The Superficial Dorsal Muscle Group in Formosan Monkey

II. Second Layer of the Superficial Muscle Group
(Mm. atlantoscapulares anterior et posterior and M. rhomboideus)

By

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According to classification by Eisler, the muscles of the nape and back (Mm. dorsi) are divided into the superficial and deep dorsal muscle groups with further subdivision of the former into the first layer (M. trapezius and M. latissimus dorsi) and second layer (Mm. atlantoscapulares anterior et posterior and M. rhomboideus). Previously, Fukui (1967) in this laboratory reported on the first layer of the superficial back muscle groups, so in the present paper, the muscles of the second layer and, furthermore, the arteries that are distributed to the superficial dorsal muscles will be described.

The material for this investigation is the same as that used by Fukui, namely, that consisted of 41 formalin-fixed bodies of adult Formosan monkey (Macaca cyclopis, Swinhoe) selected at random from among Prof. Satoh's specimen preserved in this department.

The inspection was conducted using magnifying lenses.

Findings and consideration

I. Muscles of the second layer of the superficial region

1. M. atlantoscapularis anterior (figure 1)

This muscle, which appears to be a cylinder flattened on the medial and lateral sides, arises in the greater majority of cases from the processus transversus of the atlas (95.6%) and, in rare cases, from the processus transversus of the 1st and 2nd cervical vertebrae (4.4%). It is never absent.

The lateral surface and medial side of the origin is muscular, whereas the medial surface forms a superficial fascia which closely adheres to the lateral surface of the M. atlantoscapularis posterior.

The muscle bundles of this muscle twist outward as they run laterally downward, and the transverse width gradually increases to
become a wide, flattened muscle bundle which inserts, in the greater majority of cases, into the acromion and the lateral 1/2 to 1/3 of the upper margin of the spina scapulae (98.5%) and, in rare cases, into the extremitas acromialis of the clavicle (1.5%).

The origin of this muscle, as previously mentioned, is almost always fused with the origin of the M. atlantoscapularis posterior. In addition, there occasionally is adhesion with the tendon of the M. splenius which inserts into the atlas, and in rare instances, the dorsal surface of the insertion of this muscle is adhered with the anterior surface of the insertion of the M. trapezius into the spina scapulae.

Occasionally, there is a longitudinal sulcus, about 3 cm wide, in the fascia of the muscle through which the 4th cervical nerve passes (8.8%).

The variations noted included 1 case in which, in addition to the fusion of the insertion of this muscle with the M. trapezius, a small fasciculus was given off which continued into the anterior surface of the M. trapezius (figure 2-a); cases in which the origin
was not only from the process of the atlas but also from the axis; a case with muscular insertion also into the lateral side of the clavicle (figure 2-b); and further a case in which a small fasciculus separating from the back surface of this muscle, near its middle, inserted by muscle into about the middle of the upper edge of the scapula. Moreover, this fasciculus was innervated by the anastomosing branch of the 3rd and 4th cervical nerves (figure 2-c).

**Nerve supply:** (table 1)

This muscle is innervated by the 3rd and 4th cervical nerves. Most frequently the supply is by both the 3rd and 4th cervical nerves (76.5%). In the remaining cases it was by only the 4th cervical nerve (23.5%). There was no case in which the innervation was by only the 3rd cervical nerve.

When the innervation was by the 3rd and 4th cervical nerves these 2 entered the muscle from the back surface independently, but in rare cases an anastomosing branch of the 3rd and 4th cervical branch was received (10.3%).

<table>
<thead>
<tr>
<th>side</th>
<th>cervical nerve</th>
<th>left</th>
<th>right</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C₄</td>
<td>8 (23.5%)</td>
<td>8 (23.5%)</td>
<td>16 (23.5%)</td>
</tr>
<tr>
<td></td>
<td>C₃, C₄</td>
<td>26 (76.5%)</td>
<td>26 (76.5%)</td>
<td>52 (76.5%)</td>
</tr>
</tbody>
</table>

This muscle has been assigned a variety of names such as M. omocervicalis (Miller, Bischoff), etc., and Schück considers this to be a separation from the same cervical myotome as the clavicular portion of the M. sternocleidomastoideus and the occipital fasciculus of the M. trapezius (M. cleidooccipitalis). According to the report of Howell and Strauss, the Mm. atlantoscapulares is the atlantic part of the M. serratus anterior, being a displacement of the insertion to the shoulder, and represents the levator scapulae element. In higher primates, the atlantoscapular and the upper cervical portions of the Serratus sheet are retained so as to form the M. levator scapulae (Howell and Strauss).

