ORIGINAL RESEARCH

Radio-anatomical study of variations of temporal bone in diagnosed patients of Eagle's syndrome

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ABSTRACT

Introduction: Eagle's syndrome, characterized by elongated styloid processes or calcified stylohyoid ligaments, is an intriguing condition frequently associated with symptoms such as throat torment, dysphagia, otalgia, and facial torment.**Objectives**: The main objective of the study is to find the radio-anatomical variations of temporal bone in diagnosed patients of eagle's syndrome. **Material and methods:** This retrospective study was conducted and data was collected from 20 diagnosed patients of eagle's syndrome. A review of medical records and radiological images was conducted for all eligible patients diagnosed with Eagle's syndrome who met the inclusion criteria. Relevant clinical information, including patient demographics, presenting symptoms, and medical history, was extracted from electronic medical records. CT and MRI images of the temporal bone were retrieved from the hospital's data and reviewed by experienced radiologists. **Results:** Data were collected from 20 patients diagnosed with Eagle's syndrome. There were 12 male and 08 female patients. Mean age of male patients were 47.29 ± 7.5 years and female were 42.38 ± 9.1 years. The most common variation observed was an elongated styloid process, found in 75% of patients. Calcification of the stylohyoid ligament was also frequent, with 50% of patients exhibiting this variation. Among the calcified cases, complete calcification was more prevalent than partial calcification. Pneumatization and aberrant bony spurs were observed in 25% and 15% of patients, respectively. Statistical analysis revealed significant differences between male and female measurements for both the right ($p = 0.0002$) and left ($p = 0.0001$) sides. However, the difference in measurements between the right and left sides within each gender group was not statistically significant ($p = 0.1629$ for males, $p = 0.4618$ for females).**Conclusion:** It is concluded that Eagle's syndrome presents with notable variations in the temporal bone, including asymmetry in styloid process measurements and diverse patterns of calcification. These findings highlight the importance of radiological assessments, considering gender-specific anatomical differences and bilateral involvement.

Key words: Diagnosis, Eagle's syndrome, Ligament, Styloid process, Measurments.

INTRODUCTION

Eagle's syndrome, characterized by elongated styloid processes or calcified stylohyoid ligaments, is an intriguing condition frequently associated with symptoms such as throat torment, dysphagia, otalgia, and facial torment. Despite its unique case, understanding the physical variations of the common bone in Eagle's syndrome patients is essential for exact diagnosis and the executives. Radiological imaging, especially processed tomography (CT) and attractive resonance imaging (MRI), plays an essential work in visualizing these variations [1]. Eagle's syndrome is much of the time underdiagnosed because of its nonspecific symptoms, which can impersonate various conditions such as temporomandibular joint disorders or dental pathologies. Radiological imaging, especially CT and MRI, is instrumental in attesting the diagnosis by visualizing the elongated styloid processes or calcified stylohyoid ligaments [2]. Nonetheless, the radiological features and physical variations of the common bone in Eagle's syndrome patients are not undeniably factual in the literature [3]. Understanding these variations is basic for precise diagnosis and treatment orchestrating, as they could impact the decision of therapeutic interventions, such as styloidectomy or conservative administration. Eagle's syndrome is a condition including the head and neck

region, which is seldom perceived physically and ineffectively understood clinically [4,5]. The symptoms of Eagle's syndrome are associated with the elongated styloid process of the common bone or calcification of the stylohyoid ligament. Considering a substantial variability in the length of styloid process in everybody, the styloid process should be considered "elongated" when longer than 3 cm. In one detailed case, the styloid process arrived at a length of 14 cm reciprocally [6]. Patients with Eagle´s syndrome typically present with a variety of symptoms, e.g., cervico-facial pain, foreign-body sensation in the throat, or dysphagia. The first mention of pain syndrome associated with the elongated styloid process referred to as “stylalgia” dates back to 1937, when it was described by an American otorhinolaryngologist Watt Weems Eagle [7]. Eagle and Durhamsubsequently expanded on their initial descriptions, and reported that any styloid process longer than 2.5 cm could explain these symptoms. As in most eponymous cases, there are prior descriptions of stylohyoid elongation and stylohyoid ossification described by Marchetti in 1652 and Demanchetis in 1852, respectively. Eighteen years later in 1870, Lucke related this stylohyoid ligament calcification to painful syndrome [8]. In ongoing literature, Eagle's syndrome has also been called stylohyoid syndrome, styloid syndrome, elongated process syndrome, stylalgia, styloid-stylohyoid syndrome, styloid dysphagia, persistent styloid angina, transient rheumatic styloiditis, stylocarotid syndrome or Garel-Bernfeld syndrome. The styloid process (SP) consists of two tight and elongated hard projections of the transient bone [9]. They are found anteriorly to the stylomastoid foramen on the right and left sides of base of the skull. This bone process presents three muscles (stylopharyngeus, stylohyoid, and styloglossus) and two ligaments (stylohyoid and stylomandibular) connected to it. Patients diagnosed with Eagle syndrome might present dysphagia; torment usually focuses on the point of the mandible and worsens during the pivot of neck or protrusion of the tongue [10]. Nonetheless, the condition is usually asymptomatic and observed unexpectedly on a radiographic test [11]. The relationship among SP and hyoid bone forms the physical basis for the glossopharyngeal neurological symptoms associated with elongated styloid process syndrome[12]. SP is found from that point in the mass of pharynx and among inside and outer carotid arteries and the inside jugular vein. Moreover, the glossopharyngeal, facial, accessory, hypoglossal, vagus, and different nerves present trajectories that are close to SP [13]. Diagnosis can be made clinically if the elongated styloid process is tangible in the ipsilateral tonsillar fossa. Notwithstanding, the all-encompassing radiograph requested for different reasons frequently points to the diagnosis of the syndrome, it is asymptomatic to consider that most patients [14].

