

Ambiguous Descriptions in Gross Anatomy.

B Venugopala Rao^{1*}, and Viswakanth Bhagavathula².

¹Department of Anatomy, Faculty of Medicine, MAHSA University, Kuala Lumpur, Malaysia.

²Department of Forensic Medicine Kempegowda Institute of Medical Sciences, Bangalore, Karnataka, India.

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*For Correspondence

Department of Anatomy, Faculty of Medicine, MAHSA University, Kuala Lumpur, Malaysia.
Phone: +60163716683

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ABSTRACT

Text books of human anatomy still describe of the superior root of ansa cervicalis (C1 fibers) as a “branch” of hypoglossal nerve. Since topographically, it seen as leaving the hypoglossal nerve, this superior root of ansa heads the list of branches of hypoglossal nerve. The same principle is not applied to the chorda tympani which, in fact, is “seen” as branching out from the lingual nerve in the infratemporal fossa but it is described as “joining” the lingual nerve indicating afunctional connection. Other anomalous descriptions including the insertion of the quadriceps femoris, extent of inguinal canal and certain names of foramina in the skull and mandible which may be causing confusion to the students of anatomy are discussed in this article and necessary recommendation to revise the nomenclature is proposed.

INTRODUCTION

There are countless text books and atlases of human anatomy, each with its own style of presentation and advantages that provide the students with a proper and better understanding of this complex subject. Many of them are remarkable for their attention to the finer details. Despite all this, there are many areas in gross anatomy where ambiguity still persists in the descriptions of certain structures which defy convention and simple logic. Some terms are vague and need revision. This article attempts to focus on some of those descriptions which can readily be found in all the standard textbooks of human anatomy. The students' response (in general) during the examinations is also an indicator that something has to be done to avoid confusion.

In the late nineteenth century some 50,000 terms for various body parts were in use. The same structures were described by different names, depending (among other things) on the anatomist's school and national tradition. Vernacular translations of Latin and Greek, as well as various eponymous terms, were barriers to effective international communication. There was disagreement and confusion among anatomists regarding anatomical terminology^[1].

Unless anatomical nomenclature is subject to a most rigorous revision, in terms of simplification and rationalization, general use of such an internationally official nomenclature as *Nomina Anatomica* will decline rather than increase^[2].

The *Terminologia Anatomica* (TA) is the international standard for anatomical terminology. The last revision (TA) is highly recommended to the attention of not only teachers, students and researchers, but also to clinicians, doctors, translators, editors and publishers to be followed in their activities^[3].

To describe the body clearly and to indicate the position of its parts and organs relative to each other, anatomists worldwide have agreed to use the same descriptive terms of position and direction^[4].

Review of literature and discussion

A spinal nerve is described as a “branch” of a cranial nerve

The hypoglossal nerve crosses the external and internal carotid arteries. It curves round the origin of the lower sternocleidomastoid branch of the occipital artery, and at this point the superior root of the ansa cervicalis leaves it to descend anteriorly in the carotid sheath^[5]. Because of this topographical relation, the superior root of ansa (C1 fibers) is always described as a branch of distribution of the hypoglossal nerve, a cranial nerve.

What is a branch of a nerve?

The motor components of the cranial nerves are derived from cells that are located in the brain. These cells send their axons which bundle as nerves. These axons separate from the parent trunk as branches, proceeding to supply the target structures and any damage to these fibers would result in the degeneration of their own cell bodies^[6].

Efferent nerve fibres connect the CNS to the effector cells and tissues: they are the peripheral axons of neurones with somata in the central grey matter^[7].

Last's anatomy says "the branches of the hypoglossal nerve (before it reaches the tongue) are all derived from C1 nerve fibres that join the hypoglossal at its exit from the skull. The fibres from the hypoglossal nucleus itself have no supply outside the tongue. The branches derived from C1 fibres must still be classified as branches of the hypoglossal nerve, even though their origins are not from the hypoglossal nucleus" and adds "the origin, course and distribution of the cranial nerves stand in increasing clinical importance. Knowledge of the nucleus matters least, of the course matters much more, and of the distribution is most important of all^[8].

