

# Scapulohumeral Spaces: Concordance and Proposal for *Terminologia Anatomica*

Espacios Escapulohumerales: Concordancia y Propuesta a la *Terminologia Anatomica*

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**SUMMARY:** The updating of anatomical terms is essential to facilitate teaching and learning as well as international communication through publications and presentations at scientific events. In the posterior wall of the axilla, the teres major, teres minor and triceps brachii muscles form three spaces through which neurovascular structures of clinical significance run. The current study seeks to define and propose terms for these spaces which have been omitted by *Terminologia Anatomica*. The definition of the Latin term 'Spatium' was investigated using A Latin Dictionary, while the term 'Espacio' was analyzed using Diccionario panhispánico de términos médicos (Real Academia Nacional de Medicina de España, 2023), as well as the lexemes of the words 'scapula' and 'humerus', for which the Diccionario Médico-Biológico, Histórico y Etimológico de la Universidad de Salamanca was consulted. The presence of the term 'Spatium' in the *Terminologia Anatomica* was also investigated. Finally, 10 anatomy textbooks in Spanish were reviewed to identify the terms used for these spaces. In reviewing the latest edition of *Terminologia Anatomica*, it was found that the term 'Spatium' appears 25 times in different chapters and it was evident that no terms for scapulohumeral spaces appear in the chapters on upper limb structures. Moreover, in 100 % of the anatomy textbooks reviewed, at least one term is used to describe the scapulohumeral spaces. We believe that the proposed terms: 'Spatium humerotricipitale', 'Spatium scapulotricipitale' and 'Spatium teretripitale' more accurately describe both the location and their association with the bone/muscle structures that form them. We therefore suggest that these terms be revised for inclusion in future editions of *Terminologia Anatomica*.

**KEY WORDS:** Scapulohumeral spaces; *Terminologia Anatomica*; Latin.

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## INTRODUCTION

In the study, teaching and research of human morphology, special terms are used to describe and define anatomical structures. In 1989, the International Federation of Associations of Anatomists published the *Terminologia Anatomica*, which is in Latin and from which translations into the vernacular languages are supposed to be made (Chatain, 1975). Furthermore, it was established that the names of the structures must be informative, i.e. it is necessary to eliminate eponyms and homonyms in order to avoid confusion. Finally, structures located in the same anatomical regions should be named in a harmonious manner (Federative International Committee on Anatomical Terminologies, 1998; Vásquez & del Sol, 2015).

On the posterior wall of the axilla, at the scapular origin, the teres minor and teres major muscles make contact; further towards the side, the two muscles progressively move away from each other, because their humeral insertions are separated by the total width of the humerus. They thus form the two sides of a triangular scapulohumeral space, whose base is made up of the surgical neck of the humerus while the apex is formed with the lateral margin of the scapula (Rouvière & Delmas, 2005). This triangular space is divided into two secondary spaces by the tendon of the long head of the triceps brachii muscle which crosses it, thus forming the 'scapulotricipital space', through which the scapular circumflex artery runs, and then passes along the posterior

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face of the scapula, forming an anastomosis with the suprascapular artery, and the 'humerotricipital space'; it then gives way to the axillary nerve accompanied by the posterior humeral circumflex artery and veins (Testut & Latarjet, 1969). Below the teres major muscle, the 'tricipital space' is formed between the long head of the triceps brachii (medially) and the diaphysis of the humerus (laterally), through which the radial nerve and the deep brachial artery pass (Fig. 1) (Pró, 2014; Latarjet & Ruiz Liard, 2019).

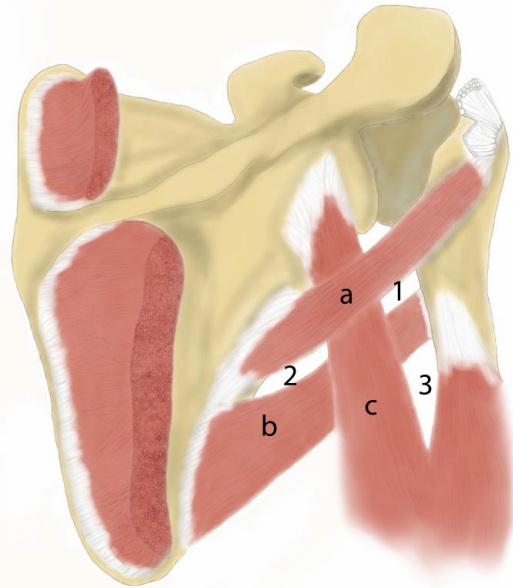


Fig. 1. Scapulohumeral spaces. 1. Humerotricipital space; 2. Scapulotricipital space; 3. Teretripital space; a. Teres minor muscle; b. Teres major muscle; c. Long head of the triceps brachii muscle.

