Anatomic and clinical studies of the extensor digitorum brevis manus

The extensor digitorum brevis manus muscle (EDBM) was found in 17 (3.0%) out of 559 dissected hands of 286 cadavers. The anatomy of the EDBM was classified into three types. The EDBM frequently arose on the distal margin of the radius, but without direct attachment to the carpal bones. The insertion of the EDBM was the same as that of the extensor indicis proprius. The EDBM and the extensor indicis proprius were often joined and had the same nerve and arterial supply. The EDBM muscle was considered to be a variant of the extensor indicis proprius muscle. Clinically five of 29 patients with an EDBM were treated. (J Hand Surg 1987;12A:100-7.)

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The extensor digitorum brevis manus muscle (EDBM) is a rare aberrant muscle on the dorsum of the human hand. It is often diagnosed incorrectly as a ganglion or some other tumor. This muscle was first described by Albinus in 1734 as "musculus extensor brevis digitii indicis vel medi." However, many authors have used the term "extensor digitorum brevis manus" coined by Macalister in 1866. The anatomy of more than 100 EDBMs has been described previously. Eighty-five clinical cases (operations performed on 68 cases) have been reported between the article by McGregor in 1926 and a recent one by Gama in 1983. However, the detailed anatomy of the EDBM has rarely been discussed because most surgeons saw only a few cases.

Materials and methods

Five hundred fifty-nine hands (13 unpaired) of 286 cadavers were dissected at Okayama and Tottori Universities in 1982, 1983, and 1984. Upper extremities with an EDBM muscle were dissected and examined with a magnifying glass. Thirteen specimens of the EDBM were embedded in paraffin and examined microscopically to observe the muscle origin.

The EDBM was defined as a short muscle, with its belly on the proximal dorsal surface of the hand. The continuous belly of the extensor indicis proprius muscle from the ulna beyond the fourth extensor compartment was excluded. The accessory belly of the dorsal interosseous muscle was also excluded.

Anatomic classification

The EDBMs were classified into three types according to their insertion and relationship with the extensor indicis proprius (EIP) (Fig. 1). In type I, the EDBM tendon inserted onto the dorsal aponeurosis of the index finger, as would the EIP, although it was absent. In type II, both the EIP and the EDBM inserted on the index finger. This type was further classified into three subtypes. In type Ia, the tiny or vestigial EIP arose from the ulna but was confluent with the EDBM belly, which inserted on the index finger. In type Ib, the distal end of the EDBM belly joined with the EIP tendon. In type Ic, the EIP inserted normally, but the thin EDBM tendon also inserted more ulnarly than the EIP tendon, often with a membranous accessory slip, which inserted on the long finger. In type III, the EIP inserted on the index finger, but the EDBM inserted on the long finger, with or without an accessory EIP to the long finger.

Results

Incidence of EDBM. The incidence of the EDBM was 3.0% of the cadaver hands (17/559) or 3.8% of the cadavers (11/286) (Table I). The EDBM was found more frequently in females than in males, but the difference in incidence of EDBM between males and females and between the right and left hands was not significant (p < 0.05). Six of 11 cadavers (54.5%) had
Fig. 1. Classification of the EDBM. a, EDBM, b, EIP.

Table I. Incidence of the EDBM

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*Thirteen unpaired hands were included in the 559 hands.
No EDBM was found in these unpaired hands.
Numbers in parentheses indicate cases with bilateral EDBM.

the EDBM on both hands. The incidence of the EDBM by type in seventeen hands is shown in Table II. Dissection of six hands is shown in Fig. 2.

Origin of the EDBM. The origin of the EDBM appeared macroscopically to be from the proximal portion of the posterior radiocarpal ligament near the lunate bone. With a magnifying glass, the proximal short tendinous slip of the EDBM could be traced as far as the distal margin of the radius in 16 of 17 cases. In the remaining case it could be traced 2 mm distally to the distal margin of the radius. In two cases (A-8, Fig. 2, C and A-9, Fig. 2, E), the muscle partially arose from the connective tissue near the distal ulna (Fig. 2, C and E). Under a microscope, the tendinous fibers of the proximal end of the EDBM were observed to be firmly attached to the radius and its periosteum in nine specimens (Fig. 3, A). In the other four microscopic specimens, the EDBM merged into the radiocarpal ligament and possibly reached the radius with the ligament. No specimens showed the EDBM attached to the carpal bones (Fig. 3, B).

