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REVIEW

Is the cervical fascia an anatomical proteus?

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Abstract The cervical fasciae have always represented a matter of debate. Indeed, in the literature, it is quite impossible to find two authors reporting the same description of the neck fascia. In the present review, a historical background was outlined, confirming that the Malgaigne's definition of the cervical fascia as an anatomical Proteus is widely justified. In an attempt to provide an essential and a more comprehensive classification, a fixed pattern of description of cervical fasciae is proposed. Based on the morphogenetic criteria, two fascial groups have been recognized: (1) fasciae which derive from primitive fibromuscular laminae (muscular fasciae or myofasciae); (2) fasciae which derive from connective thickening (visceral fasciae). Topographic and comparative approaches allowed to distinguish three different types of fasciae in the neck: the superficial, the deep and the visceral fasciae. The first is most connected to the skin, the second to the muscles and the third to the viscera. The muscular fascia could be further divided into three layers according to the relationship with the different muscles.

Keywords Cervical fascia · Superficial fascia · Deep fascia · Visceral fascia

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Introduction

As reported in *A Reference Handbook Of The Medical Sciences* [53] under the entry "fascia", "The cervical fascia has enjoyed a rather unenviable reputation. Malgaigne [24] speaks of it as the anatomical Proteus that takes different shapes according to the fancy of the observer" with the following original words: "aprés la peau vient l'aponévrose cervicale, espèce de protée anatomique, qui se présente avec une forme nouvelle sous la plume de chacun de ceux qui ont tenté de la décrire" (p. 48). Poirier and Charpy [38] also stated that "the cervical fasciae appear in a new form under the pen of each author who attempts to describe them".

Indeed, since the neck is a narrow and complicated segment of the body, without a coelomatic cavity lined by mesoderm-derived epithelium, the recognition of fascial systems and spaces appears more difficult with respect to thorax and abdomen. Furthermore, several pathophysiological conditions can impair a correct description of the fascia: differences in the development of muscular and soft tissues; anatomical varieties; secondary phenomena of fascial adhesion during pre- and post-natal periods; active or previous pathological processes which can alter the normal fascial disposition; way of living (different muscular mass development according to sport activity and kind of work) [26].

Since the first description by Burns [4], and the historical recapitulation made by Malgaigne [25], the cervical fasciae have been subject of controversy. The general confusion in its description and the discrepancies among different authors principally arise from the inherent difficulty in dissecting out fascial spaces. Moreover, discrepancies can be related to different approaches in classifying and grouping fascial spaces for descriptive purposes [23].

The cervical fasciae present a clinical interest, correlated with the chronic neck pain and tension-type headache [3, 14, 48, 49], to their role in the diffusion of anesthetics in the regional anesthesia [36], to their implication in the neck and head surgery [34]. Besides, the muscular, nervous and vascular structures are related to the fasciae [27], and it is demonstrated that nerve compression could be also due to fascial thickening [9].

Different techniques have been adopted to study the neck fasciae. The classical anatomical dissection is the main approach, possibly in a subject with habitus fibrosus where fasciae are well developed and evident [26]. The examination of frozen corpses can be also useful. To better distinguish the different fasciae, several materials have been injected in the neck spaces: water, air, colored fluids, ink, gelatine, liquid glue, diluted solutions of chromic acid (2 %) [13, 26]. The more recent plastination technique also allowed preserving and studying fascial structures [58].

In general, because of its importance in surgery, physiotherapy, osteopathy, and other health-related disciplines, there has been an increasing interest in the fascia, as announced by the first international fascia research congress in 2007 [22]. Really, modern textbooks of anatomy and surgery usually treat them very briefly and inaccurately. For this reason, we examine the earlier works of the anatomists to find out the different descriptions and to make out an easily understandable explanation of cervical fasciae. Besides, we will try to organize the fasciae of the neck including them in a more general view. During dissection, the fasciae could be very difficult to isolate, according to the different subjects. Keeping in mind a general fascial scheme, it would be easier to find out the cervical fibrous network.

