Professor Miller,

Juvenile

Simple Fractures: their repair.

by

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The importance of an accident, surgically speaking, is regulated in a great measure, by the frequency of its occurrence, and the more common an accident is, the more thoroughly acquainted with the treatment, pathology, &c. of its effects, a practitioner should be.

A surgeon in the course of his practice, meets with many times more cases of fracture, than of anything else; and certainly if he mistreat an accident of such common occurrence, the greater opprobrium attaches to his name.

The importance of possessing a thorough knowledge of such a subject is shown, by the very perfect result of a well treated fracture, the direful consequences of a mistreated one.

The simplicity of the treatment, the generally speaking easy diagnosis, as well as the aforesaid
frequency of the accident, seem also to have led to carelessness on this subject. And many a patient has lived to anathematize the surgeon, who instead of rendering his fractured limb as sound as the other, has succeeded in establishing, a pathologically interesting, but decidedly inconvenient state of matters, yealt "false joint."

Feeling convinced that the importance of a subject like the present, requires no further demonstration, but must now be sufficiently apparent, I at once proceed to the consideration of it. The best definition of a fracture seems to be, a solution of continuity.

Let me first say a very few words regarding those diseases which predispose the bones to fracture.

The bones of persons suf-
pring from Scrofula, are more liable to sustain fracture, than those of persons free from such taint. This is an undoubted fact, and we see it illustrated constantly in the Infirmary. It is not certain whether this is due to any particular change in the bones themselves, or whether it be due to general debility the result of the disease - I am disposed to consider the latter the more correct, as the fractured bones of scrofulous patients unite in as short a time as those of the healthy.

Another of the diseases which renders bones more liable to fracture, is, Osteitis ossium, or super abundance of the earthy material. This disease, although one of the most common predisposing causes, does not seem to retard the process of union in the least, except in old age, when the unsuccessful result may be attributed to the weakened condition.
of the patient: and in those cases, where the fragilitas is caused by some vitiated state of the system such as, Cancer, Syphilis etc. Syphilis is another of the causes predisposing to fracture, and one can easily imagine it is, for it appears to be a predisposing cause of every lesion to which the constitution of man is liable.

Sea Scurvy also enjoys this reputation. We have often heard of fractures of Seamen suffering from this complaint, remaining unhealed till they reached land, were enabled to change their diet, so curing both their ailments at once.

Bones have been considered more brittle in winter, than at any other season of the year, and certainly at this time one meets with more cases of fracture than at another. But surely the true reason of this is, that the roads and streets are more slippery,
and falls consequently much more frequent and more severe. Pregnancy, lactation, have also been classed among the causes predisposing to fracture, but cases are wanting in proof of this. So much for some of the predisposing causes, now for a word about fractures themselves. Fractures are either direct or indirect.

Direct fractures are those caused by violence directly applied to the part, as by, a blow from a stick, a kick from a horse &c. The injury to the soft parts, being immediately wound and about the seat of fracture.

Indirect fractures are caused by violence applied at one point, while the injury takes place at another, more or less distant. E.g. The most common fracture of all, that of the Radicles, is caused in many cases, by a fall on the
hand: the hand here receiving the violence, while the fracture takes place at another point.
Fractures caused by muscular contraction, belong to the indirect class.

I have now to consider briefly, the theories of the reparative process of fractures, which were entertained by our predecessors. For on this subject, especially as regards the source of the material whence Callus is derived, many arguments have arisen, & much erroneous doctrine has been taught.

The most ancient explanation is as follows. — That after a fracture a pusious fluid, which the surgeons of the time, called the "pusious juice," was poured out between the broken ends. That this fluid formed a connecting band between them, that it afterwards obtained the adequate degree of solidity. But no attention seems
to have been paid, to the manner
in which the process of consolidation
was effected, nor to the length of time
which it occupied.

Buchan was the first to
throw doubt on this particularly conveni-
ent theory. To endeavour to elucidate
or rather to correct it. Unhappily,
Buchan was not a medical man,
and had therefore no business with
matters, about which he was compara-
tively ignorant. Being a botanist he
took his ideas from plants, and con-
ceived that Bark Periosteum were an-
alogous. He thought that ossification
took place, by the conversion into
bone of the internal layer of the Peri-
osteum; and that in the case of a frac-
ture, the torn Periosteum became swel-
led, so that the severed edges met and
united, forming an investing ferule.

But further than this the Botanist did
not venture, there with our ferule,
he leaves us in the dark.

The next explanation of any
interest, was that propounded by Haller: and credit is certainly due to him, in as much as he conducted a course of careful experiments, on the lower animals, propagated certainly a most beautiful theory; if true (as some modern surgeons consider it), is unquestionably easily understood.

