

OBSERVATIONS

UPON

THE CALLOUS TUMOUR.

BY

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I HAVE been induced to make some dissections, and to enquire into the subject of the present paper, in consequence of the various accounts given by authors of the origin of that effusion succeeding to fracture of a bone, termed callous. How far the subject will receive illustration, I will not presume to determine; the enquiry was originally made for the purpose of clearing up my private opinions, and having no particular theory to support, I have only been solicitous to draw plain inferences from the facts.

*Of the appearances found immediately after
the fracture of a bone.*

EXP. 1. I took a young rabbit and fractured the bone of the thigh; in six hours afterwards the animal was killed, and the in-

jured parts examined. The bone overwrapped considerably, the faces of the fracture were sharp and irregular, the surrounding muscles much lacerated, and a considerable quantity of blood effused into the cellular membrane.

This observation describes a state of the injury previous to the commencement of any action of reparation, and stands as the point from whence to commence our observations. The swelling found at this period, arises from extravasation of blood, and is essentially different from a succeeding tumefaction, the consequence of increased action of the blood-vessels, and previous to which this bloody extravasation is considerably diminished by the action of the absorbent vessels of the part. The asperities of the fractured faces are to be carefully noted, since they are the chief cause of the laceration of the muscles, constantly present in a greater or less degree, and possessing a considerable influence over the termination of the case. In all the succeeding experiments, overwrapping of the bone was constantly found, and in the fracture of long bones it is rarely absent unless prevented by some mechanical cause. Betwixt the infliction of an injury, and the commencement of a curative process, a certain portion of

time always elapses, the powers of the constitution seem to suffer an immediate depression in proportion to the violence and extent of the local injury, and to those exertions which will be required to perfect a process of reparation. In the case of simple fracture, these actions of reunion commence so early as within the twelfth hour.

Of effusion from the internal membrane.

EXP. 2. Twelve hours after fracture.—The muscles surrounding the injury had suffered severely; no perceptible changes had taken place in the external membrane; the fractured faces were covered and made beautifully smooth by an effusion of coagulable lymph firmly adherent to the internal periosteum, and evidently proceeding from that membrane.

This capping or smoothing of the face of the fracture is one of great moment, since by it the asperities of the injured bone are removed, and further violence to the surrounding soft parts prevented. When a fracture is going on well, this effusion may always be early found, by examining the parts after destroying the animal; it adheres firmly

to the face of the fracture; it is also very constant, even when the fracture goes on ill, at which time it lies looser upon the face of the fracture, is scantier, and when seized with the forceps, comes away, bringing along with it a portion of the internal membrane, and leaving the cavity of the bone partially denuded, thus demonstrating the source from whence its origin is derived. This is the first effusion, and although the situation of the internal membrane is such, as to prevent our demonstrating the increased action of its vessels, except by delicate and fortunate injections, yet the appearance of this effusion is proof that such a state of them exists. Increased action therefore of the vessels of the internal membrane of the bone, and effusion of coagulable lymph from them, capping and smoothing the faces of the fracture, may be considered the first process towards the reparation of the injury.

Of effusion from the external membrane.

EXP. 3. Twenty-four hours after fracture.—The extravasated blood was of a dark colour; there was considerable laceration of the surrounding muscles, which were vascular

and tumefied; the external membrane was thickened, and the asperities of the fractured faces were removed by an effusion from the inner membrane.

EXP. 4. Thirty-six hours after fracture.— There was slight appearance of extravasation; the injured muscles were tumid and very vascular; the external membrane was thickened and vascular; a considerable effusion of coagulable lymph, evidently proceeding from the thickened external membrane, and also from the injured muscles, surrounded and enveloped the overwrapping portions of bone; the fractured faces of which were smoothed and capped by effusion from the internal membrane, of a more compact and dense organization than the secondary effusion just noticed.

From what has been stated, we have to notice the greater aptitude which exists in the internal membrane than in the external to the effusion of coagulable lymph; hence the one may be termed the primary, the other the secondary effusion. In the secondary effusion the capped surfaces of the fracture lie embedded; the effusions do not run into each other, but present a distinct and observable difference; this distinction evidently depends upon the difference in point of time, at which the

effusions are thrown out, in consequence of which, the one is in a more advanced state of organization than the other, a circumstance which perpetuates, till near the completion of the process, this separate appearance of the two effusions, the obliteration of which is one of the latest circumstances occurring.