It is important to consider these spaces, especially in the context of certain trauma, such as injuries to the proximal epiphysis of the humerus, fractures of the anatomical and surgical neck, or isolated fractures of the greater and lesser trochanter, because the posterior humeral circumflex artery is the origin of nutritional vessels that are directed towards the metaphyseal junction zone, between the head and neck of the humerus (Gerber *et al.*, 1990). Furthermore, depending on the fracture, if a deltopectoral or transdeltoid approach is used in surgery, the axillary nerve may be visible at the inferior margin or in the venter of the subscapularis muscle before entering the humerotricipital space (Mansat, 2007).

Currently, the spaces described above are not listed in *Terminologia Anatomica*. The aim of this study was to carry out a review of human anatomy textbooks in Spanish in order to establish the definition of the terms used to describe these spaces, as well as to propose concordant terms in Latin according to the principles of *Terminologia Anatomica*.

## MATERIAL AND METHOD

A search for the terms 'Spatium' in A Latin Dictionary (Lewis & Short, 1879) available on the Perseus Digital Library platform and 'Espacio' in the Diccionario de Términos Médicos de la Real Academia Nacional de Medicina de España (2012) was carried out. To identify when this word was first used in Spanish in the medicine field, Corpus Diachronicus of Spanish (CORDE, 2023) was used. To propose concordant terms in Latin, the lexemes of the words 'escápula' and 'húmero' in the Diccionario Médico de la Universidad de Salamanca (Universidad de Salamanca, 2014) were analyzed. In addition, the presence of the term 'Spatium' in the different chapters of the *Terminologia Anatomica* was analyzed. Finally, 10 anatomy textbooks in Spanish frequently used in different health professions were reviewed to identify the terms used to describe the scapulohumeral spaces.

## RESULTS

Lewis & Short's (1879) defines the term 'Spatium' as 'a space', i.e. the distance that exists between two structures and the Diccionario de Términos Médicos de la Real Academia Nacional de Medicina de España (2012), mentions that, in anatomy, the terms 'spaces', 'area', 'zone' and 'region' are often used interchangeably as a limited area or extension in the human body. According to CORDE, the first time the term 'space' was used in Spanish, in the area of medicine, was in the book *Lecciones de Patología y Clínica Médica* (Díaz-Rubio, 1964).

According to the Diccionario Médico de la Universidad de Salamanca (2014), the Spanish lexeme form of the word 'escápula' is escapul(a) and derives from Old Latin. In Classical Latin, in addition to scapula, it meant more generically 'shoulder', 'upper part of the back'; its existence in Medieval Latin is probable from Spanish derivatives such as escapulario, documented in 1246; as a sophisticated anatomical term it is documented in English in 1578; for the equivalent of 'back' the word 'spatula(m)' was substituted, from where the Spanish word 'espalda' comes. The Spanish translation of the word 'húmero' is humer(o) and in Latin, the word means 'shoulder'; documented in English in 1578; the more common Spanish form of the same word is 'hombró'; documented in Spanish from 1738.

When reviewing the latest edition of the *Terminologia Anatomica* (2019), it was found that the term 'Spatium' appears 25 times in different chapters (Table I) and no terms for scapulohumeral spaces are mentioned in the upper limb chapters. In 100 % of the anatomy textbooks reviewed, at least one term is used to describe the scapulohumeral spaces (Table II).

Table I. Presence of the term *Spatium* in *Terminologia Anatomica*.

Term Number	Term
1102	<i>Spatium intercostale</i>
2208	<i>Spatium supraesternale</i>
2415	<i>Spatium superficiale perinei</i>
2419	<i>Spatium profundum perinei</i>
2883	<i>Spatium peripharyngeum</i>
2884	<i>Spatium retropharyngeum</i>
2885	<i>Spatium parapharyngeum</i>
3061	<i>Spatium portale</i>
3813	<i>Spatium extraperitoneale</i>
3814	<i>Spatium retroperitoneale</i>
3822	<i>Spatium retropubicum</i>
3823	<i>Spatium retroinguinale</i>
3824	<i>Spatium infraperitoneale</i>
3980	<i>Spatium pyramidale inferius</i>
5380	<i>Spatium subdurale</i>
5381	<i>Spatium epidurale craniale</i>
5383	<i>Spatium epidurale spinale</i>
5387	<i>Spatium subarachnoidale</i>
6186	<i>Spatium subarachnoidale nervi optici</i>
6808	<i>Spatium retrozonulare</i>
6816	<i>Spatium episcleralis</i>
6937	<i>Spatium perilymphaticum</i>
6996	<i>Spatium endolymphaticum</i>
7096	<i>Spatium subcutaneum perinei</i>
6797	<i>Spatium apparatus suspensorii lentis</i>