He conceived that his experiments proved that union was affected by the same process as that of original ossification. That a glairy substance was poured out, between the ends, and around the seat of fracture, that this was converted into true cartilage, thence its subsequent conversion into bone, is easily comprehended. He thought that ossification took place in the form of a ring which gradually expanded, till the whole of the cartilage was ossified. The point doubted here is, whether the gelatinous substance, is converted into true cartilage or not.

Hunter, who comes next in order,
considered that the whole process was due to organization of the clot, which he considered called the "nidus of ossification."

The next theory to be considered is that of Bordenave, Richat & Richerand, who thought that the union of fractures was identical with healing by granulations, as seen in the soft parts. They supported their theory by the fact that bones are often found covered by granulations, after amputation, or the removal of a sequestrum. But it seems to be very doubtful, whether granulations ever exist, either in bone or in the soft parts, unless there be a communication with the external air.

Nickel held the same opinion as Haller, viz that the repair of fractures, was identical with the formation of bone.

These theories are all of them imperfect, though many of them are
very ingenious. And even at the present time, the reparative process is involved in considerable doubt.

The French surgeon Dupuytren justly conceiving the importance of a subject such as this, paid much attention to its unravelling. He founded a theory, which seems to me the most correct. This theory of the reparative process, with certain modifications and additions, I shall now consider more at length.

In the first place I condemn as quite erroneous, the idea that immediate union ever takes place. I imagine that in every case union is effected, by the medium of a connecting substance, effused subsequent to the fracture, between the extremities of the bone.

Immediately after the receipt of a fracture, blood is effused between and around the fractured ends, from the vessels of the bone, medullary membrane, medulla, periosteum
and surrounding tissues. This blood occupies the space between the ends, projects into the medullary canal, and surrounding the seat of fracture, distends the adjacent structures. In course of time, nature's hemostatics begin to work - the open mouths of the vessels, are pressed upon by the effused blood, a minute clot forms in the orifice of each, and blood is extravasated no longer. Shortly, this blood is converted into clot. The surrounding tissues, become harder, more consolidated and lose their elasticity, while they become more intimately connected, with the periosteum, which is also harder than usual. In fact all these parts are in a state of congestion. The calibre of the medullary canal is thinned down diminished by the thickening of its lining membrane, which undergoes a quasi gelatinous infiltration. The foregoing facts, the formation of the clot, the same factio
the surrounding tissues, &c., show the prompt measures which nature takes, to preserve the parts in a state of rest. This is better seen in the lower animals, and is a sure indication of the acquired treatment.

Meanwhile the coagulum is partly absorbed, the coloring matter and the soluble part of the blood, entirely disappear, nothing remains, but a small quantity of connecting fibrine, which is the field of the subsequent ossification. And this brings us up to the eighth or tenth day.

The surrounding & connecting fibrous substance, just mentioned increases in strength & density, by the evaporation from the ends of the bone, of a siccis gelatinous matter (mentioned by most ancient writers), to the agency of which, I apprehend, is due, in some way or other, the hereafter ossification. This gelatinous substance, might almost be called the essence of bone.
The tough mass surrounding and connecting the extremities, becomes harder and more consolidated, it is more dense immediately at the seat of fracture. The surrounding parts, which were for a time blended and confounded with one another, with the fibrinous mass, now become more distinct, and separate, till they are at length in no way connected with it, but on the contrary, glide freely over its external surface. The mass now presents the characters of callus; of firm consistence, and eteramy grey color it much resembles cartilage, indeed it is erroneously considered by some as such.

The next stage may be signified as the change from cartilaginous into honey texture, and this begins to take place, about the twentieth day. The rough and projecting points, ends have by this time been absorbed, and the bones present
rounded extremities. The process of rounding off is protracted, and lasts from about the eighth day to the thirtieth. Bone corporcles appear in the callus, which are the fruit of the gelatinous exudation which I consider is the "sin qua non" of ossification. These corporcles may be discovered as early as the twentieth day, or even earlier if carefully sought for. They quickly multiply, till the whole mass presents the characters of spongy bone. This gradually, slowly, up to the fifth month, becomes more condensed, and begins to assume more and more, the characters of compact bone. If we could, at this period, obtain a view of the injured bone, we should discover nothing but a little thickening over the seat of the quondam fracture. And if we endeavoured to break the bone, we should find it give at some other point. Such is an outline of what
I consider to be the true process of repair in simple fractures; it may be summed up, in three stages, thus:

I. Effusion of blood from the vessels of the bone, periosteum, medulla, and surrounding soft parts, absorption of most of this, and permanence of a fibrinous connection, between the ends.