Historical background

The cervical fascia has been subject of much debate since its first description by Burns [4]. In his pioneering work, *Observations On The Surgical Anatomy Of The Head And Neck*, Burns [4] described the fascia as a very strong and resisting structure (the cervical fascia in its natural state is thin but even in this condition, it is more resisting than its texture would lead us to suppose), consisting of two layers, and he simply stated that the fascia of the neck descends from the lower edge of the maxilla inferior, and is thinner at the front than at the angle of the jaw. At that part, a fold of the fascia is tucked back to the styloid process, to which it adheres, and here it is incorporated with an aponeurotic expansion from the pterygoid muscle, forming the ligament of the jaw. […] The fascia, as it descends along the neck, dips down among the muscle and glands, forming capsules for the latter. These are production from the inner surface of the fascia, in the same way that falx is a production from the dura mater. On its outer surface, the fascia is pretty smooth, and it is nearly of uniform thickness in every part below the os hyoides, till it comes to expand over the pectoral muscle, when it puts on more of a cellular appearance. The deep layer of the fascia derives from the superficial fascia and it is separated from the latter by a layer of adipose tissue. It is described as a fibrous structure stronger than the superficial fascia. Indeed, over the sternohyoid muscles, it forcibly resists any effort to push the finger through it into the chest. It likewise prevents the finger being pushed from the chest higher than the lower edge of the thyroid gland.

According to Burns [4], the main function of the deep fascia of the sub-hyoidean region, more specifically the lamina lying in front of the trachea, is to prevent the atmospheric pressure from compressing the trachea during inspiration. This thesis is shared by Bèclard [1] and Blandin and Doane [2], but refused by Malgaigne [24] who noticed that, when the aponeurosis is divided to expose the underlying large arteries, no particular difficulties in breathing can be observed.

A more detailed description of the anatomical disposition of the cervical fascia is reported by Velpeau [57] in *A Treatise On Surgical Anatomy.* According to this author, all the muscles, vessels, and nerves of the anterior region of the neck, the thyroid gland, the trachea, and oesophagus, are each enveloped in fibro-cellular sheaths; these sheaths are continuous with each other.

Merkel [28] stated that the aponeurosis of the neck is formed by a solid lamina of connective tissue, which extends from the hyoid bone to the sternum and the clavicle. This aponeurosis can be clearly distinguished from all the other connective sheets of the neck which are usually thin and should be simply considered as a thickening of the amorphous connective tissue. These sheets are fixed around cordlike formations and they form sheaths through which the vessels run.

Topographic classification of cervical fasciae

As in the past, the literature of the recent years still proposed different and arbitrary terminology and classifications of the fascia which are widely debated [7, 11, 15, 16, 19, 21, 31, 33, 35, 44, 45, 51, 59]. At the present, one of the

most common classifications is based on the work by Grodinsky and Holyoke [13] and recognizes two major divisions of cervical fasciae: superficial cervical fascia (SCF), placed in the subcutaneous tissue, and deep (or axial investing) cervical fascia (DCF), surrounding the musculoskeletal system and viscera. While SCF is described as a unique fascial sheet, DCF is further subdivided into three layers: superficial, middle and deep fasciae [15, 45]. The authors who first described three different laminae are: Blandin and Doane [2], Froriep [12], Hyrtl [17], Tillaux [56], Romiti [41], and Testut [55]. Below is reported a brief description of these layers, highlighting the differences and the similarities among these authors' works.

Superficial fascia (fascia propria)

According to Testut [55], the superficial fascia originates from the cervical linea alba. Here, as stated by Romiti [41], it is "free" in between the muscular margins and it is associated with the medium cervical fascia, hence the appearance of a white line. The above-mentioned authors agree that it continues laterally to the anterior edge of sternocleidomastoid muscle where it divides into the two layers which cover this muscle and join together again at the posterior edge of same muscle.

Moreover, according to Hyrtl [17], Tillaux [56], Romiti [41] and Testut [55], it reaches the trapezius and wraps it. Froriep [12] does not specifically mention this muscle in his less detailed description.

