AN INAUGURAL DISSERTATION
ON
Wounds and their Treatment

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On Wounds and their Treatment.

Generally considered, a wound may be defined to be a breach of continuity in the soft parts of the body, the result of mechanical or chemical injury. Various names are adopted to designate special peculiarities, according to the character of the injury and its situation in the body. On these particular circumstances I shall not, for the present, make any comment, but being thoroughly impressed with the conviction that before a structure can be built, its foundation must be laid. I first propose to examine the mode by which nature heals solutions of continuity in the animal organism. If I have rightly viewed the subject, it is indispensable to the success of my endeavors in the establishing of principles as to the mode in which organic tissues are repaired, that, as a preface, I comment on the proof by which the animal organism is first formed and for the attainment of this end. I purpose giving a brief outline of the functions of nutrition and development.

That change is constantly going on in the animal frame is a physiological fact obviously known to all. It is for the purpose of repairing and
Compensating for that deterioration of texture that a
wonderful provision has been laid in the vascular
system, which is destined to convey to all parts of the
body blood, the carrier of materials and state of
organization.

The blood, as circulating through the vessels,
contains principally of water, albumen, fibrin, pulp
and red corpuscles, patty, and extractive matter,
and certain salt. It is, however, to the fibrino
g and albuminous, constituents, that the vital fluid
and its reparative powers. The use of the red cor-
puscles is a question, by no means solved by the bio-
chemists; their use in the organism is most prob-
ably connected with the function of respiration and
coloration, and with them it is not new tissue
nor to engage. I shall, therefore, examine the blood
minus the red particles, viz. the liquid sapumine.
It is this part of the blood which, by the power
of coagulation is transected from the base of the capil-
ary vessels. At first it is clear and transparent,
but, in virtue of its power of self-coagulation, granu-
appear in it, and these coherence to form cells for
the foundation of various texture, into which the liquid
sanguine becomes effused.
From this brief sketch of the nutritive process, it behoves us as surgeons to draw important conclusions: first, that, for the reparative process of tissues, the indispensable process being Coagulation of fibrin, those circumstances upon which it is dependent must be maintained, or the process will be destroyed. Such conditions are, moderate temperature, rest, and contact of living tissue in a healthy state.

Secondly, if the process of fibrinous coagulation be indispensable, which no sceptic, I presume, will deny, it is imperative that the blood should contain its natural amount of fibrin otherwise this solidification of the tissues cannot possibly take place.

Thirdly, insomuch as fibrin is acknowledged by Chemists and Physiologists to be formed by the albumen of the blood, it is evident that one important condition for the reparative of tissue is, that the blood should contain its proper proportion of albumen, in order that the fibrin may be elaborated from it for the production of the animal textures. The healing process by which nature restores the most simple wound, namely,
A clean cut incision is by the coagulation of liquor sanguinis, followed by solidification of its fibres and the production of new tissue. It is, in fact, an extension of the process of nutrition. Consequently, the inducements which we have established respecting the nutritive process are applicable to the preparation of wounds.

No one can doubt but that the process of adhesion above described being the most simple and speedy by which a wound is healed, is the one which we, as surgeons, must invariably have in view to attain.

As, therefore, it is decisive to favour the adhesive process in our restoration of solutions of continuity, these circumstances must be attended to which have already been enumerated in rest, contact, absence of all irritation, and, above all, blood highly charged with albuminous matter whence new tissue may be formed. And here we establish the fundamental principle, generally to be followed in the treatment of wounds, viz., absence of all source of irritation, either mechanical or chemical, and perfect rest to parts, so as to favour the solidification of the liquor sanguinis, but, above all, strictly abstaining from all measure which are likely to impair the blood, insomuch as we require the plastic elements of that fluid to heal the injury.
inflicted in the soft tissues of the body; hence not only are we to abstain from withdrawing it from the system, or as to diminish its quantity, but also we are to guard against its being impaired in quality either by the inhalation of noxious vapors, or by the retention of excrementitious mucus, whence we infer the important rule, that for the proper and speedy healing of wounds, it is indispensable that free ventilation be maintained and the natural excretory processes kept active.

Having thus elucidated the various incidental propositions required as introductory to my subject, I shall now revert to the primary definition of wounds, consider their special character, effects on the organism, and mode of treatment.

A wound has been already defined to be a 

solution of continuity in the soft tissues of the body. Consequently, upon the infliction of an injury, according to the instrument or agent which causes the breach of continuity, and various names are assigned to it. Thus an incised wound is inflicted by any clean cutting instrument. A punctured wound is so denominating when the depth is proportionally greater than the width. A lacerated wound is so termed because the parts are stretched before they
are separated and to constitute a continued wound it is necessary that the tissue be subjected to pressure before the breach is completed.