In man, it usually is not found as an independent muscle. It is noted only in rare cases (2%) as a variation (Wood, Macalister). This muscle is reported to be absent occasionally even in Anthropopithecus troglodytes (Chimpanzee) (Kohlbrügge, Sutton),
but it generally is never absent in primates (S ch ü c k).

In most of these cases, similar to the condition in my Macaca
cyclopis, the origin is from the processus transversus of the atlas,
but in addition, there are cases of origin from the atlas and axis
(Inuus and Cynocephalus—L e c h e) (Orang-St e w a r t, M i c h a e l i s).
The origin may sometimes be even lower from the processus
mastoideus (Chimpanzee-M i c h a e l i s).

The site of insertion is quite variable even in primates. Accord-
ing to S c h ü c k, the insertion is as far as the acromion in Nycti-
cebus tardigradus, Lemur macaco and Cebus apella; the spina
scapulae as well as the acromion in Cebus flareus, Cynocephalus
babuin, Macacus mauros, and Cercopithecus patas; the acromion
and extremitas acromialis of the clavicle in Hylobates syndactylus (gibbon)
and Ateles ater; the Lig. cleidoangularis in Hylobates syndactylus;
and the extremitas acromialis of the clavicle in Hylobates synd-
actylus, Simia satyurs (orang) and Anthropopithecus troglodytes.
Further, H o w e l l and S t r a u s have reported insertion extending
to the acromion and spina scapulae in Macacus rhesus, while S t e-
w a r t has mentioned insertion into the upper surface of the clavicle
in Gorilla, Chimpanzee, Orang, Gibbon, etc. Moreover, even in the
report of J o u f f r o y, the insertion in such lower monkey as
Prosimiae, Platirrhinae, Catarrhinae, etc., is as a rule the acromion,
while it consistently is the clavicle in anthropoid apes.

Therefore, the insertion is the spina scapulae and acromion in
lower monkeys but in higher monkeys, in other words, in Hyloba-
tidae and anthropoid apes, the insertion gradually moves to the
clavicle.

The nerve supply to this muscle in primates is primarily by
the 3rd and 4th cervical nerves (S c h ü c k) and the condition is
similar even in Macaca cyclopis.

Innervation by only the 4th cervical nerve, such as found in a
small number of cases among my Macaca cyclopis, has been reported
in Hylobates syndactylus, Cynocephalus babuin and Lemur macaco
(S c h ü c k), as well as in Semnopithecus and anthropoid apes (K o h l-
br ü g e, B o l k, E i s l e r). Supply by only the 3rd cervical nerve,
which was not found in Macaca cyclopis, has been reported in
Nycticebus tardigradus, Ateles ater, Hylobates syndactylus, Simia
satyurs and Anthropopithecus troglodytes (S c h ü c k) and in Sem-
opithecus and anthropoid apes (K o h l b r ü g e, B o l k, E i s l e r).

2. M. atlantoscapularis posterior (figure 1, 3)

This muscle arises, adhered to the M. atlantoscapularis anterior,
from the processus transversus of the atlas. At the origin, only
the lateral surface is superficially tendinous and the other parts are muscular. The muscle bundle, which is wide antero-posteriorly at the origin, undergoes torsion as it runs backward and downward to below the scapula, so that the muscle fibers originally in the anterior part run to the lateral side, while the fasciculus of the posterior part run to the medial side. During its course, it also gradually increases in width to insert into the angulus superior of the scapula and into one part of the fossa supraspinata, but the medial portion becomes tendinous from this region to enter beneath the lower surface of the M. rhomboideus with which it fuses and inserts into the upper part of the medial edge of the scapula.

The anterior surface (lower surface) of this muscle covers the dorsal surface of the neck of the M. serratus anterior, but they can be almost completely separated, and it is infrequent that there is some degree of adhesion.

