Acta med. nagasaki. 11 : 156–163

The Musculi Suboccipitales of the Formosan Monkey

Ryosuke, MIYAUCHI *

First Department of Anatomy,
Faculty of Medicine, Nagasaki University
Nagasaki, Japan

Receined for publication January 5, 1967

The suboccipital muscles of the Formosan monkey consisted of four muscles, namely the Mm. obliquus capitis superior et inferior and Mm. rectus capitis posterior major et minor. The author considered the state of origin, insertion, innervation and arterial distribution of these muscles using a relatively large sample of cases for the determination of the standard types.

Studies involving a large number of cases, with statistical consideration of the findings, have rarely been done on the Mm. suboccipitales of primates, particularly for any single species of macaca. The present study was conducted as part of the "Anatomical Study of the Formosan monkey" being continued by this department under the supervision of prof. J. Satoh, using a large number of cases to determine the normal form (typical type) of various characteristics by statistical consideration of the findings.

The material for study consisted of 41 bodies (male 22, female 19) of adult Formosan monkey (Macaca cyclopis, *shwinhoe*) selected at random from among the Satoh collection preserved in this department. All observations were done with the utmost care using magnifying lenses with an illumination attachment.

The Mm. suboccipitales (Mm. occipito-vertebrales) appear to be suboccipital muscles in view of their location, but their origin and insertion put them into the deep cervico-occipital muscle group (Figg. 1 and 2).

1. M. obliquus capitis inferior

This muscle, which arises from the spinous process of the second cervical vertebra, forms a fusiform belly that runs latero-upward and slightly forward to insert into the transverse process of the first cervical vertebra.

* 宮 内 亮 輔

At both areas of the origin and insertion, there is a small amount of superficial tendon fiber on the dorsal surface and upper and lower surface.

Table 1. Nerve supply in *m. obliquus capitis inferior*

cervical nerves	left	right	both sides
C1	1 (2.5%)	0 (0%)	1 (1.3%)
C1, C2	1 (2.5%)	2 (5%)	3 (3.8%)
C2	38 (95%)	38 (95%)	76 (95%)

Nerve supply (Table 1)

This muscle is usually supplied by only the medial branch of the second cervical nerve (95%), which separates into 3 or 4 branches that enter from the lower and dorsal surfaces of the lateral aspect of this muscle.

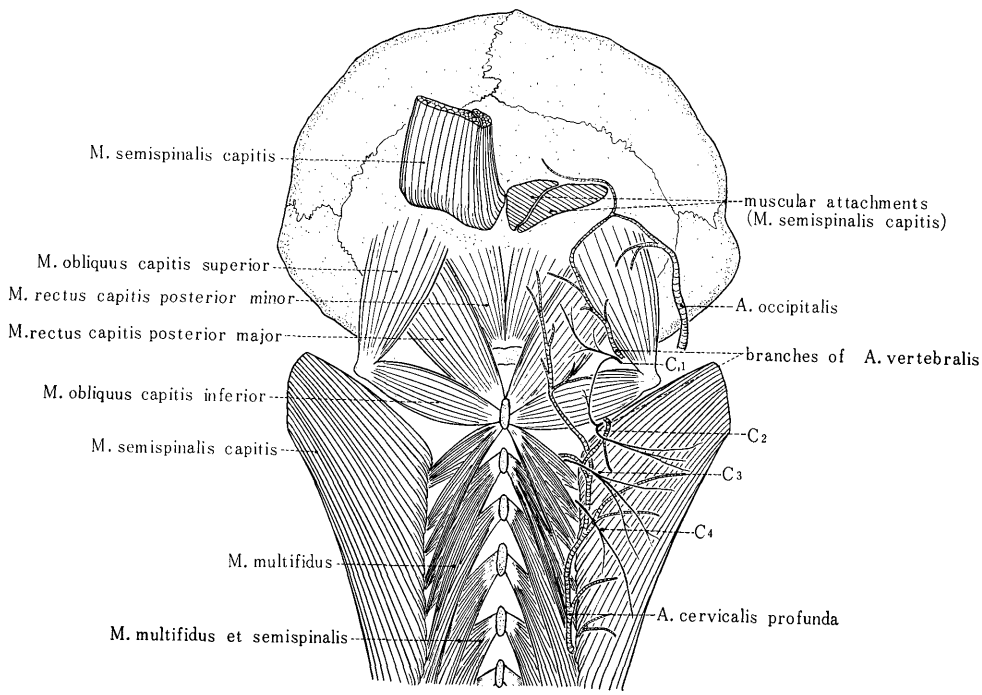

Fig. 1 Suboccipital muscles (posterior aspect)
(On the left side the arteries and nerves have been removed)