It is this tumour, in the first instance so diffused and yielding as to be distinguished through the integuments with difficulty, but becoming progressively more defined as it becomes more organized, that has been termed the callous tumour, and of whose origin so many opinions have been formed.

When the process goes on favourably, no changes are found, except that of an increased secondary effusion, till the fifth or sixth day, when the tumour becomes more firm and solid, cutting rather like the intervertebrary substance than like cartilage, and is found more dense as the knife approaches the external membrane of the bone, to which it adheres, with an extreme firmness. It is not necessary to detail singly these examinations, they would extend this paper too far; it is only necessary to detail leading appearances.

When the process of reunion goes on unfavourably, whether the causes are constitutional or local, their effect is such as to dimi-

nish or destroy effusions so necessary to recovery; it will therefore be easy to shew the necessity of them from the consequences arising out of their scanty formation, or destruction when formed.

Of the failure of effusion, from both the external and the internal membrane.

EXP. 5. Sixty hours after fracture.—The animal was languid and refused food; the limb felt flabby, and no tumour encompassed the fracture. Upon examining the limb, both portions of the fracture were found lying immediately under the common integuments, and denuded of external membrane; above the denudation the membrane was thickened, and its blood vessels numerous, enlarged and turgid; the internal membrane of each portion was diseased and easily separated from the bone, leaving the canal bare. There was no effusion from the external membrane surrounding the injury, nor any from the internal, smoothing the face and asperities of the fracture. The adjacent muscles were highly diseased, and a bloody sanious fluid was extensively diffused in the cellular membrane.

EXP. 6. One hundred and thirty-two hours after fracture.—The fractured ends protruded through the skin, denuded of external covering. The internal membrane protruded slightly from the canal of the bone, loose, unattached, and coming away readily upon being seized with the forceps. The soft parts were one extensive mass of disease; there was no effusion of coagulable lymph in the neighbourhood of the injury, but a copious secretion of thin offensive and bloody water.

These two dissections shew an entire failure of actions conducive to a reunion. Disease of the membranes to the extent here found, always effects the death of a portion of the bone; we find no healthy effusions, the fluid surrounding the fracture being always such as is the consequence of an ulcerated or gangrenous state of the soft parts, viz. pus, or a more sanious and watery secretion. The denudation and death of a portion of the fractured bone acts as a source of increasing irritation producing absorption of the soft parts, and thus facilitating a second process of nature for perfecting a cure by the protrusion of the dead bone through the skin, and its separation from the sound and healthy parts with which it is connected.

After the amputation of a limb, affections

similar to the above occasionally occur, when, instead of healing favourably, the surgeon is disturbed by a flabbiness of the stump, and a strong tendency to contraction, rendering stitches or adhesive bandages of no avail and succeeded by a protrusion of denuded bone, either through the wound or some part of the common integuments; this flabbiness and tendency to contraction have commonly been attributed to disease of the soft parts, but are undoubtedly symptoms of disease in the membranes of the bone, and especially of the periosteum intum, in consequence of which, the cut face of the bone lies loose and unconnected in the wound, uncapped by effusion, and presenting no fit medium for the reciprocal extension and communication of blood vessels, hence Dr. M'Donald, as quoted by Mr. Gibson in the 6th Vol. of the Transactions of this Society, found death of the bone to ensue, when the medulla was extracted, and the cavity of the bone filled with dry lint.

Of deficient or scanty effusion from the external membrane.

EXP. 7. Eighty hours after fracture.—The muscles were considerably lacerated; there

was a copious effusion of blood and of bloody water in the neighbourhood of the fracture.

The lower portion of bone lay embedded in the flexor muscles, which were highly diseased, its external membrane was thickened in irregular patches, the fractured face was covered with its proper effusion. The upper portion of the fracture had its external membrane inflamed and uniformly thickened, its fractured face was completely capped and smoothed, a slight effusion of coagulable lymph was thrown out by the external membrane of this portion of bone, but none from the lower portion.

