

palpitations, etc., quietly disappear, and the patients after a time leave the Hospital, with the belief that they are cured of their disease. Then, once more they return, as they must, to their labours, and once more these labours, and the other attendant circumstances of their condition, provoke the rapid recurrence of the evils, which they vainly hoped they had for ever left behind them, when they quitted the Hospital. From such persons prognosis has nothing favourable to offer.

THE PHYSICAL CONDITION OF THE MUSCLES DURING MYALGIA.

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IN a series of short papers, and at greater length in a book, I have endeavoured to call the attention of the profession to the fact, that a vast number of symptoms once supposed to indicate inflammation of internal organs, rheumatism, neuralgia, hysteria, and a variety of other diseases, are due in reality to painful affections of the fleshy or tendinous parts of muscles.

The main points established are, that whenever muscles have been excessively used (proportionally to their strength) they become the seats of pain, tenderness, etc., which last a variable time, and that this is attended with cutaneous soreness and tolerance of steady pressure; and while, in some instances, the extension of inflammation from neighbouring parts to the muscles causes the preceding symptoms to be produced, so, in other instances, overexertion in muscles may be carried to such a point as to give rise to genuine myositis.

I have long been seeking for an opportunity to ascertain the probable condition of the muscles in myalgia from excessive action, and having obtained it, I think that the profession will be interested with the result of the investigation.

Two methods are open for adoption; one, to examine into the physical condition of the muscles in those who have died of tetanus, in which we have most intense muscular overexertion; another, to examine the muscles of animals in whom, prior to death, circumstances assure us that there must have been excessive muscular action. The sole difference between these two is that in the former case the muscular action is continuous, and the circulation of the blood comparatively inactive, while in the latter it is intermittent, and the circulation is energetic. As this difference is one of degree rather than of kind, it is natural to conclude that there will be certain resemblances between the appearances in one set and the other, though at the same time certain differences might be anticipated from the differences between the circumstances.

We will adopt both methods, and examine first the condition of the muscles in those who have died of tetanus. Externally we find them firm in texture, pale in colour, and marked by purple spots. Microscopic inquiry shows that their blood-vessels have been emptied, that many of the muscular fasciculi have been ruptured, and that each of these fractures is attended with laceration of blood-vessels, and extensive extravasation of blood between and around the broken fibres. As far as my observation has gone, ecchymosis into the sheaths of muscles, or between the muscle and the skin, is not common in tetanus. In case of recovery from tetanus, the muscles remain rigid and useless for a long period, but rarely, if ever, inflame and suppurate.

I have known two instances in which rupture of fibre, and probably intramuscular ecchymosis, have occurred during life. Both were in gentlemen, and the occurrence took place while running for a long leap. The fracture occurred half way down the biceps cruris; it was attended with sudden and acute pain, and followed by local rigidity and tenderness for many weeks.

We have, then, the broad fact before us, that excessive muscular action will produce rupture of muscular fibres and their associated blood-vessels; and we have reason to anticipate that a similar effect may be produced by a smaller, yet still excessive, amount of such action. We call all muscular action *excessive* which is followed by stiffness, pain, soreness, cramp, or genuine inflammation.

As sportsmen say that after a hare has been well "coursed," or hunted with beagles, if she escape, she is next day, and for a long period afterwards, so stiff (and sore?) as to be unable to move, and that very frequently she evades the dogs only to die from her exertions to escape, it became a desideratum

with me to secure a well-coursed hare, one in whom, had it lived, stiffness and immobility would certainly have ensued. Such an animal I have, through the kindness of a friend, recently obtained, with the assurance that none, during the season, had given the dogs a longer run.* On removing the skin, the following was the appearance presented:—The whole of the muscles, where there was no ecchymosis, were as pale as the breast of a fowl, instead of the ordinary red brown colour usually presented by hares. Excessive ecchymosis existed about the head and neck, which was due to the greyhounds' teeth; and there were some other spots about the loins, which were probably due to a similar cause. In addition to these, however, there was very extensive extravasation of blood above the shoulders, along the whole course of the longissimi dorsi, and about the upper parts of the thighs, both on the posterior and the ventral aspects. The whole of the abdominal muscles were covered, externally, with a layer of extravasated blood, and the muscles themselves were purple-black. The peritoneum and bowels were of an equally dark colour, with extravasated blood. The legs and shoulders were apparently healthy, yet a close investigation showed that there were small ecchymoses in the substance of the muscles, and under the fascia. On cutting open the longissimi dorsi, they were found to be very dark in colour, very soft, and so brittle in texture that the fibres readily broke during manipulation. The fibres of the white muscles were also very friable. There was no physical change noticed in the tendons and fascia, except where they were bathed with blood, bloody serum, or simply serum.