Variations noted include 1 case in which a small fasciculus separating from the medial edge of the M. atlantoscapularis posterior, near its origin, ran medio-downward to continue into the lateral edge of the rhomboideus capitis (figure 3-a), and in another case, a small fasciculus which separated from about the center of the M. splenius ran latero-upward to continue into the medial surface of the M. atlantoscapularis posterior, near its origin (figure 3-b).

Nerve supply (table 2):
Branches from the 3rd and 4th cervical nerves are received, but in the majority of cases, the supply is by only the 4th cervical nerve (76.3%). There are a few cases of innervation by the 3rd and 4th cervical nerves (15%), or by only the 3rd cervical nerve (8.8%). In all instances, the nerve branch enters from the lower surface
(anterior surface) of the muscle. When the supply was by branches of both the 3rd and 4th cervical nerves, they entered the muscle independently or after forming an anastomosing branch in about an equal number of cases, respectively.

Table 2. Innervation of M. altantoscapularis posterior
(Macaca cyclops)

<table>
<thead>
<tr>
<th>cervical nerve</th>
<th>left</th>
<th>right</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₂</td>
<td>3 (7.5%)</td>
<td>4 (10.0%)</td>
<td>7 (8.8%)</td>
</tr>
<tr>
<td>C₃, C₄</td>
<td>6 (15.0%)</td>
<td>6 (15.0%)</td>
<td>12 (15.0%)</td>
</tr>
<tr>
<td>C₄</td>
<td>31 (77.5%)</td>
<td>30 (75.0%)</td>
<td>61 (76.3%)</td>
</tr>
</tbody>
</table>

As previously mentioned, this muscle should be considered to be the incomplete form of the M. levator scapulae in higher primates. It is said that the M. levator scapulae and the M. serratus anterior are a single muscle in Prosimiae and lower monkey, and that they are found as independent muscles in higher apes. According to S c h ü c k, the distinction between these two muscles in lower monkey is possible by the space which is formed to some degree due to the disappearance of 1 or more fasciculi (that arise from the processus transversus of the cervical vertebra). When there is no disappearance of muscle and, thus no formation of a space, a fasciculus having

Table 3. Relation of M. levator scapulae and M. serratus anterior

<table>
<thead>
<tr>
<th>species</th>
<th>origin of Proc. transversus of the cervical vertebra which corresponds to M. levator scapularis</th>
<th>origin of Proc. transversus of the cervical vertebra of M. serratus anterior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nycticebus tardigradus</td>
<td>1, 2, 3, 4 (Proc. transversus)</td>
<td></td>
</tr>
<tr>
<td>Lemur macaco</td>
<td>2, 3</td>
<td>5, 6</td>
</tr>
<tr>
<td>Ateles ater</td>
<td>1, 3, 4</td>
<td>6, 7</td>
</tr>
<tr>
<td>Cynocephalus babuin</td>
<td>1, 2, 3</td>
<td>5, 6, 7</td>
</tr>
<tr>
<td>Cercopithecus patas</td>
<td>1, 2, 3</td>
<td>5, 6, 7</td>
</tr>
</tbody>
</table>

1) Some cases in which there are spaces between fasciculi

2) Other cases in which no spaces but independent muscles are seen

Cebus apella          | 1                                                                                           | all                                                                       |
| Macacus maurus       | 1, 2                                                                                        | all                                                                       |
some independence is used as the index for the differentiation (table 3).

In contrast to this, a distinction between these two has not been made, but described as the M. trachelocostoscapularis with separation into the portion arising from the cervical vertebra and the portion from the rib in Erythrocebus by Virchow, in Cercopithecus and Ateles by Forster, and in Macacus rhesus by Nishi. Further, Howell and Straus have mentioned that, in Macacus rhesus, the M. atlantoscapularis posterior and M. serratus anterior form a continuous muscle, which extends from the atlas to the thorax, by the part corresponding to the portion reported by Nishi as arising from the cervical vertebra, particularly that part having origin from the 1st cervical vertebra whereas in higher primates, the M. levator scapulae is formed by the fasciculus of the M. serratus anterior that arises from the upper cervical vertebrae and the M. atlantoscapularis posterior.

