper and lower PP), a bony spicule of a partial PP originates both from the superior articular facet and the posterior arch; and Type IV (complete PP), in which there is complete bridge formation between the posterior arch of the Atlas and the superior articular facet.

2.3. Lateral cephalogram

Classification of PP was done following anatomical features as follows; no PP, Type I (upper PP), Type II (lower PP), Type III (incomplete both upper and lower PP) and Type IV (complete

Table 1 – Age group vs. gender distribution.

Age group	Gender		Total
	F	M	
20-30	89	33	122
31-40	35	7	42
41-50	21	4	25
51-60	11	0	11
61-70	2	2	4
Total	158	46	204

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