Incised wounds rarely occur as the result of accidents; most frequently they deserve our attention as being inflicted by the scalpel in the performance of surgical operations. It is obvious that, in all such cases, to promote the healing process by adhesion of fibrinous materials, this being the method by which parts are most speedily restored to their normal condition and that, too, with the least suffering to the animal and detriment to the adjoining tissues. For this purpose the divided surface must be brought in close approximation and kept in a perfect state of rest by means of bandages and compresses, until the bond of union is firmly established. And always bearing in mind that inflammation is diametrically opposed to the development of tissue, it is evident that all precaution must be taken in order to prevent its occurrence, or to abate it—should it have commenced. Cold application to the part are therefore indicated and the antiphlogistic regimen generally adopted is found beneficial not only as a direct remedial measure, but as a preventive to ulterior ill consequences.
Monensin incised wounds are of considerable magnitude, as when tumors are incised from some situation on the trunk, or when the incision is so situated as to preclude the possibility of maintaining the divided surfaces in contact by mere compression, as, for instance, in wounds of the head, neck, and superior parts of the body, then it is requisite to have recourse to sutures as a method of bringing into approximation the edges of the wound. In order that the sutures may not frustrate our great end, union by adhesion, care is requisite in their inserting whether wire or thread be employed.

First, Not to draw the suture so tight as to cause irritation by unnatural distention.

Secondly, Not to keep the suture in the living tissue longer than forty-eight hours, unless imperatively demanded else by its acting as a foreign agent, it will produce excitement and irritation in the part, and thus produce inflammation with its results, suppuration, sloughing &c.

In many cases, by the aid of sutures or compresses, we succeed in keeping the parts in continuity sufficiently long to favor the formation of a kind of union, frequently however in spite of all
precautionary measures, local inflammation is set up, and we must then abandon all hopes of the adhesive process taking place or becoming perfected. The emollient treatment is then to be had recourse to; in fact, the same principles are to be followed as are applicable to lacerated wounds.

Punctured wounds, for the most part present a circular aspect, which is by no means favorable to the primary organization of lymph, but nevertheless, it is to be feared to the utmost extent.

With this object in view, the situation of the wound is to be ascertained with precision as to whether or not it be in the vicinity of important organs, extending into a joint, or any of the large cavities of the body, and having carefully withdrawn all foreign bodies, the parts are to be brought into the closest possible contact, by this means it frequently occurs that the greater part of the wound heals by direct adhesion. If this be not the case, inflammation is set up, and its usual results take place, namely, suppuration and granulation, and which require at the commencement, poultices and other adjuvants, but at a subsequent period, the warm-water dressing deserves the preference.
The occurrence is not infrequent, that, owing to
the excessive depth of a punctured wound and the
narrowness of its orifice, the pus formed in its interior
burrows in the adjacent soft tissues, present in the
character of a sinus ostiolum. In such cases the
scalpel is to be used for dividing the contract of
the orifice, so as to give to it an oblong figure,
in which form the process of healing advances
according to the plan of incised wounds already
alluded to, or of lacerated wounds, now to be made the
subject of consideration.

Lacerated wounds we have already defined
as being solutions of continuity in the soft tissue,
but which are stretched previous to their being
separated. It is this kind of wound which most
frequently demands the attention of the surgeon
and owing to the extent of the injury and varied
shape of the instrument by which these lesions
are inflicted they demand some consideration in
this part of my Essay.

If the lacerated tissue be limited in
length and depth in many cases, by the aid
of suction or compresses, so as to bring the torn
edges into contact, union may be effected without
the occurrence of much derangement of the system, or even of the parts. But when the laceration is extensive, a correct diagnosis must be made as to the nature of the damaged parts, and if any considerable artery be wounded, the arresting of haemorrhage by ligature or other means is an imperative duty. Having carefully withdrawn from the wound all foreign agents, the several edges now require support and which, in the majority of cases, can only be effected by sutures.

