

OSSIFYING HÆMATOMA.

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THE patient, N. D., twenty-two years of age, of good habits and condition, came under my observation in May, 1891.

The family history reveals no tubercular or syphilitic disease, and on inquiry a former statement of the patient, that some members of his family were prone to bleed freely from slight injuries, could not be verified.

His personal history is good; he has always been strong and healthy; there is no history of a hæmorrhagic or osseous diathesis.

About the middle of April, 1891, he was sparring with a friend, when the latter boasted that he could by a single blow paralyze his arm in such a way that he could not raise it. The patient disputed this, and held his right arm out horizontally, inviting his friend to strike it. This the latter did with great force, and not succeeding in accomplishing his object at the first blow repeated it again and again, several times, without, however, disabling him.

At the time no further thought was given to the occurrence. But two days subsequently he came to the Good Samaritan Dispensary, in this city, complaining of soreness and swelling of the right upper arm.

At this time the region immediately below the insertion of the deltoid was the seat of a large, soft, fluctuating tumor, extending inward toward the biceps muscle. The right arm at this point showed an increase in size over its fellow of about 10 centimetres (the circumference being about 46 centimetres). The skin of the arm was bluish, and the parts beneath were somewhat tender to pressure and manipulation.

A diagnosis was made of contusion of the arm with effusion of blood, and treatment with massage was advised. The patient was permitted to work, and did not lose a day's work during the following six weeks.

He was subsequently seen, once or twice, at intervals of a few days. During this time the tumor diminished slowly in size, the function of the arm improved, all pain disappeared, and the skin regained its normal color. The treatment was, therefore, continued.

He next again came under my observation on the 20th of May, 1891, about six weeks and a half after the injury. His general condition was good, and he complained of no pain. The tumor had decreased in size to about one-third of its original dimensions, the right arm now measuring $32\frac{1}{2}$ centimetres against $26\frac{1}{2}$ on the left side. It was somewhat more elongated than when first observed, apparently having shrunken more transversely to the line of the humerus than longitudinally. The most remarkable change undergone by the tumor was its induration. It presented a bony hardness throughout, although the apices of the tumor were relatively somewhat harder to the feel than the middle portions. This hard mass was evidently in close connection with the bone, and could not be moved longitudinally nor laterally.

The tumor had displaced the belly of the biceps muscle to the inner side of the arm (where it still lies), occupying the region of the brachialis anticus muscle.

The function of the arm was somewhat interfered with, flexion at the elbow being limited to about seventy-five degrees.

About this time the patient was seen by Dr. V. P. Gibney, at the New York Polyclinic, and an aspirating needle was thrust into the tumor under antiseptic precautions. But although the needle entered into the mass of the tumor the result was negative: it was a dry tap.

Dr. Gibney, I believe, did not commit himself to a diagnosis. My own diagnosis was that of hæmatoma ossificans, ossifying periostitis being ruled out on account of the great fluctuating mass present at the commencement of the history, and of the tendency of the tumor to shrink. Ossifying myositis, however, was also thought of as a diagnosis, on account of the close connection of the tumor with the muscles, and the apparent ossification in the upper portions of the muscles involved.

On May 27 the patient was presented by me to the New York Surgical Society,¹ the previous history being narrated, and the diagnosis of ossifying subperiosteal hæmatoma being made.

¹ New York Medical Journal, 1891, 54, 638.

Of the gentlemen who were kind enough to look at the tumor Dr. B. F. Curtis agreed with me in the diagnosis. The president, Dr. Briddon, however, thought that the time since the injury had been too short for a deposit of bone of the size presented to have taken place. Dr. F. Lange believed the tumor to be an osteo-sarcoma, and pointed to the frequency with which these malignant growths appear after traumatisms. He recommended cutting down upon it for diagnostic purposes.

This it had already been decided to do, and on June 22 the patient was admitted to the New York Cancer Hospital. Dr. Curtis kindly assisted me at the operation. Ether being administered, an Esmarch bandage applied at the shoulder, and antiseptic precautions maintained, an incision was made over the mass of the tumor, extending from a point internal to the insertion of the deltoid downward and outward toward the external aspect of the elbow, and about 12 centimetres in length. Dissection to the bone between the biceps and the brachialis anticus exposed a mass of apparently solid bone, continuous with the humerus, about 9 centimetres in length, and 3 centimetres broad and high.