II. Rounding off of the ends, petrification, or gelatinous substance, properly called "ossous juice."  


In no other case do we see, preparation of a lesion, more perfect than in the repair of fractures. Nor when a cure is effected, do we ever see a more satisfactory result: and it is very unfortunate, that such an elaborately beautiful, or beautifully elaborated process, is still involved in so much uncertainty.

Let me now draw attention, shortly, to the consideration
of false joint, as the failure of treatment, being the disastrous consequence hinted at, in the beginning of this thesis.

The constitutional causes of non-union, are for the most part the same asthote which predispose to fracture. Thus we have old age, syphilis, psoriamic, scrofula, fever, debility &c. The local causes are the following.

1st. A withdrawal from one another of the fractured ends. 2nd. The limb not being maintained in a state of perfect rest. These two causes are by form by far the most common causes of non-union.

3rd. Presence of a foreign body. 4th. Disease of the bone. 5th. Paralysis.

A false joint is just a ligamentous union, between the fractured ends: and that this may be caused by a withdrawal of these ends.
from one another, is shown by the fact, that wherever the fractured ends are withdrawn from one another, for a sufficient distance, there ligamentous union is sure to take place. In transverse fractures of the Patella, it is almost impossible to bring the fragments into apposition, and union is therefore nearly always ligamentous. The connecting ligament is in some cases so short, that it resembles much a synarthroses.

That ligamentous union of the Patella is not dependent on any inherent property of that bone, as has been argued, is proved, by the osseous union, which may be obtained in longitudinal fractures of that bone. That motion also is a cause of non-union hardly needs demonstration. The soft parts will not heal, as long as motion is kept up at the seat of injury, no more will the bones. The surgeon can create a false joint at pleasure, by practising motion.
He constantly does so after excision of the elbow joint, which if left to itself would ankylose. The presence of a foreign body and a diseased condition of the bone, are so obviously causes of non-union, that no explanation as to their action is necessary.

Paralysis, and imperfect nutrition are acknowledged obstacles to all restorative efforts of nature, as well in the bones, as anywhere else.

That ossification and successful union of bone are due to the organization and elaboration of the material exuded from the bone, is manifested, by the treatment of false joint, by the two first mentioned causes of non-union.

Suppose a false joint, which has not been cured by re-application of the splints, comes under the notice of a surgeon. He knows that rest would be useless, for that has already failed. What does he do? By cutting or scraping...
ing the ends of the bone, he endeavours to excite them to throw out that invaluable exudation, that bone lymph, by the agency of which, I repeat, the whole process of consolidation is perfected. This treatment, although generally, is not always successful, and the oftener the ends of the bone are removed, obviously, the less are the chances of ultimate success. This may be illustrated by the following extraordinary case, which I heard of not long since.

A labourer sustained fracture of the Humerus, and obtained the assistance of a surgeon, who put up the limb in splints in the usual way. After the ordinary time the splints were removed, and to the chagrin of the surgeon, there was no attempt at union. The limb was at once replaced in splints, but this treatment proved unsuccessful. The patient was afterwards operated on, the ends
of the bone being removed, but this treatment likewise failed; he was again operated on, with a like result. After this the patient seems to have done little else, but go from one surgeon to another, getting each to remove a piece from the ends of the bone; till at length there must exist, as might be supposed, a prodigious length between. Not only had almost every thing been removed, but the head, on the one hand, the articulating extremities of the bone, on the other, but the intervening muscles seem to have stretched to an enormous amount. This man could perform the extraordinary feat of hurling a loaded wheelbarrow after having tied a knot on his arm.

Now it may be said that after all, a false joint is not such a terrible inconvenience, for I
myself have seen, a man with false joint existing in his humerus, able to lift a fifty pound weight from the ground, but while able to do this, he was totally incapable of putting his hand to his head, or at all events of keeping it there. This is certainly bad enough, but imagine for a moment the utter helplessness of such a state of matters existing in his thigh. He could not bear the slightest weight on it, though only for a moment, and even while progressing with the aid of a crutch, would this unruled unseemly member prove a constant source of annoyance to him. The advice I should offer to such a person would be to have that removed which is not only, neither useful nor ornamental in itself, but prejudicial to one's happiness and usefulness in life. For a man
with a wooden leg may be happy, but a man with false joint in his Femur may not.

In conclusion I can only express surprise, that a subject like the reparative process in fractures, soplete with varied interest, should not have been as thoroughly investigated, as its merits seem to deserve. From what I have seen of it in reading for this Thesis, I feel assured that time spent in its examination will amply repay the student, and that abundant facts have still to be gathered, from the field which has been the main subject of this paper.