## DISCUSSION

The results show that a space is the distance between two or more structures of the human body, although the terms 'area', 'zone' or 'region' are not interchangeable according to the taxonomy presented in *Terminologia Anatomica*, as these terms are mainly used in topographical anatomy, for the purpose of location and subdivision of these regions.

According to Gutiérrez *et al.* (2016), there is a clinical condition called quadrangular space syndrome, with neurological symptoms, vascular symptoms, weakness and hypotrophy of the deltoid and/or teres minor, however, it is rare for all symptoms to be present at the same time. In addition, there is a higher frequency of incomplete manifestations of the syndrome, producing pain on lateral rotation against resistance, with normal neurological examination and no visible hypotrophy of the deltoid muscle, therefore, this syndrome is often underdiagnosed due to its non-specific clinical features.

Shoulder muscle variations also must be considered, as some can cause nerve compression in these spaces. One of the most variable muscles of the shoulder is the subscapularis; the incidence of an accessory subscapularis muscle has been described by Gruber as 5 % in 10 out of

Table II. Terms used to describe the scapulohumeral spaces in different human anatomy textbooks in Spanish.

Books	Terms Used
Agur & Dalley (2022)	Quadrangular space
Drake <i>et al.</i> (2015)	Quadrangular space, triangular space, triangular interval
Pró, E. (2014)	Lateral axillary space, medial axillary space, inferior axillary space
Latarjet & Ruiz Liard (2019)	Triangle of the teres muscles (medial and lateral axillary space), inferior axillary space
Rouvière & Delmas (2002)	Quadrangular space, triangular space, humerotricipital notch
Tountas & Bergman (1993)	Quadrangular space
Chatain & Bustamante (1986)	Triangular space, omotricipital trilateral foramen, humerotricipital quadrilateral foramen
Testut & Latarjet (1982)	Humerotricipital quadrilateral, Velpeau's omotricipital triangle and Avelino-Gutiérrez interval
Quiroz (1978)	Humerotricipital quadrilateral, Omotricipital triangle
Orts Llorca (1963)	Humerotricipital quadrilateral and Velpeau's scapulotricipital triangle

Table III. Proposed Latin Terms for the scapulohumeral spaces.

Proposed Latin Term	Noun Case Ending	Adjective Case Ending	English Translation	Spanish Translation
<i>Spatia scapulohumeralia</i>	Second declension neuter, nominative plural	Third declension nominative plural	Scapulohumeral spaces	Espacios escapulohumerales
<i>Spatium humerotricipitale</i>	Second declension neuter, nominative singular	Third declension nominative singular	Humerotricipital space	Espacio húmerotricipital
<i>Spatium scapulotricipitale</i>	Second declension neuter, nominative singular	Third declension neuter, nominative singular	Scapulotricipital space	Espacio escapulotricipital
<i>Spatium teretricipitale</i>	Second declension neuter, nominative singular	Third declension neuter, nominative singular	Teretricipital space	Espacio redondotricipital

200 specimens (Tountas & Bergman, 1993). This variation runs from the superior margin of the scapula and inserts into the glenohumeral joint capsule or the crest of the lesser tubercle of the humerus and may cause compression of the axillary nerve and pain on medial rotation of the joint.

With respect to the axillary nerve and in people with spasticity, there may be limitation to medial rotation and variability in the motor points that are directed towards the teres minor muscle, so that, in treatments with botulinum toxin, it is necessary to consider these variations, given that in 69 % of cases there is one branch, in 28 % two branches and in 3 % three branches that are directed towards this muscle (Lee *et al.*, 2016).

The axillary nerve originates from the anterior branches of the C5-C6 spinal nerves and contributions from C4 and C7 have been described (Hur *et al.*, 2011). The frequency varies from 13.3 % to 48.8 % for C4 and in 20 % to 56.2 % of cases, the axillary nerve may present contribution from C7 (Kang *et al.*, 2014; Lee *et al.*, 2016), so a traumatic injury to one of these branches can also affect the trophism of the deltoid and teres minor muscles, as well as proprioception, because the glenohumeral joint has articular branches coming from the axillary nerve, mainly from C6 (Lee *et al.*, 2016).