As first described by Hyrtl [17], then by Romiti [41] and Tillaux [56], in the segment between the sterno-cleido-mastoid and the trapezius, the superficial fascia passes over the supraclavicular triangle. Here, as stated by Romiti [41], it is perforated to give passage to the external jugular vein and the trapezius and, where the passage occurs, it has a falciform fold formed by connective tracts laterally curved and stretched between the sternocleidomastoid aponeurosis and the clavicle.

Attachments to the clavicle [17, 41, 56], to the spine of the scapula and acromion [41] are described; moreover, there is a general consensus among authors in describing the insertion of the fascia to the sternum even if some confusion arises in the attempt to classify the fascial sheets as superficial or medium fascia. In particular, according to Hyrtl [17], Froriep [12] and Tillaux [56], the superficial layer is attached to the sternum anterior surface, while the posterior surface gives attachment to the medium fascia. According to Romiti [41] and Testut [55], both layers belong to the superficial fascia, which splits into two layers at the superior margin of this bone. These layers attach to the anterior and posterior surface of the sternum forming in this way the spatium interaponeuroticum suprasternale. Differently, according to Blandin and Doane [2], the superficial layer glides before the sterno-cleido-mastoid muscle and the sternum, together with the middle layer it forms a special sheath for the lower part of the sterno-cleido-mastoid muscle.

As described by Testut [55], the internal side of the superficial fascia gives rise to three extensions: vertebral, submandibular and parotid.

As regards the vertebral extension, Testut's interpretation matches with the previous description given by Romiti [41]. According to them, this extension originates in the supraclavicular region and reaches scalene muscles where it divides into two layers defining the intermedium space of scalene muscles, where there are the subclavian artery and the brachial plexus. A similar disposition is described by Tillaux [56]. According to him, this sheet, originating from the internal side of the superficial fascia, divides the neck into two big compartments: anterior and posterior. Moreover, he describes another strong prolongation which is attached to the apophyses of the spinous process and in this way further divides the posterior compartment into two lateral spaces.

According to Hyrtl's description [17], it is the medium fascia (not the superficial layer), which penetrates between the scalene muscles and reaches the vertebral transverse apophyses. Testut [55] also describes a submandibular extension, located in the suprahyoid region. According to his description, the superficial fascia reaches the hyoid bone and divides into two layers: a superficial one that is identified with the same fascia and ends on the mandible inferior edge; a deep layer corresponding to the submandibular extension. This extension inserts in the mylohyoid muscle and together they reach the mylohyoid line of the mandible. These two layers define a lodge where the submandibular gland is located. A similar description can be found in Romiti [41] and Tillaux [56].

The supra-hyoidean portion of the cervical fascia is described by Hyrtl [17] and Blandin and Doane [2]. According to Hyrtl [17] the cervical fascia, as a whole, can be described as a funnel whose anterior part is fibrous while the posterior region has a cellular appearance. The funnel opening, directed downward, embraces the hyoid bone together with the tongue root and the pharynx. The supra-hyoidean fascia originates from the lower edge of the maxilla inferior and from the stylus-maxillary ligament. It splits into two sheets at the border of the submaxillary gland: the external sheet (inferior) adheres to the parotideomasseteric fascia and to the sternocleidomastoid sheath; the internal one passes in front of the large vessels of the carotideal region and inside them, it reaches the posterior pharyngeal wall and here it fuses with the pharyngeal cellular membrane and the buccopharyngeal fascia. According to the description by Blandin and Doane [2], the supra-hyoidean part of the superficial layer is triangular

and it origins at the jaw. Il connects the two platysma muscles from above downward and unites with the deeper layer at the hyoid bone and the larynx.

Finally, Testut [55] describes a parotid extension, which originates from the superficial fascia at the level of the anterior edge of sternocleidomastoid muscle and surrounds the parotid gland. This extension and the superficial fascia define the parotid lodge.

Middle cervical fascia

According to Testut [55], this fascia originates from the hyoid bone and extends inferiorly in the sub-hyoidean region. Hyrtl [17], Tillaux [56] and Romiti [41] and Blandin and Doane [2] describe it also in the supra-hyoidean region. The supra-hyoidean portion of the middle cervical fascia described by Tillaux [56] corresponds to the submandibular extension of the superficial fascia described by Testut [55]. This sheet originates from the hyoid, covers the milohyoideus and attaches to the mylohyoid line of the mandible. Moreover, it covers the hyoglossus and envelopes the digastric, stylohyoid and styloglossus. Finally, it is attached to the styloid apophyses and, at the borders of the supra-hyoidean portion, it is fused with the sheet which inferiorly closes the parotid space.