In rare cases, besides being innervated by the second cervical nerve, an additional medial branch from the first cervical nerve may enter from the upper edge of the lateral side (3.8%) or the nerve supply may be by only the medial branch of the first cervical nerve (1.3%).

In man, this muscle is reported to be doubled in rare instances (Macalister), or the muscle bundle may separate and extend as far as the mastoid process (Dursy). Such insertion of one part of the muscle bundle into some other site has also been found in Gorilla by Deniker and in Chimpanzee by Gratiolet, but such a variation was not noted in Macaca cyclopis.

The nerve supply is said to be always by both the first and second cervical nerves in man (Eisler) which differs from the situation in Macaca cyclopis where innervation is almost always by only the second cervical nerve.

2. M. obliquus capitis superior

This muscle, arising from the process of the first cervical vertebra, gradually increases in medio-lateral width to from a flattened cylinder as it runs upward and slightly medialward. At its insertion into the area below the inferior nuchal line, it spreads out in nearly a triangular form.

Moreover, the state of insertion is such that the insertion of the deeper muscle bundles is farther down away from the inferior nuchal line so that the entire length of the deepest muscle bundle is only about half of the total length of the most superficial muscle bundle.

Furthermore, the medial edge of this muscle lies a little on top of the insertion of the M. rectus capitis major, but they are not adhered to each other.

An exceptional case was found in which the M. longissimus cervicis, not only inserted into the transverse process of the atlas but the greater part of the muscle bundle extended latero-upward beyond the transverse process to continue into the lateral edge of the upper part of this muscle (1.3%).

Table 2. Nerve supply in m. obliquus capitis superior

cervical nerves	left	right	both sides
C1, C2	6 (15%)	2 (5%)	8 (10%)
C1	34 (85%)	38 (95%)	72 (90%)

Nerve supply (Table 2)

This muscle is usually innervated by the medial branch of the first cervical nerve which enters from the lower lateral edge of this muscle (90%). Occasionally, there are cases which are supplied by, in addition to the first cervical nerve, a medial branch from the second cervical nerve that enters this muscle from the lower dorsal surface (10%).

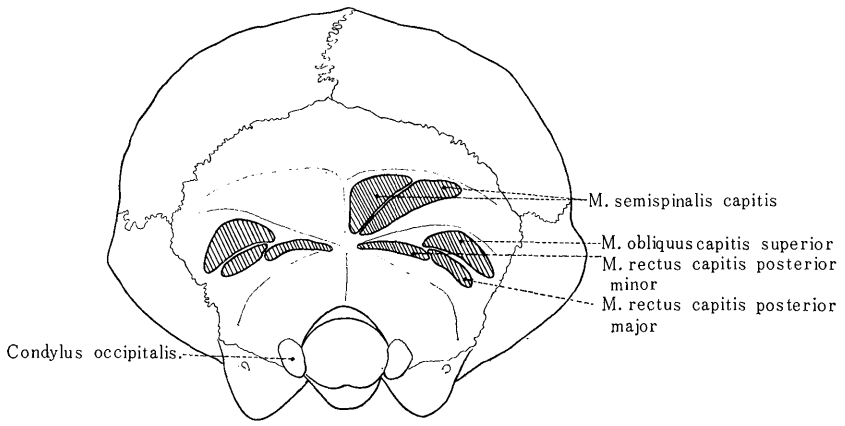

Fig. 2 Muscular attachments on the cranial bone (posterior aspect)

In man, separation of this muscle into 2 layers has been reported (Flower and Murie, Macalister), but such a separation or insertion into the mastoid process such as reported in Chiromys by Zuckerkandle could not be found in Macaca cyclopis.