The ontogeny of hypoglossal nerve explains the "hitch hiking" of C1 fibers.

Friorip says, "The hypoglossal is formed by the union of a number of segmental spinal nerves, each of which is composed of two roots, - a ventral and a dorsal, - exactly like spinal nerves" ^[9]. It is not surprising to see C1 fibers travelling in the hypoglossal sheath and leaving it as the superior root of ansa and is described as a "branch" of hypoglossal nerve merely because of the topographic appearance.

On emerging from the hypoglossal canal, it gives off a small meningeal branch^[10].

This meningeal branch is sensory in nature (and indeed is derived from C1) and if it is described as a branch of hypoglossal nerve, the last cranial nerve becomes a mixed cranial nerve, not a purely motor cranial nerve as taught in neuroanatomy and embryology and the concept of functional components becomes dubious.

Curious description of chorda tympani

In the infratemporal fossa, chorda tympani, (a branch of facial nerve) is described as "joining" the lingual nerve^[7], clearly contradicting topography and considering (rather surprisingly) functional connection.

"The special sensory component of the facial nerve transmits taste through the chorda tympani which "leaves" the lingual nerve and enters the skull through the petrotympanic fissure. The chorda tympani then joins the geniculate ganglion on the medial wall of the tympanic cavity^[11].

In the infratemporal fossa, topographically speaking, the chorda tympani "appears" to be branching off the lingual nerve and taking the example of the superior root of ansa (being a branch of hypoglossal nerve), chorda tympani shall become a branch of lingual nerve, not of facial!! It can as well be described as follows: The lingual nerve gives off a branch called chorda tympani in the infra temporal fossa which enters the middle ear through petrotympanic fissure to join the facial nerve and under the lingual nerve distribution, chorda tympani shall be included. In one case it is the topography (as is the convention to class all the off shoots from a parent nerve as its "branches") and in another, functional association is the criterion to classify as a "branch" is somewhat inexplicable.

Question: What is the insertion of Quadriceps femoris?

The usual answer (in most of the instances):

The base of patella and via ligamentum patellae to the tibial tuberosity (in that order) for that is description one finds in the text book.

A large and powerful muscle like quadriceps femoris, a great extensor of the knee getting inserted to a sesamoid bone is baffling if not amusing. The strong tendon of quadriceps is named "patellar ligament" (patellar tendon by some authors) and the vast expansions from the vasti are called "patellar retinacula" and the truth that it is the tibial tuberosity which it should be emphasised as the main insertion point (if extension of the knee is required) is given lesser preference in the text books and the students of anatomy (in general) believe as much.

Robert Walmsley in his article titled "the development of patella" writes "the patella develops behind the quadriceps tendon and independently of it" and "it is clear therefore that the patella retains in these later stages of development the same relation to the quadriceps mass that its primary rudiment had in the 20mm stage, that is, it interrupts the continuity of most of its fibers so that the vasti and rectus femoris proceed to their tibial insertion through it"^[12].

Harold Ellis comments: "It is interesting that, following complete excision of the patella for a comminuted fracture, knee function and movement may return to 100% efficiency; it is difficult, then, to ascribe any particular function to this bone"^[13].

In most of the cases of unilateral or bilateral absence of the patella without any other essential defect, the function of the knee has been normal^[14].

Currently, much of the literature describes the quadriceps femoris insertion into the patella as a common tendon with a three-layered arrangement: Rectus femoris being the most superficial, Vastus medialis obliquus and Vastus lateralis forming the intermediate, and Vastus intermedius being the deep layer. The true insertion of the quadriceps femoris is into the tibial tubercle, but convention considers it as inserting into the patella through the quadriceps tendon or the suprapatellar tendon, and the part distal to the sesamoid bone is known as the patellar ligament (ligamentum patellae), patellar tendon, or infrapatellar tendon^[15].

The patellar extensor apparatus is composed of the quadriceps muscles that converge to a central tendon that inserts on and invests the patella. It continues by the patellar tendon to act on the tibial tuberosity and thereby extends the leg at the knee^[16].

