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FEB.-24-1898

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RUPTURE OF THE PLANTARIS.*

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NEW YORK.

In Gray's Anatomy (Philadelphia, 1859) the plantaris muscle is said to arise "from the lower part of the external bifurcation of the linea aspera and from the posterior ligament of the knee joint." That "it forms a small fusiform belly about two inches in length, which terminates in a long slender tendon, which crosses obliquely between the two muscles of the calf, and running along the inner border of the tendo-Achillis, is inserted into the posterior part of the os calcis." That "this muscle is occasionally double." That "it is sometimes wanting." "Occasionally its tendon is lost in the subcutaneous tissue, or in the internal annular ligament." In the plate, however, the muscle is represented as being about four inches long, I should judge, reaching from the origin of the gastrocnemius to about on a level with the inferior end of the oblique line of the tibia.

In Rauber's Human Anatomy (fifth edition, Vol. I.), the plantaris is described as a slender muscle of varying relations, being sometimes wanting. He says that it originates from the condylus lateralis femoris and from the capsule of the knee joint; that it crosses with a thin tendon, the direction of the gastrocnemius and soleus between them to the median border of the tendo-Achillis. When it may

*Read before the New York County Homeopathic Medical Society.

be merged in this tendon, go to the ankle joint and to the os calcis.

Rauber also states that in the anthropoid apes the tendon continues over the os calcis to the hollow of the foot, terminating in the plantar aponeurosis.

Apparently rupture takes place at or near where the muscle goes over into tendon.

Judging from the scant notice taken of the accident in medical literature it might be held to be infrequent. Yet this can hardly be the case, inasmuch as Judson and Terillon each report three cases. Hood referred to several. Powell and Morton one each, while I have met with four in all. On the other hand, Koenig, in his work upon "Special Surgery," after stating that such an injury can happen, refers to a case reported by Nichols, of Boston, in confirmation, seemingly having had none of his own.

The only notice of it that I can find in Park's Surgery being that it had occurred in lawn tennis.

In Treves' "System of Surgery" he refers to rupture of the muscles of the leg as being graphically characterized by the term used by the French, "coup de fouet," and that is all.

Rupture of the plantaris is the term used by the English-speaking people. The French style it "coup de fouet." It has also been called the "lawn-tennis leg," and, I believe, lately the "bicycle leg."

The French, according to Terillon, hold that "coup de fouet" may be due to rupture of tendinous, aponeurotic, muscular and vascular tissues in the calf of the leg. The English rather look upon the damage to the locomotor structures as being the principal lesion, the vascular

fracture being inevitable, but not usually the most important, being rather inclined to consider the cases of rupture of distended veins as *hematomata*. All acknowledge that the pre-existence of varices, particularly the deep-seated, is of serious import. The French refer to phlebitis as a sequence of wide extent, at times as being fraught with danger.

In the *Index Medicus* from 1881 to 1896, inclusive, I find the following named notices of the accident:

Judson.—Rupture of the *Plantaris*, *N. Y. Med. Journal*, 1881, pp. 40-44.

Terillon.—*Varices profond, Coup de Fouet*; in *Bulletin Gen. Ther.*, 1882, CII. p. 425.

Lardier.—*Coup de Fouet et Diastase Musculaire*; *Concours Med.*, Paris, 1883, p. 446.

Powell.—*Lawn-Tennis Leg*; *London Lancet*, 1883, No. II., p. 44.

Hood.—*Lawn-Tennis Leg*, *London Lancet*; 1883, No. II., p. 728.

Morton.—*Lawn-Tennis Leg*, *Indian Med. Gaz.*; 1887, p. 330., XXII. Calcutta.

In addition, in C. W. Mansell Moulin's article on Sprains; Their Consequences and Treatment, in *Woods' Medical and Surgical Handbook*, Vol. II., No. 2, May, 1889, p. 401-5, he takes up the consideration of lawn-tennis leg.

It will be seen that I have made no attempt at an exhaustive search of medical literature for records of the affection.

The affection varies in the severity of the symptoms. Judson reports one case where perfect cure was only reached after a duration of two and a half years. In another, two years elapsed. In the third, the patient still suffered sixteen months after the date of the accident.

Terillon's cases all appear to have been of a grave nature; in fact, he refers to the lesion of vascular structures as being common, serious, and at times dangerous to a degree not even mentioned by the other writers upon the subject. Whereas, the cases reported by Powell, Hood, Morton, and those noted by me, were surely of a milder type, and in none of them was there any large implication of vascular structure, nor did the phlebitis of Terillon appear as a sequence.

