TRIUMATIC Rhabdomyosarcoma following successive fractures of the femur

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It is for two chief reasons that this tumor, which came under observation at the Memorial Hospital, is reported. Clinically it is of interest in that it had developed apparently in a femur which had twice been the seat of a fracture, and which later had been treated for periostitis. Pathologically it is noteworthy in that its morphology differs strikingly from that of a bone sarcoma, and that it must be regarded as a tumor arising in muscle tissue. That injuries bear some causal relation to the production of a certain percentage of sarcomas has been widely accepted. For instance, in a compilation of 800 cases, Löwenthal (1) noted a history of trauma in 316. Coley (2) obtained a definite history of an antecedent injury in 46 of his 170 cases of sarcoma. Interesting in this connection is it, that in two of Coley's cases the tumor had developed at the site of a fracture of the femur and clavicle respectively, the tumor in both cases being a bone sarcoma. While undoubtedly most tumors that develop at the site of a fracture are sarcomas arising from bone or periosteum, the possibility that such a tumor may have had its origin in the surrounding muscle should nevertheless be considered, because in a fracture the neighboring tissues are also injured.

The following case represents such a malignant new growth of the muscles, developing on a traumatic basis.

History. The patient, H. F., a married man, age 48, was admitted to the hospital, October 16, 1916. He complained of a swelling of the right thigh, associated with some pain and inability to use the right
leg. The patient had had a long history of injuries to the right femur dating back to his fourth year, at which time he fell and broke the bone. The fracture united, and he had good use of the leg until the age of 11, when he broke this femur again, whether at the former site or not, is not known. The fracture, however, united; and from that time until the age of 21 he enjoyed perfect function in the limb, except that it seemed to tire more quickly. At the age of 21 the patient is said to have had a periostitis, which developed at the seat of the old fracture. He was not operated upon at that time, but was treated medically for awhile. From that time up to the present, he has always had to use crutches. His condition remained about the same till June, 1916, when he noticed an enlargement at the site of the old fracture. He began to have considerable pain in the leg, and was unable to use it at all. The tumor gradually enlarged, and on August 4, 1916, he was operated on for a sequestrum, and bone was curetted out. In addition he had eight X-ray treatments. The incision wound healed fairly well, but the tumor gradually reappeared.

Physical examination. At the time of his admission to the hospital he had a swelling situated 10 cm. below the trochanter of the right femur, and covering the anterior and outer aspects of the thigh. The mass was hard, though somewhat resilient on pressure, smooth, fusiform, and apparently firmly attached to the bone. The overlying skin was slightly red and dry.

An X-ray examination on October 17, showed an extensive, localized destruction of the right femur. The shadow was reported as being "not characteristic of periosteal sarcoma."

After ten days' preliminary treatment with Coley's fluid, and two applications of radium, the right leg was disarticulated at the hip-joint on October 31.

Gross appearance of tumor. Situated on the anterior and outer aspects of the ununited ends of a fracture of the femur, at the junction of the upper and middle thirds of the shaft, there is a moderately hard mass, varying from 2 to 4 cm. in thickness. It is situated within the muscle, next to the bone, the line of separation between tumor tissue and bone being very sharp. It has a longitudinal dimension of 7 to 10 cm. The ends of the fracture on the posterior aspect are overriding about 0.5 cm., and on the anterior aspect there is a loss of bone, measuring 3 by 5 cm. in area, so that the ends of the fracture are separated on this aspect by this distance. Through this gap between the ends of the fragments, the tumor extends directly into the medullary
The only evidence of remaining callus formation is on the posterior aspect, where the lower end of the upper fragment shows a fusiform thickening, entirely distinct from the tumor. Everywhere else the ends of the fragments appear thin and smooth, as if the bone were undergoing absorption, as sometimes happens in a fracture which has failed to unite.

On section, the tumor is seen to be, on the whole, well demarcated by a thin capsule from the normal muscle; at some points, narrow bundles of fibers extend from the margin of the tumor into the growth, and are gradually lost. The tumor is friable and can easily be broken up into short bundles of fibers, corresponding to the fascicular arrangement distinguishable in the gross. The color on section is grey, with numerous patches of dark red or brown hemorrhagic areas, especially numerous just within the outer edge of the tumor.

Microscopical. Very striking are the interlacing bundles of cells, suggesting bundles of muscle fibers. These elements are exceedingly anaplastic, but in general are long and fusiform. They are distinctly acidophile, staining deeply with eosin. A good proportion of them are mononuclear or multinuclear giant-cells. These latter are also elongated as a rule, with tapering or serrated ends.