Kohlguggge has considered the muscle bundles arising from all cervical vertebrae in Semonopithecus to be the M. levator scapulae although there is union with the M. serratus anterior at its lower edge. A similar description has been made by Bischoff for Cynocephalus maimon, Cercopithecus sabaeus, C. callitrichus, Macacus cynomolgus, Hepale penicillata, etc.

Thus, in lower monkey, in which there is no definite separation of the M. levator scapulae and M. serratus anterior, the cervical fasciculus of the M. serratus anterior or possibly the fasciculus demonstrating some degree of independence serves as the M. levator scapulae.

The condition in my cases of Macaca cyclopis was similar to that in Cebus apella of Schuck and in Macacus rhesus of Howell and Straus, etc., in that a single muscle was present with no separation of the portions corresponding to the M. levator scapulae and M. serratus anterior, and among the cervical muscle bundles arising from all cervical vertebrae, only that fasciculus from the atlas showed some degree of independence. Therefore, the classification and nomenclature of Howell and Straus were adopted.

3. M. rhomboideus (figure 1, 4, 5)

This is a well developed muscle consisting of 2 parts, the Rhomboideus capitis and the Rhomboideus vertebrae.

1) The Rhomboideus capitis, in other words, the fasciculus arising from the occipital region, was present in all cases examined. The greater part of it arose from the protuberantia occipitalis externa and the linea nuchae superior, but there were a few cases
in which the part arising from the medial tip of this area of origin was absent (5 cases, 6.1%, figure 4, III b, IV b).

Furthermore, this fasciculus having origin from the occipital region arises by muscle over a width of 2.8-1.0 cm. It is comparatively thin, and as it descends sharply latero-downward, it gradually decreases in width to insert into the angulus superior scapulae.

2) On the other hand, the Rhomboideus vertebrais, in other words, the fasciculus from the vertebral region, arises from the Lig. nuchae and the processus spinosus and Lig. interspinale in the area extending from the 7th cervical vertebra to the 4th or 7th thoracic vertebra. Moreover, the upper tip of this origin (Lig. nuchae) extends in the majority of cases to the protuberantia occipitalis externa (55 cases, 67.1%), but in a comparatively large number of cases, it did not extend so far (27 cases, 32.9%). The lower tip in most cases was either the 5th thoracic vertebra (41.4%) or the 6th thoracic vertebra (48.8%) (table 4). Moreover, the greater part of the origin was muscular with only the lower tip being tendinous. It runs latero-downward to insert into the angulus superior, margo medialis and angulus inferior of the scapula. This fasciculus arising from the vertebral region is thicker than that from the occipital region and, the closer to the insertion, the thicker it becomes.

<table>
<thead>
<tr>
<th>Proc. spinosus</th>
<th>Macaca cyclops (82 cases)</th>
<th>Macaca rhesus (100: Nishi)</th>
<th>Cercopithecidae (154: Pina)</th>
<th>Japanese (100: Nishi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 thoracic vertebra</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>12%</td>
</tr>
<tr>
<td>4</td>
<td>2.4%</td>
<td>-</td>
<td>5%</td>
<td>47%</td>
</tr>
<tr>
<td>5</td>
<td>41.4%</td>
<td>72%</td>
<td>17%</td>
<td>37%</td>
</tr>
<tr>
<td>6</td>
<td>48.8%</td>
<td>28%</td>
<td>44%</td>
<td>4%</td>
</tr>
<tr>
<td>7</td>
<td>7.3%</td>
<td>-</td>
<td>25%</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>-</td>
<td>-</td>
<td>9%</td>
<td>-</td>
</tr>
</tbody>
</table>

Furthermore, the upper portion of this muscle bundle descends at a sharper angle latero-downward with marked arrangement of the fasciculi in roof tile-like pattern, but in the lower part, it runs transversely laterwards, almost horizontally.

Separation of the fasciculus from the occipital region and that from the vertebral region was possible in some cases but not in others. In the former instance, the level of the 1st thoracic vertebra
was the boundary between these 2 in all cases. In these cases, the occipital fasciculus, as it approached the insertion, ran forward from the upper edge of the vertebral fasciculus, and inserted into the angulus superior scapulae by tendon, which spreads downward for some distance. The fasciculus from the vertebral region inserts into the scapula by a mixture of tendon and muscle (almost entirely muscular on the dorsal side and tendinous on the ventral side), but in doing so, it covers and adheres firmly to the tendon of the occipital fasciculus in the area of the angulus superior scapulae.