EXP. 8. Ninety hours after fracture.—This bone was much splintered; the muscles were much injured, and a bloody water was thrown out into the cellular membrane. A small portion of muscle was interposed betwixt the overwrapping bone. No effusion covered the face of the fracture of the lower portion of bone; the external membrane was diseased, and the bone denuded in irregular patches, it had made its way through the soft parts, and lay immediately under the skin; the face of the superior fractured part was covered with its proper effusion, which adhered strongly to the internal membrane; the external membrane was vascular and thickened, it had

thrown out only a very slight effusion ; the soft parts near this part of bone were less diseased than those in the neighbourhood of the lower portion.

EXP. 9. One hundred and four hours after fracture.—The animal refused food, and became dull and languid after the injury. The soft parts in general were diseased ; there was little extravasation of blood or effusion of bloody serum ; the fracture was very oblique, and a portion of muscle interposed betwixt the overwrapping bone. The face of the superior fractured part was only partially covered with effusion ; its external membrane was inflamed and thickened, and had thrown out a slight effusion of coagulable lymph in its immediate neighbourhood. The lower portion lay immediately under the skin, was only partially covered by effusion from the inner membrane ; the external membrane was diseased, and easily separable from the bone, and had thrown out no healthy effusion.

EXP. 10. One hundred and eighty hours after fracture.—There was no feeling of tumour upon examining externally. The soft parts surrounding the injury were highly diseased ; and a considerable watery effusion was found in the cellular membrane ; there was no effusion of coagulable lymph from the

external membrane, or in other words, there was no callous thrown out by the injured parts; the fracture lay loose and unconnected in a mass of disease; the lower portion of bone was denuded of its external periosteum near the point of fracture; a slight effusion from the inner membrane lay loose upon each fractured face, upon pulling which, the membrane came away, leaving the canal of the bone denuded.

EXP. 11. One hundred and sixty hours after fracture.—The superior part of the bone protruded through the skin, denuded of its outer covering; the soft parts in its neighbourhood were much diseased. The inferior portion of bone was in a more healthy state; it was capped with an effusion from the inner membrane; the outer membrane was inflamed and thickened, and had thrown a little effusion into its immediate neighbourhood, the limb was œdematose.

EXP. 12. One hundred and eighty-four hours after fracture.—Both portions of bone were denuded of outer covering near the point of fracture; above the denudation, the membrane was inflamed and thickened, but no effusion of coagulable lymph was thrown out around the injury. A slight effusion from the inner membrane lay loose over each frac-

tured face. The soft parts were a confused mass of disease.

The experiments from 7 to 12, shew disease of the external membrane with its consequences, deficient effusion, denudation of the bone, ulceration of the soft parts, &c. &c. In these dissections we may observe the universality of the attempt to cover the face of the fracture; even when disease has produced destruction of the external membrane, and death of a portion of the outer surface of the bone, this capping and smoothing of the asperities of the face of the injury is wholly or partially effected, a circumstance which proves it to have its origin in the membranous lining of the canal, for had it been a production of the outer covering, the effusion must necessarily have partook of the actions, and shared the fate of its parent. In such a condition of the external membrane, the internal does not wholly escape uninjured, sound parts are constantly affected by the contiguity of disease in parts of a similar organization, and hence its effusion is scanty, lies loose upon the face of the fracture, and if seized brings away its parent membrane, leaving the canal of the bone denuded.

When the external membrane is diseased, we constantly find a scanty, or a total failure

in the secondary effusion, which in a state of health ought to envelope the injury; upon examining externally, we therefore find no tumour, and the bone grates and is moveable upon the slightest pressure. This effusion, when natural, is copious, and when the surrounding soft parts are not too much injured, it is increased, and they become a powerful, though not necessary auxilliary to its formation; it serves early as a kind of natural ligature, supporting the fracture and restraining its motions. As the secondary effusion is always slight or totally absent in a diseased state of the external membrane, this shews that it owes its origin chiefly to that membrane; and the existence of the primary effusion capping the face of the fracture, even in a total failure of the secondary one, shews the distinct origin of the two; and that we can only attribute the primary effusion to the internal periosteum or membrane lining the canal of the bone. And these opinions will be confirmed by examining the appearances of a fracture, when the internal membrane does not go through its assigned function at a time when the external performs its part regularly in the process of reparation.

Of deficient effusion from the internal membrane.