The symptoms of the accident are so peculiar that there is little trouble in making the diagnosis, provided the possibility of such damage is borne in mind.

Mansell-Moulin says it happens in those who are no longer young. This is not invariable, however; that it is rare in the laboring classes; that in a large proportion of cases some evidences of gout may be found. Usually it happens when some sudden effort is made (generally) a pronounced effort; but in other cases the merest slip suffices, one case happening when walking on a level road. Suddenly there is a sharp stab of pain in the calf of the leg. The English, when attempting to describe it, say that the sufferer nearly always thinks the leg has been hit by a flying stone. The French refer to the sensation as being similar to that from the stroke of a whip. When severe, it is impossible to rest the weight of the body upon that limb. The pain of the onset usually is rapidly mitigated, but any attempt at walking, particularly when the body is over or in front of the foot, is out of the question, and many will not attempt such motion under any circumstances. Visual examination now is fruitless. Palpation will disclose a ten-

der spot, which at times is also somewhat depressed; later this spot will become indurated to some extent, and ecchymotic discoloration develops after a few days, which may extend from the knee to the ankle.

Judson says the diagnosis rests upon:

I. The suddenness of the attack.

II. The insignificance of the cause.

III. The location of the trouble.

IV. The pain, usually absent or slight when at rest, being excited by any motion of the limb which disturbs the muscles of the calf; and, finally — the disproportion between the objective and the subjective symptoms.

There are no records of post-mortem examinations; no dissection of the parts concerned in the injury being thus far reported, probably none has ever been made, consequently the pathology must be somewhat conjectural.

It appears probable that in the slighter cases the rupture of the plantaris muscle is the central lesion, but the vascular lesion is inevitable to some extent, being of greater consequence when varices of the deep veins precede the accident. There still remain cases that can only be accounted for by supposing that tendinous, aponeurotic and muscular structures outside of the plantaris have been injured.

Treatment.

The slighter cases do not really demand much treatment. Three of my cases were not subjected to any kind of mechanical appliances and they got well after a few weeks. But my own personal experience demonstrated to me that even in these great alleviation of the pain and material benefit in the way of getting

about, can follow the application of what is called Hood's Method of Treatment.

Judson advises rest, fixation of the knee in a position of moderate flexion, and of the foot in a position of moderate extension, together with the use of a high-heeled shoe later in the case.

Terillon says that in his cases relief from pain was only to be obtained by lying down. Complete immobility in some cases. Compression by flannel bandages by and after the eighth day, and later, elastic bandages for a long time. It must be borne in mind that his cases all presented severe implication of the vascular structures, and called for more or less special management on account of the complicating phlebitis.

Powell treated his cases by rest, flexion of the leg on thigh, extending the tarsus. This he kept up for four weeks.

Hood, on the contrary, insists that rest, flexion at the knee and extension at the ankle, are precisely what should not be enforced, being liable, he holds, to favor repair with shortening of the damaged structures, which will render the patient prone to a recurrence of the tearing apart of the affected tissues. Hood's method, as given by Moullin, is as follows: First, as soon as possible after the hurt, the patient elevates the leg above the head for a matter of five minutes, in order to favor the flow of blood from the injured limb; then while in this position the limb is strapped with plaster strips one and one-half inches wide from two inches above the ankle to just about the thick part of the calf. When this is done the patient is directed to walk about, planting the heel firmly at each step. He insists that the patient may walk at once. On the third

day the plaster is to be re-applied. Four days later it is again changed. After that once a week will answer for the renewals. On the third day after the first strapping, the patient may go up and down stairs as usual. Hood says that on the first occasion very little pressure is desirable, later, more may be made. In his article in the *Lancet* he suggests that the good effects are due to forcing the surrounding structures to act like splints.

In my own case the accident occurred when I was starting my cycle; the wheel was in the gutter; I was standing on the curbstone, certainly nine inches higher than the pavement upon which the wheels rested. I pushed off with my right foot, the left being on the pedal. I felt the rupture take place in the right calf with the usual sensation of being struck with a flying stone. I mention these particulars to show how slight the effort was. I had already started my wheel twice, once from the middle of the street. In walking home I found that I could walk fairly well, provided I did not get my body in front of the affected limb; in other words, I could take half a stride only with the right limb. I could take a longer stride if I walked entirely on my heel turning the foot far out.