According to Romiti [41], the medium aponeurosis originates from the mylohyoid line of the mandible; then it is fused in the midline with the superficial cervical fascia and laterally proceeds towards the styloid apophysis. Finally, it proceeds downwards and it firmly attaches to the hyoid bone.

According to Testut [55], the middle cervical fascia extends inferiorly to the superior thoracic aperture. From this fascia originate extensions that reach the posterior organs and the large veins located at the base of the neck.

Following the interpretation of Romiti [41], under the hyoid bone it proceeds downwards to the clavicle and adheres to its posterior surface; it adheres and creates sheaths for the great vessels of the neck base (brachial-cephalic, subclavian, internal and external jugular); it fixes these vessels to the clavicle and to the first rib; it continues to form a sheath for the subclavian; it proceeds under the name of "clavi-coraco-axillary" aponeurosis inserted to the coracoid apophysis and to the axilla.

In Hyrtl's description [17], the second sheet is firmly fused with the superficial sheet at the hyoid bone and above the larynx. It separates from the first sheet at the insertion of the sternum thyroid muscle and it continues toward the sternum, become here firmly attached and then it continues with the superficial cellular tissue of the anterior mediastinum. Moreover, this sheet does not adhere to the clavicle, but it descends below it and in front of the brachial plexus in the axillar cavity and becomes continuous with the fascia of the arm. A fusion between the second sheet and the superficial sheet at the level of the hyoid bone and the larynx is also described by Blandin and Doane [2]. According to these authors, the cervical fascia adheres very intimately to the hyoid bone and the larynx. On the upper part, the second layer passes below the platysma, on the outside of the digastric muscles, and of the sub-maxillary gland, terminating at the lower edge of the jaw. Inferiorly, it passes below the sterno-cleido-mastoid muscle, and in front of the sterno-hyoid and sterno-thyroid muscles. Finally, it comes downward and stops on the top of the sternum, and on the posterior edge of the clavicle.

Laterally, according to Tillaux [56], Romiti [41] and Testut [55], it reaches and sheathes the omohyoid muscle. In Romiti's description [41], it completely fills the "triangle" formed by the omohyoid muscle, the clavicle and the midline: here the aponeurosis of one side is joined with that of the other side.

According to Froriep [12], Hyrtl [17], Tillaux [56] and Testut [55] this fascial layer forms sheath also for the sterno-hyoid and sterno-thyroid. According to Romiti [41], the sheaths for these muscles originate from the deep surface of the superficial fascia.

In Froriep's description [12], the medium fascial layer enfolds the jugular vein, carotid, nervus vagus, thyroid gland.

According to Tillaux [56], the medium layer is formed by two aponeurotic laminae: an anterior lamina, in front of the sterno-hyoid, and a posterior lamina behind the sterno-hyoid. The anterior lamina is inserted into the posterior margin of the sternum, the posterior lamina splits into two sheets to envelope the left brachiocephalic trunk and it continues into the pericardium. Moreover, it continues with the suspensory ligament of the axilla. Behind the clavicle it forms a fibrous envelope for the subclavian vein.

Deep cervical fascia or prevertebral fascia

According to Testut's [55] and Romiti's [41] descriptions, this fascia is fixed superiorly to the basilar part of the occipital bone. According to Blandin and Doane [2], Tillaux [56] and Hyrtl [17] this layer is not present in the supra-hyoidean region.

This fascia passes anteriorly to the prevertebral muscles and, according to Hyrtl [17] and Romiti [41], it envelopes the rectus capitis anterior muscle. In Romiti's description [41], it also sheathes the vagus nerve.

It reaches laterally the transverse processes of cervical vertebrae [12, 41, 55, 56], envelopes the anterior scalene muscle [41, 55, 56] and then it goes on with the superficial cervical fascia [55]. According to Romiti [41], it is fixed to the upper border of the scapula and merges the sheath of the subclavian.