3. M. rectus capitis posterior major

This muscle, which arises from the spinous process of the second cervical vertebra, spreads out mildly like a fan as it courses latero-upward. This muscle enters beneath the medial edge of the M. obliquus capitis superior. At the same time, this muscle lies on top of the lateral edge of the M. rectus capitis posterior minor. Therefore, this muscle inserts by a considerably thick bundle into the area on the lower surface of the inferior nuchal line of the occipital bone below the insertion of the M. obliquus capitis superior and on the latero-lower side of the M. obliquus capitis posterior minor.

Furthermore, the upper margin of the insertions of this muscle and the M. obliquus capitis posterior minor forms an arch which extends to the occipital protuberance.

Exceptional cases included 1 case in which the muscle bundle of the lateral 1/4 of this muscle showed partial longitudinal separation (1.9%) and 1 case in which there was complete separation into 2 layers except at the area of origin (1.3%).

Table 3. Nerve supply in m. rectus capitis major

cervical nerves	left	right	both sides
C1	32 (80%)	29 (72.5%)	61 (76.3%)
C1, C2	8 (20%)	11 (27.5%)	19 (23.8%)

Nerve supply (Table 3)

This muscle is supplied by the dorsal branches of the first and second cervical nerves.

Usually, innervation is by 1 to 3 branches from only the medial branch of the first cervical nerve which enter from the dorsal surface of the belly of this muscle (76.3%) while, in other cases, there is the additional supply by the medial branch of the second cervical nerve (23.8%).

Further, in the latter instance, the condition of innervation may be devided into 2 forms. That is, the second cervical nerve may cross over the dorsal surface of the belly of the M. obliquus capitis inferior and run medio-upward to directly supply this muscle by entering from the dorsal surface of the belly, or the branch supplying the M. obliquus capitis inferior may further divide and extend to supply this muscle from the dorsal surface of the belly.

Eisler claims that the origin of this muscle is displaced downward in lower mammals, but the state of origin as well as the nerve supply in Macaca cyclopis is very similar to that in man. Further, in man, the exceptional finding in Macaca cyclopis of longitudinal separation into the medial and lateral muscle bundles is said to be relatively frequent (Eisler), while others report that such division into 2 parts is rare (Mori, 4%).

Moreover, there are reports of union of the muscles of each side (Mori) or receipt of accessory slips from the M. rectus capitis posterior minor or the M. obliquus capitis inferior (Mori, 8.0%), but such findings could not be found in my cases of Macaca cyclopis.

Separation into the deep and superficial layers, such as found in my cases of Macaca cyclopis, apparently has not been reported elsewhere.

4. M. rectus capitis posterior minor

This muscle, which arises tendinously as a strong muscle bundle from the spinous process of the first cervical vertebra, spreads out in fan shape in upward and latero-upward direction. The lateral part of this muscle bundle is covered by the medial part of the M. rectus capitis major and inserts almost entirely by muscle into the lower part of the inferior nuchal line of the occipital bone.

The upper margin of the insertion of this muscle forms an arch with convexity toward the origin and, therefore, the medial tip of the upper margin is adjacent to the medial tip of the inferior nuchal line but the more lateral portion becomes farther below the inferior nuchal line.

An exceptional case was noted in which an incomplete superficial

longitudinal separation was present at about the middle of this muscle (13%).

Nerve supply

This muscle is supplied solely by the medial branch of the first cervical nerve. This nerve after innervating the M. rectus capitis posterior major enters from the dorsal surface by piercing this muscle near its medial edge. There was no case, such as in man, in which the occipital nerve contributed in addition to the first cervical nerve.

The above condition noted in Macaca cyclopis considered to be the normal type in man also (59.8%), but this muscle may also frequently be absent (25.4%), and the separation of this muscle into 2 or 3 parts, the signs of which could be found in my cases, is reported to be present in a few cases (Mori).

5. M. atlanto-mastoideus

This is a small muscle located on the lower surface of the M. splenius, medial to the M. longissimus capitis, and is supplied by the dorsal branch of the first cervical nerve. According to Mori, it is a separation from the same anlage as the M. longissimus capitis and M. obliquus capitis superior.

In man, its presence is exceptional (17.5%, Mori) and has been reported in Gorilla (Sommer, Eisler) and Chimpanzee (Gratiolet) but not a single case could be found in Macaca cyclopis.