In the latter instance, in other words, cases in which there was no separation between these 2 fasciculi, insertion took place as a single body, muscular on the upper surface and partially tendinous on the lower surface, into the area extending from the angulus superior to the margo medialis and angulus inferior of the scapula. Occasionally, in the vicinity of the processus spinosus of the 1st thoracic vertebra, 1 portion of the muscle bundles from the vertebrae, in other words, that part arising from the cervical vertebrae, was given off separately so that this muscle was divided into 3 parts, that is, the Pars capitis, Pars cervicalis and the Pars thoracalis (4 cases, 4.9%). In these cases, the upper fasciculus, in other words, the cervical fasciculus, inserted into the area extending from the angulus superior to the upper third of the margo medialis of the scapula in such a fashion that it almost completely covered the dorsal side of the tendon of insertion of the occipital fasciculus, while the lower fasciculus, in other words, the fasciculus of the thoracic region, attached to the area extending from the lower 3/4 of the margo medialis to the angulus inferior of the scapula, in such a condition that it covered about the lower 1/2 of the cervical fasciculus. These, of course, were firmly adhered to each other at the insertion.

This muscle can be classified morphologically into 4 types according to the condition of separation (figure 4).

Type I is that in which it is entirely a single muscle with no separation at all (31.7%), type II barely shows evidence of separation into the Pars capitis and Pars vertebralis only at the region of origin (6.1%), type III is that where there is complete separation into the Pars capitis and the Pars vertebralis (57.3%), and type IV shows separation into the Pars capitis, Pars cervicalis and Pars thoracalis (4.9%).

Furthermore, it is possible to make subdivisions of type III into IIIa (52.4%) and IIIb (4.9%), as well as type IV into IVa (3.7%) and IVb (1.2%) according to whether the medial tip of the origin from the occipital region is absent or not.
The variations noted include a case where a small fasciculus, 0.2 cm wide arising from the Lig. nuchae, about midway between the fasciculus from the occipital region and that from the vertebral region, ran about 2.2 cm latero-downward to continue into the medial edge of the occipital fasciculus (1 case, case number 125, figure 5-a). In another case, the medial tip of the occipital fasciculus (width 0.5 cm, length 1.0 cm) separated and continued into the back surface, near the medial edge, of the cranial origin of the M. trapezius, instead of attaching to the linea nuchae superior (case number 125, figure 5-b).

![Diagram](image)

**Fig. 5**

**Nerve supply:**

The 3rd to 6th cervical nerves enter the M. serratus anterior (including the M. atlantoscapularis posterior) from the anterolateral side, and as they progress medio-backward within the muscle, branches are given off to the muscle. When about the middle part is reached, they emerge to the anterior surface of the muscles. They run medialward along the anterior surface to anastomose with

<table>
<thead>
<tr>
<th>Cervical nerve</th>
<th>Left</th>
<th>Right</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>C3, C4, C5</td>
<td>2 (4.9%)</td>
<td>1 (2.4%)</td>
<td>3 (3.7%)</td>
</tr>
<tr>
<td>C3, C4, C5, C6</td>
<td>4 (9.8%)</td>
<td>5 (12.2%)</td>
<td>9 (11.0%)</td>
</tr>
<tr>
<td>C4, C5</td>
<td>6 (14.6%)</td>
<td>9 (22.0%)</td>
<td>15 (18.3%)</td>
</tr>
<tr>
<td>C4, C5, C6</td>
<td>28 (68.3%)</td>
<td>25 (61.0%)</td>
<td>53 (64.6%)</td>
</tr>
<tr>
<td>C5, C6</td>
<td>1 (2.4%)</td>
<td>1 (2.4%)</td>
<td>2 (2.4%)</td>
</tr>
</tbody>
</table>
each other in the area near the upper part of the insertion of the M. rhomboideus, to form a plexus from which several branches are given off that distribute to the lower surface of the M. rhomboideus.

Innervation most frequently is by the 4th, 5th and 6th cervical nerves (64.6%) followed by the 4th and 5th cervical nerves (18.3%) (table 5).