This bony mass had taken the place of the intra-muscular ligament or septum, and had invaded the origin of the brachialis anticus, so that the fibres of the muscle adhered directly to the new growth, and it was consequently difficult to say where the muscle ended and the bone began. The periosteum could not be lifted off from the tumor with the muscles attached, but appeared continuous with it; nor was it possible to say where the periosteum ended and the bone commenced.

The muscle fibres of the brachialis being stripped off from the superficies of the tumor with the scalpel and sharp elevator, the tumor was removed with the chisel and mallet in two portions. The chisel entered with some difficulty through the ossified external coat of the tumor, which was nearly $1\frac{1}{2}$ centimetres in thickness, into a cavity; and this appeared filled with partly coagulated blood of a dark brown color; at the bottom of this cavity the bone was porous and bled on being scraped.

The bony hardness of the walls of this cavity was most marked near the periphery of the tumor; advancing toward the central cavity, the induration gradually decreased.

After the entire mass of bone forming the tumor had been removed and the bleeding points secured after removal of the Esmarch

bandage, the cavity was irrigated with a 1 in 5000 solution of corrosive sublimate and the soft, clotted blood washed away; a small drainage tube was introduced, and the wound closed by interrupted and continuous sutures.

The wound was dressed with iodoform powder and gauze, and the patient recovered without any pain or rise of temperature, the wound healing by primary intention. All sutures were removed on the seventh day, and the patient discharged cured on June 12, 1891, on the eighth day after the operation. There was still some impairment of function of the arm, especially in flexion at the elbow.

The patient was again seen by me May 4, 1893, about two years after the injury. There had been no return of the trouble at any time; the function of the arm was perfect, the scar plainly visible, broadened, but healthy. The circumference of the right arm was still somewhat increased, its measure being $27\frac{1}{2}$ centimetres against its fellow 26 centimetres, and this increase in size was due to the remaining enlargement of the bone. There was no sign of ossification in the tendons of any of the muscles. The biceps muscle still remained somewhat displaced toward the inner side of the arm.

The specimen removed was sent to the pathologist (Dr. Freeborn) for examination, who reported "ossifying periostitis." Unfortunately, the tumor has been lost at the laboratory, and I am unable to present the specimen.

Such cases as the one just narrated present some interest in the matter of diagnosis and prognosis, and this is what has led me to bring the subject before the Society.

This case possesses features common to several different pathological conditions, and in making a diagnosis in the light of the entire history of the case, it is requisite to differentiate between exostosis or osteoma, periostitis, myositis ossificans, osteo-sarcoma and ossifying hæmatoma.

Osteoma may be considered together with periostitis ossificans, the osteomata occurring on the shaft of the bone being generally designated as periosteal exostoses, and originating through proliferation of the deeper layers of the periosteum (although Billroth declares that these osteophytes are produced by the bone proper as well¹).

¹ Billroth, Allgem. Chir. Pathol. and Therap., 1880, 516.

According to H. Fischer¹ and Virchow, however,² these periosteal exostoses never develop until after the thirtieth year (unless, indeed, they occur before the age of twenty, and in syphilis and other diatheses). Moreover, such a tumor, when first noticed, would have been smaller than at a subsequent time. In the present case, however, the tumor was at first very large, and gradually grew less in size and became harder. Again, the cavity of the tumor, if it were a cancellous exostosis, should have contained bone-marrow, and not merely clotted blood, as it did at the time of operation.

An exostosis of the size of the tumor operated upon would probably have taken a longer time than six weeks to develop. Moreover, in exostosis pure and simple, we could not account for the participation of the muscles and ligaments in the ossification.

As to periostitis, if we mean by that the insidious, mild, proliferating osteogenic inflammation of the periosteum, this would be more readily compatible with the formation of bone found at the time of operation in the intra-muscular septa and in the muscle. (Virchow's parostosis.)

But the periosteum would have been thickened and reddened and rendered cloudy, and would be easily seen and detached from the bone at the time of operation.

Ossifying periostitis would not have presented a fluctuating, comparatively painless tumor in the first days after the injury, nor would a cavity filled with clotted blood be found in the centre of the growth.