6. The arteries supplying the Mm. suboccipitales

The A. cervicalis profunda, as it ascends between the M. semispinalis capitis and M. transverse spinalis, gives off branches to these muscles, and then, after anastomosing with the branches of A. vertebralis that emerge from between the first and second transverse processes and from between the second and third transverse processes, it passes in medio-upward direction across the dorsal surface of the belly of M. obliquus capitis inferior, M. rectus capitis posterior major and M. rectus capitis posterior minor, but during its course branches are given off to these muscles.

On the other hand, the branch of the A. vertebralis which emerges from the space formed between the base of the skull and the first transverse process, in other words, by the M. obliquus capitis superior and inferior and the M. rectus capitis posterior major, progresses medio-upward along the medial edge of the M. obliquus capitis superior to the vicinity of the medial portion of the insertion of the M. obliquus capitis superior where it anastomoses with the A. occipitalis, but during its course branches are given off to the dorsal surface of

the M. obliquus capitis superior and M. rectus capitis posterior major and minor.

Furthermore, the A. occipitalis as it runs medialward along the line of insertion of the M. obliquus capitis superior, gives off branches to the dorsal surface of this muscle, but in rare instances, it is well developed and gives off branches to the dorsal surfaces of the M. rectus capitis posterior major and minor in the region near their insertion.

Summary

The term Mm. suboccipitales applied to this group of muscles is simply a name from the topographical anatomical standpoint and more appropriately it should be called the deep cervico-occipital muscle group.

1. M. obliquus capitis inferior

The origin is from the transverse process of the second cervical vertebra and inserts into the transverse process of the first cervical vertebra.

No duplication, separation or abnormal form of this muscle could be found.

Nerve supply most frequently is by only the medial branch of the second cervical nerve with rare cases in which there is the additional participation by the medial branch of the first cervical nerve besides the second cervical nerve or there may be supply by only the first cervical nerve.

2. M. obliquus capitis superior

This muscle arises from the transverse process of the first cervical vertebra and inserts into the lower region of the inferior nuchal line.

The nerve supply is usually by the medial branch of the first cervical nerve and there occasionally is supply by the medial branch of the second cervical nerve as well as the first cervical nerve.

3. M. rectus capitis posterior major

The origin is from the spinous process of the second cervical vertebra and inserts into the surface below the inferior nuchal line of the occipital bone.

The nerve supply is by the dorsal branches of the first and second cervical nerves.

Exceptional cases in which there is partial separation of the muscle bundle into 2 parts or separation into deep and superficial layers were

found.

4. M. rectus capitis posterior minor

The origin is from the spinous process of the first cervical vertebra and insertion is into the inferior nuchal line of the occipital bone.

The nerve supply is by the first cervical nerve.

5. M. atlanto-mastoideus

Not a single case was found.

6. Arteries that supply the Mm. suboccipitales

The arteries distributed to these muscles are branches from the A. cervicalis profunda, A. vertebralis and the A. occipitalis.

References

1) Deniker, J. : 1885, Recherches anatomiques et embryologiques les sings anthropoides. Arch. Zool. exper. , 3
2) Dursy : cited from Eisler
3) Eisler, P. : 1912, Die muskeln des Stammes (Bardeleben : Handbuch der Anatomie des Menschen). Jena
4) Flower and Murie : 1867, Account of the dissection of a Bushwoman. J. Anat. and Physiol. , 1
5) Gratiolet, L. P. et Alix, P. H. : 1866, Recherches sur l'anatomie du Troglodytes. Arch. Mus. Hist. Nat. Paris, 2
6) Macalister, A. : 1867, Notes on muscular anomalies in human anatomy. Proc. Roy. Irish Acad., 9
7) Mori, M. : 1964, Statistics on the Musculature of the Japanese. Okajimas Fol. Anat. Jap., 40
8) Sommer, A. : 1907, Das Muskelsystem des Gorilla. Jena. Z. Naturw., 42
9) Zuckerkandle, E. : 1899, Zur Anatomie von chiromys madagascariensis. Denkschr. K. Akad. d. Wiss., Math.-naturw. Kl. , 48