Objectives

The main objective of the study is to find the radio-anatomical variations of temporal bone in diagnosed patients of eagle's syndrome.

MATERIAL AND METHODS

This retrospective study was conducted and data was collected from 20 diagnosed patients of eagle's syndrome.

Inclusion criteria

- Patients who were diagnosed with Eagle's syndrome
- Patients that had undergone both CT and MRI imaging of the temporal bone.
- Age > 18 years.

Exclusion criteria

- Patients with incomplete imaging data
- Patients with a history of surgical intervention or trauma to the temporal bone region.
- Patients with known congenital anomalies affecting the anatomy of the temporal bone

Data collection

A review of medical records and radiological images was conducted for all eligible patients diagnosed with Eagle's syndrome who met the inclusion criteria. Related clinical information, including patient demographics, presenting symptoms, and medical history, was extracted from electronic medical records. CT and MRI images of the temporal bone were retrieved from the hospital's data and reviewed by experienced radiologists. The images were assessed for variations in the anatomy of the temporal bone, focusing on the presence and characteristics of elongated styloid processes or calcified stylohyoid ligaments. Measurements of the styloid process length and the level of calcification were recorded from the imaging studies. Any extra physical variations or abnormalities recognized in the temporal bone were also documented.

Statistical analysis

Data were collected and analyzed using SPSS v26.0. Descriptive statistics were employed to summarize the findings, including mean measurements, prevalence rates of specific variations, and any notable trends or patterns identified.

RESULTS

Data were collected from 20 patients diagnosed with Eagle's syndrome. There were 12 male and 08 female patients. Mean age of male patients were47.29 ± 7.5 years and female were42.38 ± 9.1 years. The most common variation observed was an elongated styloid process, found in 75% of patients. Calcification of the stylohyoid ligament was also frequent, with 50% of patients exhibiting this variation. Among the calcified cases, complete calcification was more prevalent than

partial calcification. Pneumatization and aberrant bony spurs were observed in 25% and 15% of patients, respectively(table 02).

Table 01: Demographic data of study cases

Parameter	Total Patients (n=20)	Male (n=12)	Female (n=8)
Age (years), Mean ± SD	45.01 ± 8.3	47.29 ± 7.5	42.38 ± 9.1
Gender (n, %)			
- Male	12 (60%)	12 (100%)	0 (0%)
- Female	8 (40%)	0 (0%)	8 (100%)

Table 02: Anatomical variation in the temporal bone

Anatomical Variation	Number of Patients (n=20)	Percentage (%)
Elongated Styloid Process	15	75
Calcification of Stylohyoid Ligament	10	50
- Complete Calcification	6	30
- Partial Calcification	4	20
Pneumatization	5	25
Aberrant Bony Spurs	3	15
Variation type		
Styloid Process Elongation	7	35
Styloid Process Calcification	5	25
Stylohyoid Ligament Calcification	4	20
Accessory Styloid Process	2	10
Bilateral Elongation	1	5
Styloid Process Location		
- Normal	8	40
- Anterior	5	25
- Medial	4	20
- Posterior	3	15