Hood's dressing was applied first with the old-fashioned diachylon plaster, but it was of little use, not holding well. Then the rubber adhesive plaster was used, and this was more efficient. But I soon discovered that what I needed was to get elastic compression of the limb. Simple support was not sufficient, though Hood implies this in his account where he says that "very little pressure is desirable, and mere laying on of the plaster will be suf-

ficient." In order to get this elastic compression the plaster was applied tightly in strips reaching from over and just to the outer side of the crest of the tibia, around the limb, over and just a little anterior to the shaft of the fibula, surrounding in this way about seven-eighths of the limb. Complete encircling of the limb gave a rigid compression that became unbearable when the muscles of the calf played to and fro in walking. But I soon made another discovery, which was this: the straps, no matter how well applied, would yield in a few hours, and my compression would be gone. So to supplement this I had a flannel roller bandage applied from the tarsus to the spine of the tibia. This again was efficient for a time only in assisting the compressive action of the plaster, as the bandage would give and slip down when walking. Then I adopted a method of securing the bandage which maintained its efficiency for from two to three days at any rate. It consisted in this: The flannel roller was applied as usual to the tarsus and limb up to the lower fifth, after this each round of the bandage was secured by a strip of rubber plaster half an inch wide and three inches long applied to the external surface of the bandage and to the skin of the leg above on each turn; this was continued up to the level of the spine of the tibia, where the end of the bandage was secured, and then strips of plaster were applied, after an imbricated fashion, over the upper and middle thirds of the leg on the anterior surface of the bandaged and strapped limb. Even this, however, only kept the apparatus in an efficient state for from forty-eight to seventy-two hours; in fact,

I think it would be profitable to re-apply the whole dressing every second day.

By brother suggested to me the trial of an elastic rubber roller bandage, but this did not appeal to me, as, without trying it, I feared that the compression would be too forcible. The use of the elastic stocking, similar to those used for varicose veins, was another suggestion, and I am inclined to think this worthy of experiment, though, of course, it could probably not be had for immediate use.

In my case I never found a depression of the site of the injury, though later the spot was indurated and tender, the ecchymotic discoloration extended from the ankle to the knee. The spontaneous pain was never of any account after the first, while the pain from walking would be very severe. There was no edema of the leg, and certainly but little swelling of the calf. The lesion was mainly muscular, I feel sure, with only such vascular injury as necessarily was due to the tearing of the muscular substance. The site corresponded very well with that given for the lower end of the plantaris in Gray. Finally, the amount of benefit obtained from the use of the appliances I have described, was well worth all the trouble I took to apply them. And I feel certain that frequent renewals of the straps and bandages are important points in practice, if the full amount of benefit is to be obtained. I used the apparatus for nearly four weeks, though I rode my wheel before this time elapsed.

In conclusion, I would urge that a sharp distinction should be drawn between those cases where the principal injury consists in the rupture of veins previously varicose, on the one hand, from

those where the principal damage is to a part of the locomotor apparatus, be it muscular, aponeurotic or tendinous, upon the other, the first variety being much more severe, evidently, and somewhat prone to be followed by complications, if we are to trust the accounts of the French.

And in addition, while it may be proper to include muscular rupture of all varieties in the calf of the leg under the term "Coup de fouet," the same license cannot be accorded to the use of the title of this paper.

The expression, "rupture of the plantaris muscle," should be limited strictly to those accidents in which the injury occurs in the area in which this muscle is found. In my own cases the site of the damage was in the calf, rather to the inner side and at the junction of the upper and middle thirds of the leg, just where the muscle goes over into the tendon, I should say. There is certainly no justification for speaking of rupture of the plantaris when the damage is clearly not in the vicinity of the structure.

In addition, I do not know that Hood's method is appropriate when other muscles are torn, though Mansell-Moullin says he has found it to be as successful when a deep vein has been ruptured as when muscular fibres are plainly torn.

While I am ready enough to explain the pain excited by moving the muscles of the calf as being due to the traction upon and disturbance of the torn margins, yet I am quite unable to understand the comparative freedom from this distress which follows the application of Hood's dressing, and my modification of it, which is an improvement only inas-

much as it maintains the compression longer and more effectively.

Hood's explanation, that it forces the surrounding parts to act in a splint-like fashion, does not appeal to me at all, and yet I am able to give nothing better.

I wish to say, however, that there is no room for doubt as to the relief afforded by the apparatus, which is very great, and is perhaps only to be thoroughly appreciated by one who has suffered from the accident.

I wore it for a month, and at the end of that time, on taking it off, pain could be excited by certain motions of the calf muscle.

177 W. FORTY-FOURTH STREET.

SURGICAL ERA,
CHICAGO.
January, 1898.