On the inferior side, this fascia goes on in the thoracic cavity within the adipose tissue of posterior mediastinum [12, 41, 55]. According to Romiti [41], it also gives off fibrous bundles to the pericardium and the lung hilum proceeding up to the tendinous center of the diaphragm.

Classification of cervical fasciae

An essential description of the fascial systems of the neck according to their morphogenesis recognizes two groups [26]:

1. Fasciae which derive from primitive fibro-muscular laminae (muscular fasciae or myofasciae).
2. Fasciae which derive from connective thickening (visceral fasciae).

This classification allows distinguishing the different nature of the two groups. Indeed, the fasciae of the first group are related only to muscles (myofascia), whereas the fasciae of the second group are related only to viscera.

In particular, the first group includes different muscle-associated fascial structures: the fascia that wraps each muscle (the investing fascia to be identified with epimysium), the aponeurotic laminae that allow flat muscles to be inserted on the bone, and the two-layer myofascia. The epimysium and the aponeurotic laminae strictly belong to the muscle. The attention must be focused on the most important two-layer myofascia. As suggested by the name, it consists of two connective laminae that include the muscular tissue. The musculature of the body appears organized as concentric two-layer myofascial rings. During development, the musculature regresses where it is not functionally necessary and the two laminae adhere. Then, the two-layer fibrous component of the ring is continuous, whereas the muscular component is often discontinuous. In classical fascial descriptions, it is reported that the fascia splits to surround muscles, but this is not correct. Indeed, this fascia is not a unique lamina that splits to envelop a muscle: the so-called fascia is formed in any case by two laminae (adherent when the musculature is absent and appearing as a unique lamina), which simply separate to envelop a muscle. In this way, distinct muscles belonging to the same myofascial ring are connected and included within fascia. Furthermore, the two laminae act as a guide for muscular movements and several muscular fibers originate from the inner side of these fascial laminae.

The second group includes the deepest fasciae, which are derived from connective thickening. They envelop viscera and appear as a single layer. Two types of such a fascia can be distinguished: the fascia that envelops a single organ (true visceral fascia or false capsule), and the fascia that envelops a group of organs in a visceral space (common perivisceral fascia). The formation and the thickness of these fasciae depend on: development of organs, vessels, and muscles during ontogenesis; arterial pulsation; organ activity (peristalsis, swallowing, breathing, etc.); general movements of head, neck, and trunk. Indeed, cells and connective fibers of these fasciae are oriented according to these mechanical challenges. In this respect, the formation and the thickness of these fasciae are not genetically determined and depend on the occurrence and entity of these mechanical challenges.

Key elements about the fasciae of the neck

From this review, it is evident that in the neck three different types of fasciae could be recognized:

1. The superficial fascia. It is in the middle of the subcutaneous adipose tissue and envelops the platysma muscle.
2. The deep muscular fascia, divided into three layers. The different authors have described them in various ways, but we can summarize the more common descriptions in the following way:
   (a) External layer, in relation with the sternocleidomastoid and trapezius muscles.
   (b) Middle layer, in relation with the infra-hyoid muscles.
   (c) Deep layer, in relation with the prevertebral, scalene and nuchal muscles.
3. The visceral fasciae, divided in:
   (a) Fasciae that envelop a single organ.
   (b) Fasciae that envelop a group of organs.

The superficial muscular fascia (or tela subcutanea)

Traditionally [11, 15, 16, 45] the superficial fascia is classified apart with respect to the deep (or investing) fascia because of their different structure. Indeed, unlike the deep fascia, the superficial fascia is provided with a more or less consistent fatty, loose connective tissue. More precisely, the superficial fascia is immersed in this subcutaneous tissue, which results divided into two layers. The superficial layer mainly contains fatty tissue specialized to synthesize and contain large globules of fat within a structural network of fibers, whereas the deep layer mainly contains loose connective tissue, also called areolar tissue, which is composed by loosely organized collagen and elastic fibers that run in random direction, and abundant blood vessels. The two subcutaneous layers also contain a dense network of fibrous septa (retinacula cutis or skin ligaments) that connect the superficial fascia to dermis and

deep structures, respectively. The superficial fascia and the retinacula cutis are so interconnected that they could be considered as a morphologic unit.

