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Variations of the digastric muscle in children: Magnetic resonance imaging evaluation

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Abstract

Objective: The digastric muscle is an important component of the suprahyoid region and may demonstrate various morphological variations, particularly in its anterior belly. Data regarding digastric muscle morphology in the pediatric population based on magnetic resonance imaging (MRI) remains limited. This study aimed to evaluate digastric muscle thickness and anatomical variations in children using MRI.

Materials and Methods: In this retrospective cross-sectional study, head and neck MRI scans of 30 pediatric patients (mean age 12±2.3 years) without cervical pathology were analyzed. Thickness of the anterior and posterior bellies of the digastric muscle was measured bilaterally on axial images. Morphology and symmetry were evaluated on coronal and sagittal planes. Variations were classified as accessory muscle slips, double anterior belly, or asymmetric thickness. Side-to-side comparisons were performed using paired t-tests.

Results: No significant difference was observed between right and left anterior belly thickness (4.2±0.6 mm vs 4.1±0.5 mm; p=0.32) or posterior belly thickness (3.8±0.5 mm vs 3.9±0.6 mm; p=0.28). Digastric muscle variations were identified in 9 patients (30%). The most frequent variation was asymmetric thickness (16.7%), followed by accessory muscle slips (10%) and double anterior belly (3.3%). Most variations were localized in the anterior belly.

Conclusions: The digastric muscle in children demonstrates substantial bilateral symmetry on MRI. Variations are predominantly located in the anterior belly and can be reliably identified with multiplanar MRI evaluation. Awareness of normal digastric muscle variants is important in pediatric head and neck imaging to avoid misinterpretation of submental lesions.

Keywords: Digastric muscle, Pediatrics, Magnetic resonance imaging, Anatomical variation.

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Introduction

The digastric muscle is an important anatomical structure of the suprahyoid region, forming a functional connection between the mandible, hyoid bone, and temporal bone. It consists of anterior and posterior bellies connected by an intermediate tendon and originates from two distinct pharyngeal arches: the anterior belly from the first arch and the posterior belly from the second arch. This dual embryological origin is considered the main factor underlying its morphological variability and predisposition to anatomical variations (1,2).

In addition to its role in mandibular depression, swallowing, and phonation, the digastric muscle serves as a key surgical landmark in the submental and submandibular regions. It contributes to the boundaries of the submental and submandibular triangles and is widely used as a reliable anatomical reference in head and neck surgery (2,3).

Digastric muscle variations have been extensively described in cadaver studies, with numerous different variations reported (4,5). Although they are generally asymptomatic, these variants can mimic pathological masses in the submental region and cause diagnostic confusion on imaging (2,6).

Magnetic resonance imaging (MRI), with its high soft-tissue contrast and multiplanar capability, is particularly suitable for evaluating submental musculature. The anterior belly morphology can be reliably assessed on coronal and axial planes, while sagittal images help confirm muscle continuity and fiber orientation (7).

However, most available data on digastric muscle morphology derive from adult populations. Imaging-based studies in the pediatric age group remain limited. Because craniofacial muscle development is dynamic during childhood, morphometric parameters may differ from those of adults (4,8,9).

In pediatric otolaryngology practice, knowledge of normal digastric muscle variants is essential in the differential diagnosis of submental masses, infections, and congenital neck lesions. Accessory slips or asymmetric muscle thickness may mimic pathological lesions on imaging (2,6,10).

Therefore, this study aimed to evaluate digastric muscle thickness, symmetry, and variation types in pediatric patients using MRI.

Materials and methods

Study population

This retrospective cross-sectional study was approved by the Van Yuzuncu Yil University Non-Interventional Clinical Research Ethics Committee (date: 10.05.2024, and no: 2024/05-09). Patient files meeting the study criteria were reviewed. Patients who applied to our hospital for any reason were included based on age, gender, and MRI scans.

The study evaluated 30 pediatric patients (18 males, 12 females) with an average age of 12 years. The patients included in the study had no history of congenital anomalies, neuromuscular diseases, trauma, or surgery in the head and neck region.

MRI protocol

MRI was performed using a Siemens Aera Magnetom MRI device. The sagittal, axial, and coronal planes were examined simultaneously, allowing for a three-dimensional assessment of the morphological continuity and variation characteristics of the digastric muscle. This approach is consistent with previously described MRI-based evaluations. (7). Multiplanar analysis allowed a comprehensive assessment of the digastric muscle morphology.