The nucleus is, in general, rod-shaped, with blunted ends and coarsely granular chromatin, and often contains a distinct nucleolus. Scattered throughout the tumor are leucocytes and red blood cells.

Cross-striations could not be demonstrated in any of the tumor cells. The large spindle-shaped, acidophile elements just described, have, however, with their interlacing fascicular arrangement, a strong resemblance to bundles of smooth muscle fibers, or to young undifferentiated voluntary muscle fibers. Moreover, in some places the cells resemble somewhat those seen in regeneration of striated muscle.

A connective tissue capsule separates the tumor from the surrounding muscle.

With reference to the proper classification of this tumor, it is necessary first to consider briefly the attempt that has been made to classify myosarcomas in general. In 1913, Kuettner (3) in “Die Chirurgie der quergestreiften Muskulatur” collected 130 cases of primary muscle sarcomas which had been reported in the literature up to that time, and included in this report 16 of his own. Since then several additional cases have
been reported (4, 5, 6, 7). Depending upon the histological structure from which they take origin, these sarcomas have been divided into two main groups, one containing those which take their origin from the fascias and aponeuroses, and the other group those derived from the muscle fiber itself; the former are relatively the most frequent. With regard to the question as to what part the striated muscle itself can play in the formation of tumors, there seems to be some uncertainty. The vast majority of neoplasms containing striated muscle fibres are those occurring in the ovary, testis, kidney, and other parts of the body, i.e., the mixed tumors or teratomas. Here the striated muscle fiber occurs in combination with one or more other tissues, and is thought to be derived either from embryonic muscle fiber rests, or from undifferentiated tissue capable of producing striated muscle cells. Such tumors are not uncommon. On the other hand, neoplasms derived from adult voluntary muscle fibers, in which the tumor cells retain the striations—the rhabdomyomas—are very uncommon. Of the 16 cases reported up to 1913 as having had such an origin, Kuettner rejects 6 as being positively not rhabdomyomas, and regards the remaining 10 as being still disputable. Then, finally, there appears to be a group of tumors, evidently exceedingly uncommon, derived from adult striated muscle fibers, in which the tumors are composed not of adult striated fibers, but of non-striated, highly anaplastic cells, and of numerous muscle giant-cells. To this group the name “rhabdomyosarcoma” has been applied. To those collected by Kuettner should be added the tumor reported by Adami, (8) which occurred in a fish. It was composed wholly of multinucleate cells, derived from muscle tissue,—a “pure giant-celled rhabdomyosarcoma.” Probably also the tumors reported by Scott-Carmichael (4) as being sarcomas of both brachial biceps muscles were rhabdomyosarcomas.

As was indicated in the preceding description of the tumor reported in this paper, its characteristic features are in favor of its being, not a sarcoma of the bone or periosteum, but a tumor arising from the striated muscles surrounding the old fracture. It would likewise, on that account, have to be called
a rhabdomyosarcoma. It was a tumor, which, although situated next to the bone, was still easily separated from the shaft, and invaded the medullary cavity only between the ends of the ununited fracture. The bone itself was everywhere either quiescent, or, as around the ends of the fracture, undergoing absorption. The growth itself was made up of interlacing bundles, as verified by the microscope. The cells themselves were different from cells of a bone sarcoma, either periosteal or medullary, in that they were long, acidophile cells with a type of nucleus generally supposed to be characteristic of muscle cells. Long, tapering mononuclear, or multinuclear giant cells were abundant. As a result, the section appeared in some places like undifferentiated striated muscle, or like smooth muscle, and in other places like regenerating muscle.

In the pathogenesis of this tumor, the repeated and long continued injuries to the femur must have been very important, because at the time of the fractures and the periostitis, the muscle must undoubtedly have been injured. In injuries to muscles, produced either by physical agents or by infectious processes, it is known that the muscle fibers react with some vigor, as is shown by the production of multinucleate giant-cells, and mononucleate cells resembling young muscle fibers. These elements, which are said to be derived from the normal striated muscle fiber, may be non-striated for a time, and later assume again the cross striations. It is possible that in the present case the normal impetus to the formation of muscle cells was disturbed, and that a lawless overproduction of these elements took place. There had been for the past 27 years a chronic irritation of the surrounding muscles, emanating, as the specimen showed, from an ununited fracture.

SUMMARY

In a man, age 48, a rhabdomyosarcoma appeared at the site of an ununited fracture combined with periostitis.

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REFERENCES


PLATE 1

Fig. 1. Large Acidophile Cells Resembling Plain Muscle. For size, compare with leucocytes present.
Fig. 2. Very Large and Long Cell, Resembling Muscle Fiber. Higher magnification: compare size with leucocytes present.