EXP. 13. One hundred and twenty hours after fracture.—The injured part was surrounded and enveloped in a firm tumour, resembling the intervertebrary substance, but rather darker; the tumour adhered to the surrounding soft parts, which were very vascular; and so intimate was its connection with the external membrane, that they were not distinguishable from each other. Upon cutting into the tumour, a small cavity was exposed, containing a slippery glairy fluid; into this cavity the point of the superior portion of bone slightly projected, having a small part of the fractured face uncapped and bare. The inferior portion of the fracture was in a natural state, capped and embedded in the tumour, and not communicating with the cavity above mentioned.

EXP. 14. One hundred and forty-four hours after fracture.—The adhesion of the integuments to the parts beneath, was unusually firm, when these were removed there appeared an increased vascularity of the soft parts, with a firm tumour encircling the injury, not

perfectly defined, but extending irregularly into the cellular membrane and amongst the lacerated fibres of the muscles. Upon cutting into the tumour, a little bloody slippery fluid escaped from a cavity, the interior of which was ragged and crossed in various directions by numerous slender fibres; the fracture was very oblique, and the extreme point of the lower portion projected uncovered into this cavity. The superior portion presented a natural appearance, was embedded in the tumour, and not communicating with the cavity. The tumour encircling the injury, was more dense internally than externally, and so closely and intimately connected with the external membrane, that when forcibly pulled, it detached that part from the bone, leaving it studded with innumerable bloody points.

EXP. 15. One hundred and ninety-four hours after fracture.—There was a considerable firm tumour encircling the fracture; in the centre of the tumour was found a small cavity, containing a slippery glairy fluid, into which projected, uncovered, a portion of the face of the superior part of the bone. The other appearances were similar to those in the two last cases, except that a greater organi-

zation of the tumour was shewn by the presence of spots, of a redder colour, interspersed through its substance.

In these dissections we find perfect actions of the external membrane, the fracture is therefore enveloped in a tumour clearly a production of that part; but the actions of the internal membrane are deficient, and hence a portion of the face of the fracture is uncovered; the denuded part is found projecting into a cavity formed in the tumour, which is filled with a smooth slippery fluid. In cases of ununited fracture, tumour will be found in those cases where the want of union depends simply upon deficient actions of the internal membrane; it will be absent where the want of union is caused by disease of the external membrane. By considering the above dissections, we become able to explain the formation of that very curious circumstance, the artificial joint, (a rare case, but of which several are upon record,) and to ascribe it to deficient action of the internal membrane, whilst the outer membrane performs its function duly. In the artificial joint the secondary effusion in its progress to organization, beomes converted into a capsular ligament; the fractured faces, partially uncovered by effusion from the inner membrane, project

into a cavity filled with a smooth fluid as above; as the process goes on, the uncovered asperities of the fracture are taken up by the absorbents, and moderately adapted to each other; they become partially covered with cartilage, and the glairy fluid serves all the purposes of synovia, lubricating and rendering motion of the new joint as easy as possible. In the first volume of the Transactions of a Society for the improvement of Medical and Chirurgical Knowledge, is a case by Mr. Home, with an engraving so very much to the point, that I hope the quotation will be excused, since it shews the completion of the process here spoken of, and of which Exp. 13. 14 and 15, may be considered only an earlier stage. “ A man aged sixty-eight, died in “ St. George’s Hospital, whose right os hu- “ meri had been broken three years and nine “ months before, but the bones had continued “ disunited, and admitted of motion more “ freely at that time than immediately after “ the accident.—The arm was carefully dis- “ sected, to examine the state of the frac- “ tured part, between which there was no “ callous, but a large bag filled with a glairy “ fluid resembling synovia. The internal “ surface of this bag was smooth, resembling “ a capsular ligament, and its attachment to

“ the bone was of the same kind, it adhered
“ firmly to the surrounding parts, which were
“ thickened and consolidated, rendering it
“ very strong. The two ends of the bone
“ were adapted to each other, all their irregu-
“ larities having been absorbed, and their
“ surfaces were of considerable extent from
“ the fracture being oblique. The surfaces
“ of the bones were fitted for motion, were
“ not completely covered with cartilage, but
“ studded over with it, and the bone was ex-
“ posed in the interstices.”