The superficial fascia was described in great detail several years ago by Sterzi [54] in a bulky paper. The fine morphological observations reported in that work are still anatomically valid and they have been recently commented by Riva et al. [40] and Micheli-Pellegrini [29]. An accurate description of the subcutaneous tissue and superficial fascia has been provided by Chopra et al. [6], Lancerotto et al. [20] and Stecco [50]. Even though with different consistency, the subcutaneous fascia is continuously present in the whole body. In the face, it envelops the mimic muscles and forms the SMAS (superficial musculo-aponeurotic system), in the neck it envelops the platysma muscles (Fig. 1). The platysma muscle is thicker in Black and Mongol races and it can also extend to the nuchal region, to thorax and abdomen, this disposition being reminiscent of the well-developed cutaneous muscles in other Primates and animals [8]. Proximally, the platysma does not insert in the jaw, as some sources allege. Rather, it continues beyond the border of the mandible to fuse with the SMAS and, in particular, with the risorius muscle of Santorini. Distally, the platysma is continuous with the superficial fascia of the thorax and of the deltoid region [52]. Posteriorly, the superficial fascia of the neck continues cranially with the galea capitis and distally with the thick superficial fascia of the back.

The deep (muscular) cervical fascia

The deep fascia of the neck is arranged in three fascial laminae (layers) that envelop the neck muscles: external, middle and deep lamina. All three of these layers of the deep cervical fascia adhere strongly to their underlying muscles.

The external (or superficial) layer of the deep cervical fascia

It completely encircles the neck. In the supra-hyoid region it envelops the digastric and stylo-hyoid muscles. This two-layer myofascia envelops the sterno-cleido-mastoid and trapezius muscles (Fig. 2). According to some authors, the fascia would not exist between the sternocleidomastoid and trapezius muscles [60] and between the sterno-cleido-mastoid muscles in the anterior region of the neck [33]. The work of these authors is mentioned in the 40th edition of Gray's Anatomy [47], but the description of the superficial layer of the deep cervical fascia did not take into account their opinion. Besides, anatomical varieties, compared with other animal species, confirm the continuity of this myofascial layer. The most common varieties include: the presence of isolated muscular bundles or a muscular bundle between the sterno-cleido-mastoid and trapezius muscles; the fusion of anterior bellies of digastric muscles (in some monkeys); the fusion of sterno-cleido-mastoid muscles (in dolphins); the fusion of sterno-cleido-mastoid muscle with the trapezius muscle; the duplication of digastric and stylo-hyoid muscles; the presence of cleido-occipital muscle [26].

The comparison with other parts of the body allows describing this fascial layer as continuous with other myofascial systems. In the thorax, it continues with the fasciae enveloping the following muscles: episternal (excessive variety), pectoralis major, latissimus dorsi, thoracic part of the trapezius [26, 43, 48].

The middle layer of the deep cervical fascia

It is a muscular fascia that envelops the infra-hyoid, mylo-hyoid and genio-hyoid muscles (Fig. 3). Anatomical varieties, compared with other animal species, confirm the continuity of this myofascial layer. Excessive varieties include; the fusion of omo-hyoid muscles without intermediate tendons; the fusion of sterno-hyoid muscles (in horses); the duplication of omo-hyoid muscles; the presence of muscular bundles between the omo-hyoid muscle and clavicula and muscular bundles between the sterno-hyoid muscles; the appearance of sterno-hyoid and mylo-hyoid muscles as a unique muscle [26]. Defective varieties include: the absence of infra-hyoid, omo-hyoid or mylo-hyoid muscles; mylo-hyoid muscles subdivided into several bundles [26]. The comparison with other parts of the body allows describing this fascial layer as continuous with other myofasciae. In the thorax, it continues with the clavipectoral fascia, that is the fascia that envelops the subclavius, pectoralis minor, and serratus anterior muscles. Posteriorly, it continues with the fascia that envelops the levator scapula, rhomboid major, rhomboid minor and serratus posterior muscles [26, 49].