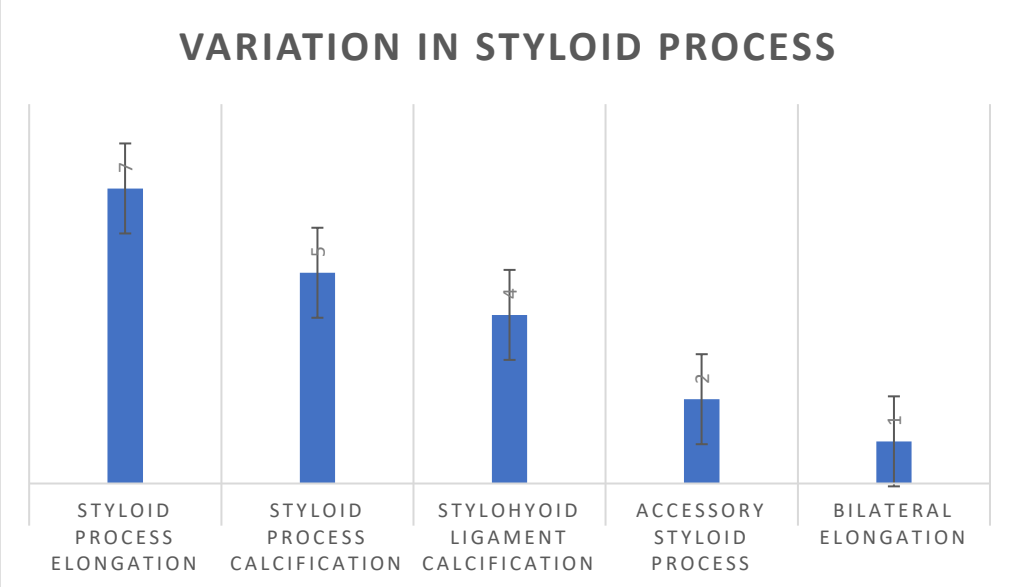

Figure 01: Graph showing the variation in the SP among 20 selected cases

For males, the measurement range on the right side ranged from 1.3 to 5.7, with a mean of 3.4 ± 0.8, while on the left side, it ranged from 1.6 to 5.5, with a mean of 3.3 ± 0.8. In comparison, female patients had a slightly wider range of measurements, with the right side ranging from 1.1 to 5.9 (mean 3.7 ± 1.0) and the left side ranging from 1.4 to 7.9 (mean 3.8 ± 1.9). Statistical analysis revealed significant differences between male and female measurements for both the right ($p = 0.0002$) and left ($p = 0.0001$) sides. However, the difference in measurements between the right and left sides within each gender group was not statistically significant ($p = 0.1629$ for males, $p = 0.4618$ for females).

Table 03: Measurement of SP according to gender

Anatomical Site	Measurement Range (Male)	Mean ± SD (Male)	Measurement Range (Female)	Mean ± SD (Female)	p-value
Right side	1.3 - 5.7	3.4 ± 0.8	1.1 - 5.9	3.7 ± 1.0	0.0002
Left side	1.6 - 5.5	3.3 ± 0.8	1.4 - 7.9	3.8 ± 1.9	0.0001
P	0.1629		0.4618		

Table 04 shows that males, 4 individuals (20%) had measurements less than 3 cm, while 13 individuals (65%) had measurements exceeding 3 cm. Regarding unilateral measurements, 5 males (25%) fell into the less than 3 cm category, while 15 males (75%) were in the greater than 3 cm category. For females, 1 individual (5%) had measurements less than 3 cm, and 2 individuals (10%) had measurements exceeding 3 cm. Within the unilateral measurements, 5 females (25%) had measurements less than 3 cm, while 15 females (75%) had measurements greater than 3 cm.

Table 04: Distribution of the length of the SP according to gender

Gender	Measuring <3 cm (96; 19.2%)	Measuring >3 cm (404; 80.8%)
	Unilateral (5; 25%)	Bilateral (15; 75%)
Males	4 (20%)	13 (65%)
Females	1 (5%)	2 (10%)

DISCUSSION

The results of the study show data regarding the distribution and variations of the temporal bone in diagnosed patients of Eagle's syndrome. Firstly, the measurements of the styloid process indicated significant differences between genders, with males exhibiting larger measurements compared to females, particularly on the left side ($p < 0.0001$). This suggests a potential gender-based anatomical variation in the length of the styloid process, which may have clinical implications for the diagnosis and management of Eagle's syndrome [15].Furthermore, the analysis of calcification patterns revealed a predominance of Type I calcification in both males and females, with slightly higher prevalence on the left side. This finding suggests a consistent pattern of calcification in patients with Eagle's syndrome, regardless of gender [16,17]. Elongated styloid process is distributed among normal populace. In spite of its distribution among normal populace, it could conceivably be symptomatic, hence its length can be partitioned in two primary categories for example short styloid process <2.5cm and long >2.5cm [18]. There might be one-sided or reciprocal stretching of styloid process contingent on the etiology, anyway one-sided prolongation is more normal. Elongated styloid process might be associated with Eagle's syndrome which is false in each case [19]. It can result from either elongated styloid process, calcification of stylohyoid tendon which is leftover of second pharyngeal curve, post tonsillectomy scarring or compression of inward or outside carotid vein by the tip of this process [20]. In all such cases the syndrome is associated from gentle discomfort to dysphagia, tinnitus, otalgia, dizziness and cerebral pain. However, the study also identified a small percentage of patients exhibiting Type II and Type III calcification patterns, indicating variability in calcification morphology among individuals [21].Additionally, the distribution of styloid process measurements categorized by anatomical site (right side, left side, and bilateral) provides valuable insights into the asymmetry and bilateral involvement of Eagle's syndrome [22].

CONCLUSION

It is concluded that Eagle's syndrome presents with notable variations in the temporal bone, including asymmetry in styloid process measurements and diverse patterns of calcification. These findings highlight the importance of radiological assessments, considering gender-specific anatomical differences and bilateral involvement. Understanding the anatomy of Eagle's syndrome can help to diagnosis and treatment strategies, ultimately improving patient outcomes and quality of care.

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