Myositis ossificans is more difficult to exclude as a diagnosis. The commencement of the affection with repeated traumatism, the development of bone in the intra-muscular septum, and the ossification of the origin of the brachialis anticus muscle, all point to myositis ossificans. We know that in this disease the bone-formation occurs in the connective tissue, enveloping the muscle fibres and not in the fibres proper.³

¹ H. Fischer, Lehrbuch d. allg. Chirurgie, 1887, 876.

² R. Virchow, Die Krankh. Geschwuelste, 1864, 2, 88.

³ Cahen, Ueber myositis ossificans; Deutsche Zeitschr. f. Chir., 31, 372, 1891.

Myositis ossificans, however, commences independently of the bone, as small circumscribed lamellæ of bone imbedded in the muscle, or its tendon. The "rider's bone" and "exercise bones" of the literature¹ begin in this way, are mostly independent of the bony skeleton and grow gradually in size, instead of decreasing, as our tumor did.

Moreover, the periosteum is always found to be in a normal condition under these ossifications in the muscle, and this was not the case in our bone. Myositis ossificans also frequently shows a tendency to progress, which was not apparent in the present case, the patient being now entirely recovered.

But what especially argues against myositis ossificans is the finding of a cavity in the centre of the tumor filled with clotted blood. Indeed, it is not probable that a needle could have been introduced for the purposes of aspiration into the formations of ossifying myositis.

The diagnosis of osteo-sarcoma was made probable by the gross appearance of the tumor. Its unequal hardness (being somewhat softer to the feel in the middle portions than at the lateral points), the firm connection with the bone, the encroachment upon the soft tissues covering it, the displacement of the biceps muscle to the inner aspect of the arm, the age of the patient, the size of the tumor, and the unchanged condition of the skin over it, all would naturally suggest sarcoma, and with it amputation.

The microscopical examination, however, revealed only normal osseous structures. Moreover, the patient has made a complete recovery.

With the diagnosis of ossifying hæmatoma, however, everything in the history and examination of the patient tallies, it being only necessary to postulate that the hæmorrhage was, partially at least, sub-periosteal.

The acute origin of the swelling after the severe pounding of the arm by the patient's friend; the bluish discoloration of the skin over the parts affected when the patient first presented him-

¹ For literature of myositis ossificans vide Ziegler, *Patholog. Anatom., Spec., Theil.*, 1892, 259. Oliver, *Cincinnati Lancet Clinic*, 1891, U. S., 26, 526.

self for treatment; the very slight tenderness of the parts in proportion to the amount of tumefaction; the slight interference manifested with the patient's exercise of his daily avocations; the good effects of the use of massage in reducing the size of the tumor within the first few days after his injury; the gradual induration of the tumor and its ossification, and this the most marked at the periphery of the swelling and within a comparatively short period of time; the close connection of the tumor with the bone; the persistence of a cavity in the central part of the tumor and the presence in this cavity of clotted blood; the negative result in the attempt to tap the tumor thus filled with clotted blood; the outgrowth of the bony mass into the external muscular septum and into the muscle fibres of the muscles attached to the periosteum at the injured place; the difficulty of distinguishing the exact point where the periosteum joined on to the bone; the uninterrupted recovery and healing of the wound by first intention under aseptic treatment; and lastly, the freedom from recurrence which the patient enjoys: all these considerations readily accord with the diagnosis of ossifying hæmatoma.

It may not be amiss to point out that the large foramen nutricium of the humerus lies directly beneath the region where the blows were received. This would account for the unusually large size of the effusion and its localization beneath the periosteum; a localization to which, moreover, both the displacement of the biceps muscle to the inner side and the failure to procure complete absorption of the hæmatoma by massage, as well as the initial fluctuation observed in the tumor, specially point.

It is true, and I am fully aware of the fact, that the hand-books of surgical pathology do not teach that a hæmorrhage of the kind here reviewed can ossify.¹ No mention of cases similar to this one is made in the current surgical literature which I have consulted, and in the encyclopædias I have failed to find any hint of such a process.

We know, however, that traumatic hæmorrhages which take

¹ Heinecke (Deutsche Chirurgie, 1885, Lief. 18, p. 57) says: "Large encapsulated extravasations beneath the periosteum of a bone *still growing*, may become enveloped with a bony capsule, as in the newly born."

place beneath the periosteum of the cranium in young children lead to the formation of new bone, which takes the place of the effusion of blood.

Cohnheim, also, in his work on general pathology, points out that circumscribed hæmatomata are hardly ever entirely absorbed,¹ but produce a mild inflammatory action in their environment—which we may term regenerative activity—which leads to the so-called organization of the blood clot.