The Rhomboideus capitis, which was always found in my cases of Macaca cyclopis, has been reported to be generally absent in man, as well as in anthropoid apes except the 1 case in Gorilla by Plattner, 3 cases of Orang by Pina and in Semnopithecidae with the exception of Semnopithecus nasicus of Kohlbrügge. In other primates, in other words, in Prosimiae and lower monkeys, it usually is present.

Even among anthropoid apes, in which it is absent as a rule, the presence of the Rhomboideus capitis has been noted in Chimpanzee by Gratiolet, in Gorilla by Bronn and Wood, and in Orang by Owen, Primrose, Barnard, Schück, etc. In contrast to this, among lower monkeys in which it usually is present, there are reports of cases of it being absent in Nycticebus tardigradus by Schück, in Propithecus microcebus of Jouffroy, as well as in Cercopithecidae of Pina.

Even when the Rhomboideus capitis is present, there apparently are differences in the form and area occupied by this muscle according to the species. That is, there are instances in which it has an extensive area of origin from the protuberantia occipitalis externa to the Linea nuchae superior (Cebus, Orang, etc.), or its lateral portion may disappear somewhat and be shifted medially (Cynocephalus), while in other cases, the medial portion may disappear and be limited to only the lateral part (Lemur, Ateles, Cercopithecus). Furthermore, the form may be also classified into that in which there is a single muscle sheet and that in which there is separation into 2 fasciculi.

The lower limit of origin of this muscle, according to Schück, is the 7th or 8th thoracic vertebra in anthropoid apes, and the 4th to 7th thoracic vertebra in other lower monkeys (table 6). The lower limit in the former instance (anthropoid apes) apparently is lower than in the latter case (lower monkey), but in a review of other authors literature, it has been reported to be the 5th (Nishi) or the 6th thoracic vertebra (Pina) in Cercopithecinae, the 5th or 6th thoracic vertebra in Semnopithecinae (Kohlbrügge), the 5th thoracic vertebra in Macacus rhesus (Nishi), the 5th (Virschow) or 4th thoracic vertebra (Plattner) in Chimpanzee and the 4th (Plattner) or the 3rd to 5th thoracic vertebra (Preuschoft).
Table 6. Comparison of lower limit of origin of M. rhomboideus (according to Schück)

<table>
<thead>
<tr>
<th>species</th>
<th>lower limit (Proc. spinosus)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nycticebus tardigradus</td>
<td>5 thoracic vertebra</td>
</tr>
<tr>
<td>Lemur macaco</td>
<td>5</td>
</tr>
<tr>
<td>Cebus apella</td>
<td>6</td>
</tr>
<tr>
<td>Ateles ater</td>
<td>7</td>
</tr>
<tr>
<td>Cynocephalus babuin</td>
<td>4</td>
</tr>
<tr>
<td>Macaca mauroy</td>
<td>7</td>
</tr>
<tr>
<td>Cercopithecus patas</td>
<td>5</td>
</tr>
<tr>
<td>Hylobates syndactylus</td>
<td>8</td>
</tr>
<tr>
<td>Semia satyrus</td>
<td>7</td>
</tr>
<tr>
<td>Anthropopithecus troglodytes</td>
<td>8</td>
</tr>
</tbody>
</table>

in Gorilla. Therefore results seem to be opposite to that of Schück, but in view of the small number of cases examined for each species, it is impossible to definitely point out any relation between the differences in the lower limit of the origin of this muscle and a phylogenic significance.

The lower limit of origin in many of my cases of Macaca cyclopis seemed to be slightly higher than in Cercopithecidae of Pina and a little lower than in Macacus rhesus of Nishi, but further study is required to determine the reason for this difference, whether it is due to the difference in species (table 4). It is reported that there is no racial difference in the lower limit of the origin in man (Nishi, etc.).

Previously, I have classified this muscle in Macacus cyclopis into 4 types according to the degree of the existence (or absence) of separation of the fasciculi and its location. When this classification of mine was applied here to the findings by Eisler, Schück, Kohlbrügge, Howell and Straus, Bolk, Nishi, etc., type I would include Cebus apella, Inuus, Cynocephalus, Cercopithecus and Macacus cynomolgus; type II would be Orang; type III would consist of Lemur, Ateles, Cebus hypoleucus, Macacus radiatus, Macacus rhesus (Nishi), Macacus mauroy and Semnopithecus nasius; and type IV would be Macacus rhesus (Howell and Straus).