Muscle belly and insertion of the EDBM. The EDBM had a single belly in all cases. The proximal end of the belly was located slightly distal to the radiocarpal joint, where it coincided well with the firm distal edge of the extensor retinaculum. The belly extended to the midpoint of the second or third metacarpal bone. The belly formed a prominence between tendons of the extensor digitorum communis to the index and long fingers. The belly of types I and IIa tended to be larger than that of other types. In 12 of 17 EDBMs the main insertion was on the index finger, and in the other five digits it was on the long finger.

Nerve supply. In all cases, a fine branch of the posterior interosseous nerve entered the proximal and radial
Fig. 2. Dissections of the EDBM. A, Case A-1 (right) showing type I EDBM without the EIP. B, Case A-2, type IIa. C, Case A-9 (right), type IIb, partially arising from the ulna (arrows). D, Case A-10 (left), type IIc, with a membranous accessory slip to the long finger. E, Case A-8, type III partially arising from near the ulna (arrows). F, Case A-10 (right), type III. a, EDBM. b, EIP. c, Accessory EIP. d, Extensor digitorum communis. e, Extensor retinaculum.

parts of the EDBM before the nerve crept into the posterior ligaments of the wrist joint (Fig. 4).

Arterial supply. In six cases, a termination of the posterior branch of the anterior interosseous artery was found to enter the EDBM after branching to the EIP. In Fig. 4, case A-7 (left), india ink was injected into the anterior interosseous artery on the deep forearm because the EDBM was noted by limited dissection. The posterior branch of the anterior interosseous artery, which was stained black, ended at the EDBM, with a network on the wrist dorsum (Fig. 4).

Discussion

The incidence of the EDBM was almost the same as previously reported by authors who were anatomists5, 7-13 (Table III). The incidence between male and female was not significantly different, not only in our study but also in studies by Yoshida and colleagues and Kosugi et al.13 The difference in incidence between the right and left hands was also not significant in their studies.

Previous authors reported several variations in the origin of EDBM. In papers of the nineteenth cen
Fig. 3. Longitudinal section of the origin of the EDBM. A, Case A-1 (left) showing the proximal end of the EDBM attached to the radius. B, EDBM not connected to the lunate bone in case A-7 (right). (Arrow). EDBM. (R), radius. (L), lunate bone.
Fig. 4. Case A-7 (left) shows that a branch of the posterior interosseous nerve (*) and a posterior branch of the anterior interosseous artery (**') enter the EDBM. a, EDBM. b, EIP. c, Extensor retinaculum.

Fig. 5. Inspection of the EDBM.

relationship with the EIP. Therefore, a classification of the EDBM was derived in combination with the EIP. In our series, the EDBM without the EIP (type I) was less frequent than the EDBM with the EIP (types II and III). This coincides with the series by Kosugi et al., but not with the series by Yoshida and associates when their cases were arranged according to our classification.

As reported in previous studies, we found that the nerve supply to the EDBM was from the posterior interosseous nerve, the same as the EIP.

This study showed that the terminal posterior branch of the anterior interosseous artery supplies the EDBM. Vascular anatomy has not been previously described.

In early publications by Wood, Gruber, Smith, and others, the accessory belly of the dorsal interos-}

Fig. 6. In case B-4, an unusually prominent type III EDBM (a) containing an intramuscular ganglion. The EIP (b) and the accessory EIP (c) connecting with the EDBM are retracted by tapes. The nerve is caught by a thread.

mous muscle was also described as the EDBM; Fig. (10)5 in the works by Gruber and all cases in the article by Smith. This variant was described by Kadanoff as “zusätzlich Bauch zu den Mm. interossel dorsales der Hand.” This variant lying under the dorsal interosseous fascia has its origin at the base of the metacarpal bones or the distal row of the carpal bones, its insertion on the dorsal interosseous tendon mostly on the long finger, and is supplied by the ulnar nerve. However, it is apparently different from the EDBM that is generally recognized at present. The accessory belly of the dorsal interosseous muscle is considered very common in human beings (48.9%) as stated by Kadanoff, but it is not likely to be found clinically because it is very thin.

