The prevalence of posticus ponticus: retrospective analysis of radiographs from a chiropractic health center

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Abstract

Objective: The potential clinical significance of posticus ponticus is controversial because the majority of patients with this finding are asymptomatic. This study sought to estimate the prevalence of posticus ponticus in a chiropractic college clinic patient population.

Methods: From the archived records in the College Health Center, 304 lateral cervical spine radiographs were randomly selected and assessed by 2 independent examiners for the presence of posticus ponticus in any of its forms. The number of radiographs showing posticus ponticus, as well as analysis of agreement between examiners, was obtained.

Results: There were 60 radiographs where the examiners disagreed as to the presence or absence of posticus ponticus. These 60 were not counted for prevalence of posticus ponticus but were included in the κ analysis. Among the remaining 246 radiographs, 112 (46%) showed some type of posticus ponticus, whereas 132 (54%) did not show any posticus ponticus finding. Examiners A and B showed a κ score agreement of 0.72, and examiners C and D showed a κ score agreement of 0.51.

Discussion: The κ scores for both sets of examiners show acceptable agreement. Within this population, the finding of 45.9% prevalence of some type of posticus ponticus was determined. Compared with other studies, the prevalence of posticus ponticus was found to range between 9% and 72%.

Conclusion: Within this sample, 45.9% of radiographs showed some type of posticus ponticus.
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Introduction

Posticus ponticus is a clinical finding that can be detected on a lateral radiograph. It may present either as a partial or complete radiopaque bridge arching along

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the oblique portion of the atlantooccipital membrane from the posterior aspect of the superior lateral mass to the posterior arch of atlas.¹ Historically, posticus ponticus has been referred to by many names including , *ponticulus posticus*, *pons posticus*, *arcuate foramen*, *foramen arcuale*, *retroarticular vertebral artery ring*, *Kimmerle anomaly*, *foramen atlantoideum*, *foramen sagitale*, *canalis arteriae vertebralis*, and *retroarticular canal of the atlas*.¹⁻⁴ There is a significant amount of human research that has been done regarding posticus ponticus in many countries including Turkey, South Africa, Poland, India, New Zealand, France Greece, the United Kingdom, Australia, and the United States.⁴⁻²⁰ It is interesting to note that posticus ponticus research has also been conducted on nonhuman primates.² The results of the nonhuman primate research indicated a greater prevalence of posticus ponticus in nonhuman primates vs humans.² Some of the earliest writings on the subject of posticus ponticus are said to date back to Dutch anatomist Louis Bolk in 1906.³ In addition, posticus ponticus has been found on human skeletons dating back to the 12th century.¹¹

The potential clinical significance of posticus ponticus is controversial because the majority of patients with this finding are asymptomatic.¹ Some studies have determined that patient's with posticus ponticus have no greater chance of experiencing adverse effects from cervical adjustments related to the presence of a posticus ponticus.¹⁷ However, symptoms that may be associated with posticus ponticus include migraine, vertigo, diplopia, and neck pain.^{1,3} It has even been suggested that posticus ponticus may contribute to vertebral artery compression, vertebrobasilar insufficiency, or vertebral artery dissection.^{1,3} Therefore, some chiropractors may choose to alter their cervical adjusting technique or limit the amount of force introduced with the adjustment.

Over the years, researchers have investigated the unilateral vs bilateral occurrence of posticus ponticus,^{1,3,4,6-8,11,12,18} measured the size of the arcuate foramen formed by it,^{4,5,8,14} investigated the occurrence of complete vs incomplete ponticles,^{1,6-8,11,12,14,17,19} examined its progressive potential,^{1,14,18} correlated patient age or sex to its presence,^{1,3-5,8,11,14-16,18-19} examined genetic predisposition of posticus ponticus among family members,³ and explored the prevalence of posticus ponticus within specific human populations.^{1,3,4,8-16,18,20} The literature suggests that the prevalence of partial posticus ponticus can be up to 35% and that of complete posticus ponticus can be up to 15% in the white population.¹ This study sought to determine the prevalence of posticus ponticus within a sample of chiropractic health center patients.