Inguinal canal is described as extending from the deep ring to the superficial ring (hence its length being 3 to 4 cm) while in clinical practice it is seen that the indirect inguinal hernia extends till the bottom of scrotum (or to mons pubis or labium majus in females). The gubernaculum is described as extending from the bottom of future scrotum to the lower pole of the developing testis and regarded as one of the factors which bring the testis down to scrotum. The scrotum is an extension of all the layers of anterior abdomen and how the various layers of it are represented in the layers of scrotum and spermatic cord is very well known. Indirect inguinal hernia does not stop at deep inguinal ring.

In many institutions, changing educational approaches have resulted in the phasing out of traditional topographical anatomy courses that included dissection. In their place have appeared integrated courses which incorporate imaging and clinical anatomical relevance^[17].

Terms like roof and floor (roof and floor of popliteal fossa, cubital fossa, floor of the fourth ventricle and of the various triangles in the neck to quote a few) refer to the body in supine or prone position (as the case may be) which goes against the convention that the descriptive terms shall be applied to the body in anatomical position.

Question: Name the nerve passing the mandibular foramen?

Answer (by a significant number of students): Mandibular nerve.

If only this foramen is named the inferior alveolar foramen, the answer would (expectedly) be the inferior alveolar nerve and the purpose is served. Similarly, the students seem to be having difficulty in recalling the structures passing through the mandibular notch. This could have been named "masseteric notch" as the masseteric vessels and nerve pass through it. (The chances of mentioning the masseter cannot be ruled out though!)

Certain foramina in the cranial cavity continue to be known by their shapes which do not give any idea of the structures passing through them like the foramen rotundum and foramen ovale which could be named maxillary foramen mandibular foramen and in that order, indicating the nerves passing through them (a la optic canal). Similarly the foramen spinosum, though refers to the spine of sphenoid, could have been the middle meningeal foramen.

CONCLUSION

It is apparent that such changes as it may prove necessary to introduce will take time to become absorbed into general medical terminology, but such terms as dorsivertebrae, Poupart's ligament, musculo-spiral nerve, and internal lateral ligament of the knee-joint" have in the space of 40 years almost entirely been replaced by the terms "thoracic vertebrae, inguinal ligament, radial nerve, and medial ligament of the knee-joint," respectively.

The revision of anatomical nomenclature was properly the responsibility of anatomists. They were well aware that it was most important to obtain the sympathetic co-operation of all who are actively concerned with the teaching of medical students (T.B. Johnston)^[17].

The superior root of ansa should not be described under the branches of hypoglossal nerve as it is not originating from the hypoglossal nucleus in the medulla oblongata. It is as fallacious as describing chorda tympani as a branch of lingual nerve. The meningeal branch also should not be grouped under the branches of hypoglossal nerve as this would clash with the functional components. All these can be kept as communications of the hypoglossal nerve. The quadriceps femoris is inserted to tibial tuberosity and the expansions from the vasti are attached to the tibial condyles. Undue importance to the patella may be avoided. It is not to undervalue the role played by the patella during the extension at the knee but describing it as the primary insertion point of quadriceps is erroneous as discussed previously. Terms like patellar retinacula, patellar ligament may be replaced with quadriceps expansions and quadriceps tendon. The continuation of the misnomer "aponeurosis" (apo=from; neurosis= nerve) (Latin) in anatomy is very well known, for want of a better term perhaps.

Patella shall remain only as "the largest sesamoid bone" that develops in the quadriceps tendon.

As a skeletal muscle is expected to act on its insertion, the quadriceps shall act (it does indeed) on tibia, not on the patella.

"His (Galen's) theories dominated and influenced the western medical science for more than 1,300 years. His anatomical reports, based mainly on dissection of monkeys, especially the Barbary Macaque, remained uncontested until 1543 (Wikipedia)^[18].

It may not be right to say "ambiguity can be used as a pedagogical trick, to force students to reproduce the deduction by themselves".

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