In summary, our anatomic study shows the following: (1) The origin of the EDBM from the radius suggests that the EDBM is derived from an extrinsic muscle, (2) variations of the insertion are the same as those of the EIP, (3) the EDBM and EIP are often joined, and (4) the EDBM and EIP are supplied by the same nerve and artery. These facts suggest that the EDBM is a variant of the EIP. The interosseous muscle, which is truly intrinsic, differs from the EDBM in origin, insertion, and nerve supply.

Clinical reviews

Five cases of the EDBM were found surgically outlined in Table IV. Only one of the five patients was male. In three cases, the affected hand was dominant. Although previous clinical case reports have shown more frequent involvement of the dominant hand and in male patients, our dissection study showed that the
Table III. Incidence of the EDBM in dissection studies

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Table IV. Clinical cases

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Table IV. Clinical cases

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EDBM can develop equally in either sex or on either side, it is considered that the EDBM becomes hypertrophic and symptomatic through heavy use of the hand. Type I and type IIa EDBM is likely to be more prominent than other types as a result of compensation for the function of the missing EIP. In fact, type I EDBM of our classification was present most frequently in previous clinical reports.

Patients (except in case B-2) had pain during or after overwork with their affected hands. Pain or discomfort during or after overwork is not a pathognomonic sign of the EDBM because the EDBM is usually accompanied by little or no pain according to our clinical experience. Only three of 24 other patients were thought to have pain derived from an EDBM (our unpublished work). Pain is likely to be caused by synovitis because of recurrent constriction of the hypertrophic belly by the firm distal edge of the extensor retinaculum.²⁰, ³³, ³⁴ Pain caused by hand movement is usually noticed during the most active period of life.

The EDBM can be found as a fusiform,²³ often bluish,²⁵ and soft prominence on the proximal second metacarpal space (Fig. 5). It becomes clear and firm when the wrist is slightly flexed and the finger is fully extended. Other conditions, e.g., ganglions, tenosynovitis, or tumors, must be ruled out. Absence of transillumination,¹⁸ or fluctuation,³⁺ and a negative aspiration test²² are sometimes misleading because occasionally a cyst coexists with an EDBM. In 68 cases, 17 ganglions associated with the EDBM have been reported up to
the present.6, 21, 23, 26-28, 36-38 There were nine ganglions reported by Gama,6 in a personal communication. Symptoms of the EDBM may become noticeable because of the coexisting ganglion. Mechanical stress due to the EDBM can also cause ganglions. Intramuscular ganglion in the EDBM has not been reported previously (Fig. 6).

The “extensor indicis proprius syndrome” can be ruled out according to Ritter and Inglis.29 In this syndrome, the EIP belly, which usually lies proximal to the fourth extensor compartment, passes beyond the compartment during full flexion of the wrist and results in constriction of the belly by the extensor retinaculum. By contrast, the EDBM belly always lies distal to the extensor retinaculum. The pain due to the “extensor indicis proprius syndrome” was reproduced when, with the wrist fully flexed, the examiner resisted the patient’s attempts at active extension of the index finger.30 Resistive extension of the finger also caused pain in hands with the EDBM.6 However, in our clinical study, the pain was reproduced when patients pushed their palms against a table with dorsiflexion of the wrists.

Demonstration of action potentials by electromyography during voluntary extension of the finger and response to radial nerve stimulation to the arm gives a definite basis for making a diagnosis. The function of the EDBM was first shown electromyographically by Egawa and Hashimoto25 to be the same as that of the EIP. The type of EDBM can be determined electromyographically by the following: The detection of action potentials on the EDBM without discharge at the normal position of the EIP belly indicates type I of our dissection study, the detection of both the EDBM and the EIP means type II, and maximum activity on extension of the long finger indicates type III.

The EDBM is not an excess structure but is an extensor, especially in type I or type IIa EDBM, and acts to compensate for the EIP. Thus, surgical intervention should be avoided in cases in which the patient has no pain. Even in cases with pain, the indication for surgery should be decided carefully, as the pain usually is not severe enough to interrupt daily life. An explanation of the harmlessness of the prominence can often relieve the patient’s discomfort. If surgery is considered to be necessary, operative procedures may be selected as follows: In type I or IIa, division or partial resection of the extensor retinaculum is recommended; in type IIb, IIc, or III, resection of the EDBM belly, leaving the EIP tendon intact, may be warranted.

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