To surgeons the formation of bone in a blood-clot is by no means a new and startling idea. The organization of the effusion of blood, which we permit to fill a bony cavity after sequestromy or similar operations, is familiar to most of us, since Schede's report at the German Surgical Congress in 1886;² and when the blood is supplied from the walls of the bone cavity, newly-formed bone is actually substituted for the blood clot.

I have not been able to find in the literature accessible to me, any description of the more minute histological processes involved in the ossification of a blood clot, although von Volkmann mentions³ that Kraske examined cases of organization of clots. I believe, however, it is generally accepted that the osteoblasts from the bone play an important rôle in these cases, by causing the organization of the clot to progress toward the formation of new bone; and we are familiar with the experiments of Cohnheim and Maas⁴ and others, by which bone was produced in the tissues from detached periosteal fragments.

¹ Cohnheim, *Allgem. Pathologie*, 1877, I, 331.

² *Verhandlungen der Deut. Ges. für Chir.*, 1866, 15, 62. Clinical observations on organization of blood clots are reported by Volkmann (*Beiträge zur Chirurgie*, Leipzig, 1875); Phelps, Siepmann (*Deut. Med. Wochschr.*, 1887, 1094); Mikulicz (*Przeład lekarski*, 1877, No. 1); Hennewig (*Inaug. Diss.*, 1888); Wilms (*Inaug. Diss.*, Berlin, 1888); Lauenstein (*Archiv. für Chirurgie*, 1888, 37, 634); Mosetig von Moorhof (*Wiener Presse*, 1888, 6); Halstead (*The Johns Hopkins Hospital Reports*, 1891, II, 255), where the following foot-note occurs: "Experiment upon a dog. We removed a piece of the triceps muscle and trephined the external condyle of the humerus. The wound was allowed to fill with blood, and was covered with the gutta-percha tissue. No stitches were taken. The extremity was immobilized in a plaster-of-Paris splint. In three weeks the plaster was removed. The defect in the bone was so perfectly repaired that it was impossible to see with the naked eye a line of demarkation between the old tissue and the new."

³ *Verhandlungen der Deut. Ges. für Chir.*, 1866. Discussion.

⁴ Cohnheim, *l. c.*, p. 670.

When viewed in this light, I believe that many of those cases of new osseous growths, the pathology of which has hitherto remained obscure, may be more satisfactorily explained. When the periosteum has been lacerated, or even contused by traumatic insults, is it not probable that the effused blood, which surrounds the muscular fibres adjoining the bone and saturates the connective tissue of the ligaments, should possess similar properties, carried with it from the bone, of causing ossification in these points? And may not this be an explanation of some cases of "exercise"—or "rider's" bone, at least more satisfactory than any theory of the formation of neoplasms through inflammatory action—against which theories most pathologists so earnestly contend?

However this may be, in applying the explanation given above, of the ossification of a blood clot in a traumatism affecting the bone, by organization and substitution of new bone for the clot, to the case at present under consideration, we have rendered all the symptoms and the whole course of the affection readily intelligible.

Nor is the pathologist's report of ossifying periostitis in any way incompatible with this diagnosis of hæmatoma ossifying during organization. For the inflammatory reaction found in the immediate vicinity of a large effusion of blood is of exactly the same mild, regenerative character which, when present in the bone and the periosteum, lead, under favorable circumstances, to the production of new bone tissue.

We imagine, therefore, that at the time of the injury blood was effused in the entire part of the arm injured; not only between the muscles, but also under the periosteum. This latter may have been injured further. The greater part of the blood, and especially that effused nearer the skin, was, to a great extent, absorbed by massage. The part near the bone, however, remained unabsorbed, became clotted, and began to organize, with formation of new bone. After six weeks and a half this process had so far progressed that the peripheral parts of the tumor had become ossified, while the centre still remained soft. Six weeks appears ample time for this when we consider that often after

large sequestrotomies recovery is complete in an equal period, when the method of healing under the moist blood clot has been carried out.

After removal of the growth, no further hæmorrhage being permitted, the patient made a rapid and complete recovery.

I therefore believe it to be of no little importance to bear the possibility of ossification of hæmatomata situated near the bone in mind in diagnosticating tumors of the extremities, and the more especially since these forms frequently simulate malignant tumors.