The deep layer of the deep cervical fascia

While the deep layer of the neck is sometimes referred to as the prevertebral fascia, the prevertebral fascia itself covers mainly the anterior vertebral muscles and extends laterally on the scalenus anterior, medius and posterior [47]. The deep lamina also has a posterior portion, which covers the longissimus and the semispinalis muscles. It contains also the rectus and longus capitis muscles and the sympathetic nerves (Fig. 3). A study by Miyake et al. [32] indicates that the prevertebral lamina develops as an intermediate aponeurosis for the bilateral bellies of the longus colli muscles.

Fig. 1 The subcutaneous cervical fascia (myofascia; platysma muscles in grey). Modified from Mauro et al. [26]

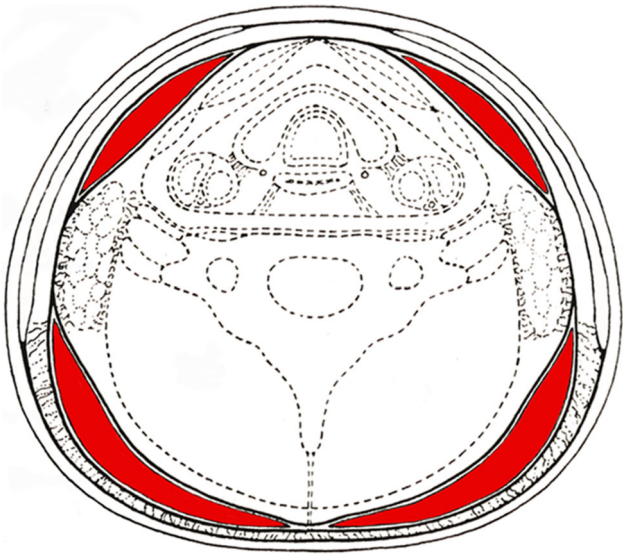

Fig. 2 The superficial layer of the deep cervical fascia (myofascia; sterno-cleido-mastoid and trapezius muscles in grey). Modified from Mauro et al. [26]

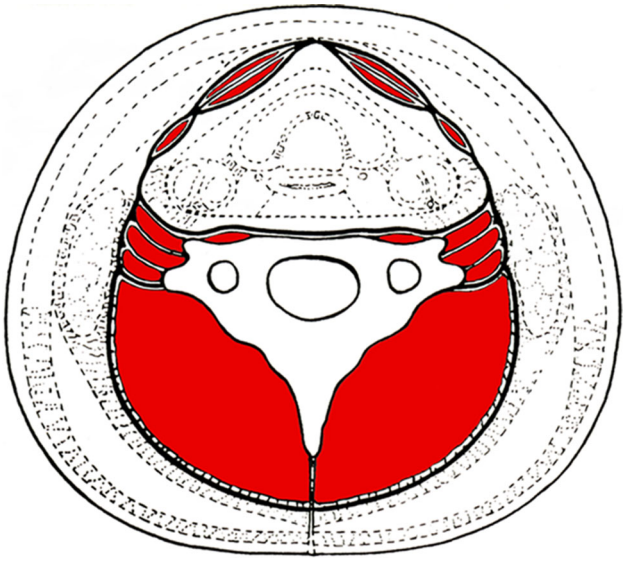

Fig. 3 The middle and deep layers of the deep cervical fascia (myofascia; deep muscles in grey). Modified from Mauro et al. [26]

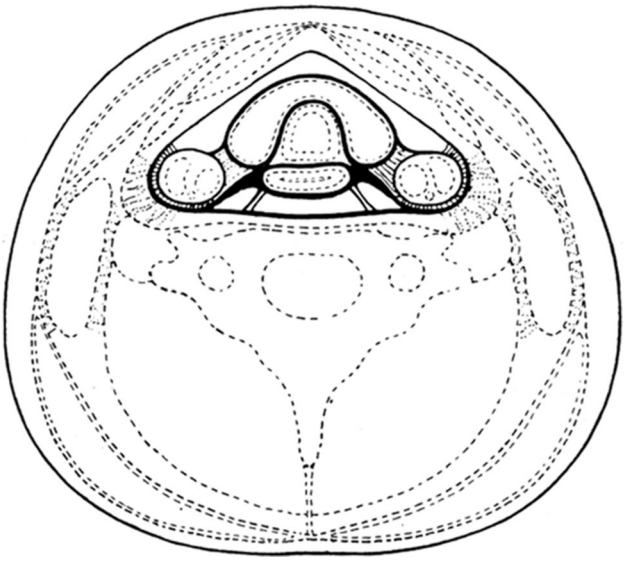

Fig. 4 The visceral cervical fascia (endocervical fascia). Modified from Mauro et al. [26]