Methods

This study was approved by the Sherman College of Chiropractic institutional review board. From archived records in the Sherman College of Chiropractic Health Center, 304 lateral cervical spine radiographs were randomly selected for assessment. Four independent examiners assessed the radiographs—2 (examiners A and B) for approximately one half of the 304 and the other 2 (examiners C and D) for the remainder of the films—for the presence of posticus ponticus in any of its forms (ie, complete, partial, upper, lower, unilateral, or bilateral) (Figs 1 and 2). A complete posticus ponticus is one continuous bridge that extends from the posterior aspect of the lateral mass to the anterior aspect of the posterior tubercle. A partial posticus ponticus is one that does not extend fully from the posterior lateral mass to the posterior tubercle. A partial upper posticus ponticus is one that extends partway from the posterior aspect of the lateral mass toward, but not touching, the posterior tubercle. A partial lower posticus ponticus is one that extends partway from the posterior tubercle toward, but not touching, the posterior aspect of the lateral mass. Each radiograph was reviewed by 2 blinded examiners who noted whether any type of posticus ponticus (ie, partial or complete) was present. The examiners who participated in this study were trained in advance to establish consistency regarding the presence of any degree of posticus ponticus. Despite this training, examiners still demonstrated disagreement when it came to the presence of partial posticus ponticus. Only radiographs where both examiners agreed regarding presence or absence of posticus ponticus in any of its forms (ie, complete, partial) were included in the calculation of prevalence,

Fig 1. Example of complete posticus ponticus. From Sherman College patient data bank with patient's permission.

Fig 2. Example of partial posticus ponticus. From Sherman College patient data bank with patient's permission.

whereas radiographs that had disagreement were excluded. Agreement between examiners was assessed with κ analysis in a 2×2 spreadsheet table. Agreement interpretation was as follows: less than 0 = none, 0.0 to 0.19 = poor, 0.20 to 0.39 = fair, 0.40 to 0.59 = moderate, 0.60 to 0.79 = substantial, and 0.80 to 1.00 = near perfect.²¹ A κ score of 0.40 or greater was considered as acceptable agreement.

Results

There were 60 radiographs where the examiners disagreed as to the presence or absence of posticus ponticus, and these were not included for prevalence of posticus ponticus calculations. These 60 radiographs were however included in the κ analysis for agreement between examiners. Among the remaining 244 radiographs, 112 (45.9%) showed some type of posticus ponticus, whereas 132 (54.0%) did not show any posticus ponticus finding. Each pair of examiners exhibited acceptable reliability as follows: examiners A and B showed a κ score agreement of 0.72, and examiners C and D showed a κ score agreement of 0.51.

Discussion

The κ scores for both sets of examiners showed acceptable agreement. Within this population, the finding of 45.9% prevalence of some type of posticus ponticus was determined. Among the references cited in our study,⁴⁻²⁰ the prevalence of posticus ponticus was found to range between 9% and 72%. Because this

study was limited to a chiropractic health center population, the findings may not be generalizable to the population at large.

During review of the radiographs, discrepancies arose when one examiner would identify a small development as sufficient enough to be labeled as a posticus ponticus whereas another examiner would not. One recommendation for future studies would be to identify in advance how much development constitutes a partial posticus ponticus. Slight variations in film quality may also have affected the examiners determination.

Limitations

Limitations of the study include the following: (a) because the study was limited to a chiropractic health center patient population, the findings are less easily generalized to the population at large; and (b) the study does not focus on one particular type of posticus ponticus, but rather focuses on the prevalence of a number of different types of posticus ponticus.

Conclusion

Within this sample, 45.9% showed some type of posticus ponticus. Future research should be conducted on other populations for comparison purposes with an awareness of the possible genetic predisposition for posticus ponticus as well as age, sex, and/or racial comparisons.

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No funding sources or conflicts of interest were reported for this study.

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