Morphometric analysis

Anterior and posterior belly thicknesses were measured bilaterally on axial images. Coronal images were used to assess symmetry, and sagittal images were used to evaluate muscle continuity and morphology (Figure 1).

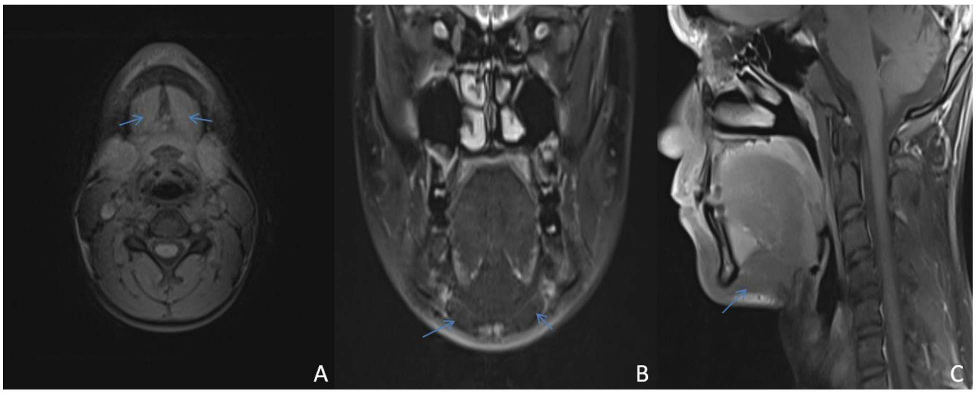

Figure 1: Multiplanar MRI evaluation of the digastric muscle: (A) Axial image demonstrating anterior digastric bellies (arrows), (B) Coronal image confirming bilateral symmetry and morphology (arrows), (C) Sagittal image showing normal anterior belly course and insertion (arrow).

Classification of variations

Digastric muscle variations were categorized as: accessory muscle slips, double anterior belly, asymmetric thickness. This classification was based on established morphological descriptions of digastric muscle variants (4).

Statistical analysis

Data were analyzed using SPSS (version 22.0; IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequency and percentage. The normality of continuous variables was assessed using the Shapiro–Wilk test. Since the measurements followed a normal distribution, paired t-tests were used to compare right and left digastric muscle thickness measurements within the same patient. Differences between male and female patients were evaluated using the independent samples t-test. The relationship between age and digastric muscle thickness was evaluated using Spearman correlation analysis. A p-value <0.05 was considered statistically significant.

Results

Thirty pediatric patients (mean age 12±2.3 years) were analyzed; 18 (60%) were male, and 12 (40%) were female (Table 1).

Table 1: Demographic characteristics and digastric muscle thickness

Variable	**Value**
Age (years)	12±2.3
Sex (M/F)	18 / 12
Number of patients	30

Right and left anterior belly thicknesses were similar between sides (4.2±0.6 mm vs 4.1±0.5 mm). Posterior belly thickness measurements were also comparable between sides (3.8±0.5 mm vs 3.9±0.6 mm). Paired t-test analysis demonstrated no statistically significant difference between right and left muscle thickness measurements (p>0.05) (Table 2).

Table 2: Comparison of right and left digastric muscle thickness

Region	**Right (mm)**	**Left (mm)**	**p-value**
Anterior belly	4.2±0.6	4.1±0.5	0.32
Posterior belly	3.8±0.5	3.9±0.6	0.28

Paired t-test was used.

Digastric muscle variations were detected in 9 patients (30%). The most frequent variation was asymmetric thickness (5 patients, 16.7%), followed by accessory slips (3 patients, 10%) and double anterior belly (1 patient, 3.3%). Most variations involved the anterior belly (Table 3).

Table 3: Types of digastric muscle variations

Variation type	**n**	**%**
Asymmetric thickness	5	16.7
Accessory muscle slips	3	10.0
Double anterior belly	1	3.3

Sex-based comparisons showed no statistically significant difference between male and female patients regarding digastric muscle thickness measurements (p>0.05) (Table 4).
Correlation analysis between patient age and digastric muscle thickness did not demonstrate a statistically significant relationship (p>0.05).

Table 4: Comparison of digastric muscle thickness between male and female patients

Variable	Male (n=18)	Female (n=12)	p-value
Anterior belly	4.25±0.29	4.14±0.27	0.31
Posterior belly	3.85±0.19	3.88±0.21	0.47

Independent samples t-test was used.