On making sections for the microscope, the greatest care was taken not to destroy the natural appearance during manipulation; and sugar and water were employed to prevent the blood from being dissolved out. The first thing noticed (with a half-inch object glass of Powell and Lealand's) was that lines of extravasated blood accompanied every muscular fibre in the abdominal muscles, and about every third fibre in the longissimi dorsi, and every tenth fibre in the crural muscles. This



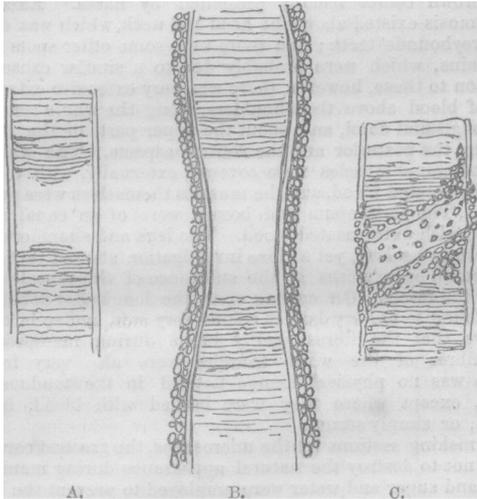
Muscular fibres from abdominal muscles of coursed hare, shewing absence of strie, extravasated blood between the fibres, and ruptures of various kinds. When the human heart is soft, partly fatty or atrophied or very feeble, the muscular fibres have an appearance very similar to the above.

gave sections, of the first, an appearance similar to that of the pyramidal bodies of the kidneys. The next thing which attracted attention was that the transverse lines were very indistinct in the vast majority of the fibres in all the muscles. After a close investigation, it was seen that many of the muscular fibres were ruptured through their "sarcolemma," the sarcolemma remaining entire. At first, I attributed this to some accidental violence during manipulation, and made a series of observations accordingly. The question was ultimately set at rest by my finding, in an abdominal muscle, a ruptured fibre with an accumulation of extravasated blood around the fractured portion. The sarcolemma being entire, no globules were seen between the divided "sarcolemma." I found no fibres ruptured completely across.

On carefully examining sections from various parts, it was ascertained that ruptured fibres were most common in the abdominal muscles, where the amount of ecchymosis was the greatest; next to these, fractures were most common in the lumbar region; and next to these, in the crural extensors. I found no fractures in the scapular region, nor did I find any laceration of fasciculi. In every instance the rupture was confined to individual fibres. In some there was a bulging of the

* It was run for twenty minutes, and completely exhausted the dogs. After being killed, it was marked, and forwarded to me.

sarcine above and below the rupture, while in others the division was a simple *crack* across it. In some the sarcolemma retained its usual appearance, in others it was stretched out, so as to appear like a delicate cord uniting the separate ends of the sarcine. In some instances, the whole fibre in view was surrounded by coagulated blood; in others, one or two adherent blood-corpuscles could alone be seen. I send sketches of the appearance.



A. Ruptured fibre, with indistinct striæ.
B. Ruptured fibre, with layer of extravasated blood outside the sarcolemma.
C. Blood-corpuscles outside the sarcolemma, but around the ruptured fibre.

This, then, being the condition to which the muscles of a hare are brought from excessive action, it is not straining analogy too far to assume that in a man who had overstrained his muscles as "poor Puss" had done, a similar state of things would be found, had we an opportunity for examining him; and it is easy to understand how such a condition would be attended with cutaneous tenderness, prolonged soreness, great disinclination to use the bruised organs, and severe suffering if the action was continued daily. We can readily see, with this physical condition of the muscles, how inflammation might readily supervene, in cachectic constitutions, upon the injury done, as an abscess occasionally follows a bruise, and how it would be difficult for the muscles to recover their healthy state without a large amount of rest, or a great reparative power in the system, or a long apprenticeship of pain. If the foregoing reasoning be valid, it is equally valid to assume that an amount of exertion, less than that we have described, might produce an analogous state of things, though of less severity. If so, we may conclude that in such myalgic cases as we have previously described, there is less or more rupture of muscular fibre, laceration of blood-vessels, and extravasation of blood.

It must next be noticed that the above phenomena are due to *excessive* muscular action, and we must pause to inquire what is the signification of those words. In a previous communication I have endeavoured to prove that the standard by which *excess* must be judged is not the general average of human exertion, but the powers of the individual—*e. g.*, a daily walk of twenty miles is not excessive exertion for a country postman, while he is healthy, but a walk of twenty paces is excessive exertion for that postman when ill with typhus. A feeble woman, therefore, is quite as obnoxious to suffering from overexertion, though she may never leave the house or her bedroom, as is a healthy man or a hunted hare.