It is interesting here that it is difficult to perceive any definite rule for the animals to belong to any particular type. There is no consistent type associated with Cebus or Macacus. This perhaps
could simply be attributed to the difference in species, but I will not believe that. For supposing so how can we explain the differences between the findings on the same Macacus rhesus by Nishi and Howell and Straus, though Nishi has even mentioned that a separation into 3 parts such as by Straus is too extreme.

The fact that the different types were seen at varying frequencies as my cases of Macaca cyclopis clearly indicates that it is not proper to reject the findings of others simply on the basis of one's own results. Differences in the findings may sometimes be due to the small number of cases examined as well as differences in species. In other words, the study of a large number of cases is prerequisite in any discussion.

In addition, Pina has classified this muscle in his examined 129 cases of primates into 4 types according to the original portion (his insertion). His type I corresponds to my types II, III and IV, and his IV comes to my I. Though the appearance of his type IV (my type I), however, is only a little more frequent than in my examined cases, his type I appears remarkably more frequent than mine (II, III and IV). Furthermore, according to his statistics the lower the monkeys are, the less frequent type I appears, and on the contrary, the higher they are, the more frequent type IV appears.

This muscle is reported as being present from reptilia in which it is found as a single sheet of muscle. Although the reason for the difference in the form of this muscle which was shown in my findings should be based upon a phylogenic study of a large number of cases, if I may be permitted to make a bold assumption based only on the findings in which it was described that the Rhomboideus capitis is frequently present in lower monkeys but absent in higher apes, it appears that my type I progresses to types II, III and IV, finally becoming the type where there is disappearance or absence of the origin from the occipital region, such as usually seen in many anthropoid apes and man. More detailed description might be added that these types can be imagined to take following order of change.

type I—II (Pina)→II—III→IV—III (Pina)

The nerve supply to this muscle in primates is said to be by the 3rd to 6th cervical nerves (Eisler) and the nerves in Macaca cyclopis were also found to be within this range.

The type in which the innervation is by the 4th to 6th cervical nerves, which was most common in Macacus cyclopis, has been reported in Lemur macaco by Schück and in man by Eisler. The type having supply by the 4th and 5th cervical nerves has been noted in Orang by Westling, in Hylobates, Lemur macaco, Orang
and Chimpanzee by Schück and in Gorilla by Eisler; while the type with innervation by the 3rd to 5th cervical nerves has been seen in Macacus maurus and Cercopithecus patas of Schück; and the type supplied by the 5th and 6th cervical nerves has been found in Macacus by Brooks and in Nycticebus by Schück. However, there is no report of innervation by the 3rd to 6th cervical nerves in primates. Further, supply by only the 3rd cervical nerve has been reported in Cynocephalus of Champeys, while supply by only the 4th cervical nerve has been noted in Prosimiae by Bolk, in Cebus apella, Cynocephalus and Hylobates by Schück, in Chimpanzee and gorilla by Hepburn, and in Gorilla by Eisler. There was innervation by only the 5th cervical nerve in Semnopithecus of Kohlbrügge, in Chimpanzee, Ateles after and Hylobates of Schück, in Orang of Hepburn and in Gorilla of Eisler; while there is control by the 3rd and 4th cervical nerves in Chimpanzee of Schück and in Gorilla of Eisler; and there is mention of supply by the 3rd and 5th cervical nerves in Cebus of Bolk. Such types of nerve supply were not found in Macaca cyclopis.

II. **Arteries distributed to the superficial dorsal muscles**

The arteries that are distributed to and supply the superficial dorsal muscles include the A. transversa colli, A. thoracodorsalis, A. transversa scapulæ and the Aa. intercostales, as well as, occasionally, the A. occipitalis.

The A. transversa colli, when it reaches the area near the boundary between the middle third and lower third of the anterior surface of the M. atlantoscapularis anterior, gives off branches that supply both the anterior and posterior surfaces of the area near the insertion of this muscle. It then emerges to the lower surface of the M. trapezius, from the medial edge of this muscle, to give off 2 main branches. This artery generally runs together with the N. accessorius and gives off many nutritive branches to the M. trapezius.