When the necessary effusions are well got over, another process, whose circumstances may be sufficiently gathered from what has been said takes place, viz. the organization of the tumour. The thickening of the external membrane, its increased vascularity, and the manner it assimilates itself to its effusion ; the increased vascularity of the surrounding soft parts, and their adhesion to the tumour, shew from whence it is pervaded by blood vessels. The manner the bone is studded with bloody points upon tearing away its external covering shews that the bone itself is more vascular, and by inference, that the inner membrane is so also. A vascularity sensible to the eye first takes place where the bones overwrap, and two portions of external membrane touch,

and here earth is first deposited ; the interposition of the least portion of muscle is sufficient to diminish or destroy the activity of the vessels here, and to retard or even destroy the whole process. When the tumour is completely pervaded by blood vessels, we then observe it diminish, which shews that absorbent vessels have also made their way ; the callous tumour at this period is found detached from the adjacent soft parts, and becomes more and more defined, and not till this period do we find it covered with any proper investing membrane. This part of the subject is so entirely regulated by those laws which govern the same process when taking place in soft parts, and have been so minutely described by former observers, that I have only thought necessary to allude to it in this cursory manner, in order to connect the subject and bring me more naturally to consider the origin of that membranous covering which is destined to form the future external periosteum of the fractured part.

Of the membrane investing the callous tumour.

The further progress of reunion produces destruction of that part of the external membrane which is enveloped in its own effusion,

these parts becoming the bed of an earthy deposition, hence arises a necessity for the formation of a covering to the callous tumour which shall ultimately become the true external periosteum. This membranous covering first appears about the thirteenth day; most observable where the extreme bounds of the tumour terminate upon the sound periosteum; hence we naturally conclude it to be a production or prolongation of that part of the membrane, and not a condensation of the cellular membrane, as is the case with the covering of many unnatural tumours. On the fifteenth day the tumour is wholly covered by an extension of the periosteum, and is perfectly defined. On the nineteenth day several large blood vessels are found ramifying upon this membrane; the tumour is very vascular and the pervasion and union of all parts by blood vessels is complete.

From this period the tumour gradually diminishes in size, and becomes more and more consolidated as it approaches the structure of solid bone. Into this process of earthy deposition as into the pervasion of the tumour by blood vessels, it forms no part of my subject to enquire; nothing more is necessary to a completion of reunion than a continuance of actions now in full operation, viz. the absorp-

tion of parts which have served their destined purpose, and the deposition of earthy matter so as to assimilate the new formed parts to the original bone ; this requires a period far beyond that when the limb becomes useful, for the tumour at the point of fracture does not arrive at its greatest diminution for a great length of time ; the absorbent vessels of the part would seem to retain for ever afterwards an aptitude to be easily excited into action, since under circumstances of long continued fatigue, privation, and disease, at any succeeding period of life, they will take up the parts thus formed and leave an ununited bone, as was the case in some instances of the crew of the *Centurion* under Lord Anson.

These observations were made by fracturing the thigh bone of young rabbits ; the fracture constantly overwrapped, no attempt being made at reduction, hence I was enabled to attend to what was going on upon the face of the fracture much better than if the bone had been replaced.

It has been thought that the callous tumour was a coagulable juice flowing from the face of the fracture, and gradually hardening into bone. It has been asserted that the effused blood itself underwent changes from which this tumour resulted. One observer attri-

butes its formation entirely to the internal membrane, another entirely to the external membrane; another to a thickening of the periosteum alone, and others to the bone itself. In this conflict of opinion the subject still remains very much undecided, and upon the origin and formation of the callous tumour, all authors I have consulted are obscure. I hope sufficient has been said to shew that this tumour consists of two successive effusions; the primary one from the internal membrane, smoothing the face of the fracture by the removal of its asperities, thereby preventing further injury to the soft parts, and offering a fit medium for the reciprocal communication of the vessels of the injured parts: the secondary effusion from the external membrane aided by the injured soft parts, and forming the great mass of the tumour, a deficiency of either of which is attended by its peculiar inconveniences and mischiefs, and incompatible with an early and perfect recovery.



Wood, Kinder. 1819. "Obsevation Upon The Callous Tumor." *Memoirs of the Literary and Philosophical Society of Manchester* 3, 275–297.

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