Our chain of argument would be strengthened if we could show that the muscular fibres will fracture and the blood-vessels give way in the weakly, under a less amount of force than they do in the strong. I am unable to give demonstrative proof of this, and must content myself with the best available analogy.

1. Toleration of muscular exertion is in direct proportion to a muscle's *tone*—*i. e.*, firmness, hardness, and development. In strong muscles, "soreness" is unknown, except from such very prolonged exertion as "pumping at sea", a thirty hours "march", a long day at the oar, etc.

2. Myalgic pains are severe in the direct proportion to the atony or softness of muscles; they are, therefore, most common in those whose system has been reduced by cachexias of various kinds.

3. Experience in the dead-house and dissecting-room tells us that the muscles of certain corpses give way sooner than those of others; *e. g.*, it is not an uncommon thing, when dissecting the upper extremity, to find that both the pectorals are torn through by the simple weight of the arm. This easy rupture occurs only in those dying of cachexia. In such corpses, too, it is that the blood-vessels are commonly broken by "injection". We further know that those hearts are most liable to rupture whose tissue is pale, soft, and friable, and whose fibres are indistinctly marked with striæ; and we also know that when cardiac rupture does occur, it is the result of very trifling over-exertion, if there can be said to be over-exertion at all. The ecchymosis under the skin, and the hardness and other phenomena characteristic of myositis in the legs of scorbutic seamen, lead us to infer that a condition of things exists in them resembling that recognised in the tetanic patient or the hunted hare; and if it do exist, it cannot be from absolutely excessive muscular action, but from exertion disproportionate to the contractile power.

4. Experience amongst the living tells us that the blood-vessels are sooner ruptured in some persons than in others; that is to say, that some will have ecchymosis from a touch, a pinch, a blow, or other trifling injury; while others will endure far more violence without any extravasation of blood whatever; and, if we classify these, we shall find that the tendency to "breaking of blood-vessels" is great or small according to the cachectic condition of the individual, and *vice versa*. Thus, accidental hæmorrhages into the muscular, mucous, sub-mucous, cutaneous, and subcutaneous parts, are common in scurvy, in purpura, and in typhus; they are not uncommon in phthisis, scarlatina, Bright's disease, and general asthenia; they are very rare in the healthy countryman or robust sailor. It is amongst the former that we find myalgic pains are the most severe, prolonged, and intractable. If, then, we find that the cachectic are, *cæteris paribus*, far more liable to rupture of muscular fibre and of blood-vessel than are the strong, we are justified in the belief that such fracture will occur from a smaller *absolute* amount of muscular effort in the former than in the latter (the *relative* muscular effort is perhaps *greatest* in the weak); consequently, that there is nothing improbable in the belief that *excessive* exertion in the delicate and feeble, even though the effort seems to us very trifling, will produce similar painful effects to excessive exertion in the strong. But it is a physiological fact of great interest, that, as a general rule, the weakly suffer pain from any given cause to a far greater extent or proportion than the strong; *e. g.*, a bad tooth does not trouble us at all while we are well; but if we get "pulled down" in any way, that same tooth will produce both odontalgia and neuralgia, both of which complaints may be removed by full doses of quinine or other tonic, which builds us up again, the bad tooth still remaining the same. Consequently, we judge that the muscular and vascular ruptures, which are the cause of suffering in the strong, are the cause of a proportionably greater suffering in the weak.

If the preceding account of the physical changes produced in muscles from excessive exertion be accepted, it disproves most completely the idea of Dr. Handfield Jones that the pains and other phenomena of myalgia are simply "neurolytic" and dependent on "nerve-debility"; and that of others, which attributes them to hysteria, feminine fancy, or the desire of sympathy. It gives us a good ground for the belief that the sufferings described are *real*; and it unequivocally points to a plan of treatment of which practice has already proved the value; *viz.*, that the muscles should have time to rest, and thus be enabled to repair fractured fibres, and "take up" extravasated blood; it leads us to expect that in cachectic subjects, ecchymosis may pass on to inflammation, and this to abscess or disorganisation; and it still farther points to the necessity there is, in all cases of myalgia, for improving muscular "tone" and increasing vascular tenacity. It demonstrates that, as a general rule, champeering, friction, galvanism, or other means which would aggravate muscular exertion, blisters or other counter-irritants, or leeches or local blood-letting, cannot be expected to do more good than they do in common ecchymosis.

In conclusion, I would only add, that the preceding remarks apply to myalgia of the fleshy portion of the muscles alone, and are not applicable to the pain, etc., which accompanies a prolonged strain upon their fibrous parts.