One of the above branches runs medially (toward the dorsal line) to the M. atlantoscapularis posterior. After supplying the central part of the dorsal surface and the lateral edge of this muscle, this branch runs further to supply the central part of the anterior surface (lower surface) of the Pars capitis of the M. rhomboideus or the region corresponding to this. Moreover, the nutritive branch extends a very short distance to the lower surface of the Pars vertebralis.

The other branch similarly runs medially, on the lower (caudal) side of the above branch, to supply the lateral surface and dorsal
surface of the area near the insertion of the M. atlantoscapularis posterior. It then enters into the lower surface (anterior surface) of the Pars capitis of the M. rhomboideus in the vicinity of its insertion, giving off nutritive branches into the surrounding area, and then anastomoses with the A. transversa scapulae, described below.

When the A. transversa scapulae, which runs between the fasciculi of the Pars cervicalis and Pars thoracalis, reaches the area of the upper part of the insertion of the M. rhomboideus, it anastomoses with the above mentioned A. transversa colli, after which it descends along the insertion of the M. rhomboideus to the lower part of the insertion. During its course, many branches are given off to this muscle.

One or two of these branches, after piercing the lower part of the M. rhomboideus, emerge to the lower surface of the lower part of the M. trapezius to supply this muscle. In addition to the above arteries, in very rare cases, one or two branches of the A. intercostalis, that come from the upper edge or after piercing the upper part of the M. latissimus dorsi, are received by the lower part and which supply to the M. trapezius from the lower surface.

Furthermore, the dorsal surface of the area near the occipital origin of this muscle may, in rare instances, receive a branch from the A. occipitalis.

Finally, the supply to the M. latissimus dorsi is principally by a branch from the A. axillaris, in other words, the A. thoracodorsalis. This artery generally runs with the N. thoracodorsalis. In addition to this, one of the lateral branches of the 7th to 11th intercostal arteries, which pierce this muscle and run to the skin, always gave off a branch, immediately after penetrating, that enters the anterior surface of the belly of this muscle.

Summary

The superficial dorsal muscle group in Macaca cyclopis may be classified into first and second layers. In this paper, the muscle of the second layer and arteries that supply the superficial dorsal muscles will be described.

1. M. atlantoscapularis anterior

This muscle arises, fused with the M. atlantoscapularis posterior, from the processus transversus of the atlas, and most frequently inserts into the acromion and the upper lateral edge of the spina scapulae. It is never absent. The nerve supply in many cases is by the 3rd and 4th cervical nerves but there are some cases inner-
vated by only the 4th cervical nerve.

2. M. atlantoscapularis posterior

This muscle arises from the processus transversus of the atlas, and inserts into the upper part of the scapula, fossa supraspinata and the upper medial edge of the scapula. Its condition suggests that it is an independent separation of the atlantic part of the M. serratus anterior. The nerve supply is by branches of the 3rd and 4th cervical nerves, but most frequent is innervation by the 4th cervical nerve.

3. M. rhomboideus

In most cases this muscle can be separated into the muscle bundle that arises from the occipital region and inserts into the angulus superior scapulae, in other words, the rhomboideus capitis, and the fasciculus which arises from the spine over an area extending from the cervical vertebrae to the middle thoracic vertebrae and inserts into the margo medialis of the scapula, in other words, the rhomboideus vertebralis. In rare cases, the fasciculus from the cervical vertebrae may separate so as to form the Pars capitis, cervicalis and thoracalis. It is possible to classify this muscle into 4 types according to the state of separation. Most frequent was that type in which there was complete separation into the 2 parts, the Pars capitis and the Pars vertebralis. The lower limit of the origin is usually the 5th thoracic vertebra or the 6th thoracic vertebra. The nerve supply is by the 3rd to 6th cervical nerves, but most frequent is innervation by the 4th, 5th and 6th cervical nerves.

4. The arteries distributed to the superficial dorsal muscle group include usually the A. transversa colli, A. thoracodorsalis, A. transversa scapulae and the Aa. intercostales.

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