The prevertebral fascia originates from the base of the skull. It attaches to the transverse processes of the vertebrae and extends inferiorly between the oesophagus and the spine to the posterior mediastinum, where it blends with the anterior longitudinal ligament. Loose connective tissue separates it from the buccopharingeal fascia and from the tunica adventitia of the esophagus (retropharyngeal space). The deep lamina defines the retrovisceral space. Laterally it fuses with the superficial and middle laminae, forming a boundary between the neck and the nape. In the lower part of the neck, the deep lamina forms a tube that sheathes the brachial plexus. Thus, the deep lamina continues downwards and laterally behind the clavicle as the axillary sheath.

The visceral fascia of the neck (or endocervical fascia)

The visceral fascia of the neck derives from connective thickening that completely encircles the viscera of the anterior part of the neck (Fig. 4). It corresponds to the endothoracic (subpleural) fascia in the thorax, to the

endoabdominal (subperitoneal) fascia in the abdomen, and to the endopelvic (subperitoneal) fascia in the pelvis. The continuity of these connective fasciae is only apparently interrupted by the Sibson's fascia (neck–thorax) and by the diaphragm (thorax–abdomen). Furthermore, inside the endocervical fascia, each organ is provided by its own fascia: peripharyngeal, perilaryngeal, peritracheal, perithyroidal, periparathyroidal and perioesophageal fasciae. This fascia also envelops blood vessels and nerves: in particular, it forms the carotid sheath. In the case of hollow organs, blood vessels and nerves, this investing fascia must not be confused with the outer adventitial layer which belongs to the organ. In the case of solid organs, this investing fascia (false capsule) must not be confused with the capsule, which depends on the visceral stroma and belongs to the organ [26].

Concluding remarks

In the present review, among the wide debated literature concerning the cervical fascia, an anatomical classification based on morphogenetic, topographic and comparative approaches was preferred and discussed for its essential effectiveness. Thanks to this approach, it is evident that in the neck, three different types of fasciae could be recognized: the superficial, the deep and the visceral fasciae. The first is connected to the skin, the second to the muscles and the third to the viscera. The deep muscular fascia could be further divided in three layers according with the relationship with the different muscles: superficial, middle and deep.

The present approach would provide a fixed pattern of description of cervical fasciae. This means that anatomical descriptions may differ (excessive or defective) from this approach depending on the technique used or on the observation that some fasciae may have additional sepiments or may be incomplete or absent in some people. In this respect, the fascial thickness varies as in some sites, the fascia is so weak and indefinite that it can not be well appreciated and does not contain a possible pathologic process.

Some investing fasciae (organized into two layers) wrap only muscles, and the others (one layer formed by lamination of loose connective around viscera for mechanical stress) invest only viscera. Independently on the organ (muscles or viscera) wrapped by the fascia, all cervical fasciae appear as concentric collars that completely encircle the neck. So, each collar is continuous, although with different consistency. The first collar (Fig. 1) is represented by the superficial fascia (*tela subcutanea*), the second collar (Fig. 2) by the superficial layer of the deep muscular fascia, the third collar (Fig. 3) by the middle and deep layers of the deep muscular fascia which are continuous with each other [5, 10, 30, 37, 39, 42, 46], and the fourth and inner collar (Fig. 4) by the visceral fascia.

The consideration that the fasciae are organized in the neck as in other parts of the trunk confirms the role of some fascial systems in creating compartments for muscles. The continuity of myofascia among different regions is important in coordinating muscular and proprioceptive activity and would better support the idea of kinematic muscular chains [18].

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