Despite the above, the *Terminologia Anatomica* does not include the scapulohumeral spaces, and in the descriptions used in the anatomy textbooks reviewed, there are a variety of different terms used. As a result, there is no single term to refer to the spaces, and as Table I demonstrates, the *Terminologia Anatomica* does include other clinically significant spaces in the human body.

The terms medial, lateral and inferior axillary space (Pró, 2014; Latarjet & Ruiz Liard, 2019) are not very informative with respect to the bone and muscle structures which form it and the superior axillary space is non-existent.

Taking into account the variability in the insertions of the teres minor, teres major and triceps brachii muscles, as well as the hypertrophy which may affect these muscles in high-performance athletes (Tountas & Bergman, 1993; Moore *et al.*, 2017), the shape of the spaces (trilateral or quadrilateral) was not considered.

Our proposal is to add the terms for the scapulohumeral spaces in the axillary region of the chapter on upper limb structures. According to the principles of the *Terminologia Anatomica*, the adjectives of the structures should be descriptive and concordant in Latin.

For the term 'Spatia Scapulohumeralia', we considered the plural forms of the term Spatium, which is a second declension neuter noun, as well as the lexemes scapul(o) and humer(alis) which combine to form a concordant, third declension adjective. For the terms 'Spatium humerotricipitale' and 'Spatium scapulotricipitale', the surrounding bone structures, humerus and scapula, were considered, as well as the surrounding muscle structure, the long head of the triceps brachii muscle. Both Latin terms are nominative singular, the word Spatium is a second declension neuter noun and each term has a concordant, third declension adjective. Finally, the term 'Spatium teretricipitale', bears reference to the muscular structures that form it, the teres major muscle and the lateral and long heads of the triceps brachii muscle. The Latin term is again comprised of a nominative singular neuter noun, followed by a concordant third declension adjective.

The terms described above allude more precisely to the location of the spaces, since they refer to the bone and muscle structures that surround them (Table III) and it is of fundamental importance, both in clinical and morphological contexts, to refer as precisely as possible to these anatomical spaces.

## CONCLUSIONS

The concordant Latin terms 'Spatium humerotricipitale', 'Spatium scapulotricipitale', 'Spatium teretricipitale', should be reviewed for inclusion in future editions of *Terminologia Anatomica*, due to the informative description that they provide as well as their presence in the anatomical textbooks reviewed.

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**TORRES-VILLAR, C.; VALENZUELA-AEDO, F.; NICHOLSON, C.; OLAVE, E. & ALVES, N.** Espacios escapulohumerales: Concordancia y propuesta a la terminología anatómica. *Int. J. Morphol.*, 42(2):525-529, 2023.

**RESUMEN:** La actualización de términos anatómicos es esencial para facilitar la enseñanza-aprendizaje y comunicación internacional a través de publicaciones y presentaciones en eventos científicos. En la pared posterior de la axila, los músculos redondo mayor, redondo menor y tríceps braquial, forman tres espacios por donde discurren estructuras neurovasculares relevantes

en la clínica. El estudio tuvo como objetivo definir y proponer términos para estos espacios omitidos por *Terminologia Anatomica*. En el diccionario A Latin Dictionary se investigó la definición en latín del término 'Spatium' y 'Espacio' en el Diccionario panhispánico de términos médicos (Real Academia Nacional de Medicina de España, 2023), además de los lexemas de las palabras 'escápula' y 'húmero' en el Diccionario Médico-Biológico, Histórico y Etimológico de la Universidad de Salamanca. También se investigó la presencia del término 'Spatium' en la *Terminologia Anatomica*. Por último, se revisaron 10 libros-textos de anatomía en español para identificar los términos utilizados para estos espacios y su relevancia clínica. Al revisar la última edición de *Terminologia Anatomica*, se observó que el término 'Spatium' aparece 25 veces en distintos capítulos y se evidenció que no aparecen términos para los espacios escapulohumerales en los capítulos de miembro superior. Además, en el 100 % de los libros-textos de anatomía revisados, se utiliza al menos un término para describir a los espacios escapulohumerales. Consideramos que los términos propuestos: 'Spatium humerotricipitale', 'Spatium scapulothoraciale' y 'Spatium teretriscapitale' aluden con mayor precisión a la ubicación, ya que relaciona a las estructuras óseas y/o musculares que lo forman. Por lo que sugerimos que estos términos sean revisados para incluirlos en futuras ediciones de *Terminologia Anatomica*.

**PALABRAS CLAVE: Espacios escapulohumerales; Terminologia Anatomica; Latín.**

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