Discussion

This study evaluated digastric muscle morphology and variations in a pediatric population using MRI. The findings demonstrate that the digastric muscle exhibits substantial bilateral symmetry during childhood and that variations predominantly involve the anterior belly.

The absence of significant right-left thickness differences suggests that bilateral morphological symmetry is established early in development. Despite the dual embryological origin of the digastric muscle, normal development is expected to maintain symmetrical morphology (1,2).

The prevalence of digastric muscle variation in this study was 30%. Previous literature reports variation rates of approximately 15–20% in the general population (1,4). However, these estimates are largely derived from cadaveric adult studies, and imaging studies may demonstrate different detection rates (1). Although pediatric imaging data are limited, the present findings suggest that variation frequency in children may be comparable to that reported in adults.

The most frequent variations observed were asymmetric thickness and accessory slips, both predominantly located in the anterior belly. Previous anatomical studies similarly report that digastric muscle variations mainly affect the anterior belly in the form of accessory or multiple slips (4,5). This predominance is explained by the first pharyngeal arch origin and shared embryological development with the mylohyoid muscle (1,9).

Clinically, digastric muscle variations are highly relevant because accessory slips or asymmetric muscle enlargement may mimic lymph nodes or soft-tissue masses in the submental region. Recognition of normal variants is therefore essential in head-neck radiology and otolaryngologic practice to avoid misdiagnosis and unnecessary intervention (2,6).

The use of multiplanar MRI in this study allowed reliable identification and classification of variations. MRI provides excellent soft-tissue contrast and multiplanar visualization, making it well suited for evaluating suprahyoid muscle morphology (7).

Although a weak trend toward increasing muscle thickness with age was observed, the correlation analysis did not reach statistical significance, likely due to the limited sample size. Craniofacial muscles are known to undergo volumetric changes with growth (2,10). The lack of statistical significance may be related to the limited sample size.

The predominance of anterior belly variations observed in this study is consistent with previous reports that describe the anterior belly as the most variable component of the digastric muscle (4, 5).

Studies conducted on cadavers have reported variable frequencies of digastric muscle variations, and some studies suggest that accessory anterior abdominal muscles may be present in a significant proportion of individuals (2,11). However, radiological studies generally report lower detection rates; this may be related to the limited spatial resolution of imaging methods or the small size of accessory muscle bundles (4,5).

Clinically, recognition of these anatomical variants is important because accessory digastric muscle bundles or asymmetric muscle morphology may mimic pathological lesions such as submental lymphadenopathy or soft tissue masses. Being aware of these normal anatomical variations can help prevent diagnostic confusion in head and neck imaging and reduce unnecessary diagnostic procedures (5,12).

Magnetic resonance imaging, providing excellent soft tissue contrast and multiplanar imaging, is a reliable method for evaluating suprahyoid muscle morphology. Therefore, MRI-based morphometric studies may contribute to a better understanding of normal anatomical variation and its clinical implications in pediatric patients (5,8,13).

Although MRI measurements are more effective in demonstrating the anterior belly of the digastric muscle, it should be kept in mind that they may vary with different imaging protocols.

In addition, morphometric measurements were performed on routine clinical MRI scans rather than dedicated high-resolution anatomical sequences. Variations in slice thickness, partial volume effects, and differences in head positioning may have introduced measurement variability. Small differences in section plane orientation between axial, coronal, and sagittal reconstructions could also affect the perceived thickness and morphology of the digastric muscle. However, evaluation of pathology-free pediatric MRI scans using multiplanar analysis represents a strength.

Limitations

This study has several limitations. First, the sample size was relatively small and derived from a single center, which may limit the generalizability of the findings. Second, the retrospective design prevented stratification according to developmental stage or pubertal status, which may influence muscle morphology in the pediatric population.

Conclusions

The digastric muscle in children demonstrates substantial bilateral symmetry on MRI. Variations occur in approximately one-third of cases and predominantly involve the anterior belly. Recognition of normal digastric muscle variants is important in pediatric head and neck imaging to avoid misinterpretation of submental lesions and to support accurate surgical planning. Larger pediatric MRI studies are needed to establish age-specific morphometric reference values.

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Data availability: The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.
Contributions:
Research concept and design: AY
Data analysis and interpretation: AY
Collection and/or assembly of data: AY
Writing the article: AY
Critical revision of the article: AY
Final approval of the article: AY
All authors read and approved the final version of the manuscript.

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