Upon reflection, I cannot omit impressing on the mind of the reader the necessity of abstaining from excising the lacerated edges of the wound. It is only with great expense that Nature can repair lacerated and it behooves us to be economical in preserving tissue, not only as directly useful in healing wounds, but as a preventive against an excessive expenditure of natural powers. Having thus adapted to their normal position the injured parts, the enrolling plan of treatment, viz., warm fermentation and cataplasms, are the only means by which
we can hope for ultimate success. The reason for which these soothing applications are applied is not, as many erroneously suppose, to set up inflammation and thus to perfect the healing process, since inflammatory action requires heating to promote it; it invariably occurs as the effect of the injury, and indeed, as we have already pointed out, is detrimental to the healing process, and requires abatement for which purpose fomentations are highly beneficial, because during their evaporation, such a large amount of heat becomes latent as to lower the temperature of the inflamed part and thus to promote the object we have in view. But another great point is gained by the use of warm applications when the acute inflammatory stage has once subsided. Tonicity, the power by which arteries retain their caliber, is diminished, they become comparatively lax tubes, and permit with greater facility the transudation of their contents by osmosis, and by this discharge of the superfluous contents of the vessels two great objects are attained: 1st. The vessels are relieved of their excessive distention and, the nervous fibrilla being
no longer possest upon two leading symptoms of
inflammation, namely, swelling and pain, beside
endly. The materials which are eroded from the Co-
ats of the vessels are the elements of the liquor
sanguinis, and precisely those by which torn pa-
nts are reunited, and new tissue produced.
After the wound has been thus treated upon, the
antiphlogistin, plan, suppuration, and granulation
will commence.

These processes involve many interest-
ing points elucidative of physiological facts, and
instructive of surgical principles. The formation
of pus is first preceded by a layer of lymph
from the inflamed vessels, through that lymph
transudes the sanguinis, which contains fibrous
materials in the form of the denaturation of proteins,
partly in a solid state and partly in the
form of the pale corpuscles. By exposure of
these materials to the air, or the influence of oxygen,
the chemical union between the proteins compounds
and an additional proportion of oxygen is pos-
certed so that a tri-oxide of protein is produced
and the solubility of it is that which gives
to pus its opaque character and also its enlarged
Corpuscles with composite nuclei.

Those corpuscles of the blood which, in imperfectly oxygenated albumen, when exposed to the influence of oxygen, acquire on their exterior the more perfect character of a vesicular envelope; in which state, being more susceptible of osmosis, the corpuscles necessarily enlarge by the imbition of fluid; while the granules of the fat-in the interior of the corpuscle, acting as a centre, around which fibrine concrete, acquire a new and clear aspect.

When pus is produced according to the above named process, part of the liquor sanguinis or aggregable lymph, becomes consolidated, and in its blood-drops are formed from the subjacent tissue so as to develop conical vascular papillae or granulation. It is by this continued production that the chasm becomes filled up, and when the new material reaches the level surface, the cuticle extends concentrically from the margin of the wound, and as it advances, not only does the extent of surface become diminished, but the supplicative action likewise decreases.

When this process of granulation is
progressing, the best treatment, in my opinion, is that which does the least harm, viz. The least active. The most splendid of Nature's works—the nutrition of textures—cannot be improved upon; and therefore I conceive that all stimulating applications are sources of injury so long as the healing process progresses normally. Upon this principle I give decided preference to the warm water dressing, as it possesses the advantage of soothing and allaying any local irritation, and at the same time promotes the condition most propitious for the production of new tissue.

Occasionally the granulations are exuberant, that is, so much developed above the level of the adjoining parts, as to prevent the cuticle from spreading their surface. Under such circumstances mild caustics are indicated for repelling them, and here I beg to allude to the mode of application of these agents.

It is usual to apply the caustic indiscriminately to the whole surface of the wound from which at least one great evil arises, namely, considerable irritation, and further than this, the healing process is necessarily disturbed by the adoption of such virescent measures.
When it is borne in mind that cuticle only advances from the margin of a wound it is clear that the simple application of the cautery around the most exterior granulations sufficiently deprives them so as to allow them to be covered by epithelium.

This treatment may be daily repeated, applying afterwards dry lint with pressure, until the whole surface is healed, which end will be speedily attained, since the processes of nutrition and nervous sensibility are not materially impaired.

In some cases, however careful the surgeon may be, the healing process is by no means speedy; the edges of the wound become raised and tender; the secretion of pus is thin, yellow, and offensive; the granulations are flabby, and upon the application of pressure they readily bleed and are highly sensitive. These appearances are evidently the result of a defect in the plasticity of the lymph, which must consequently be promoted by stimulant applications.

In the consideration of contused wounds, or those solutions of continuity which are the result of violent pressure or concussion before the soft parts are torn asunder, it is necessary to
distinguish those cases in which the vitality of the tissue is simply impaired from others in which it is definitely extinct. In the former the tissue are not dead but injured, the capillary coats being torn and blood extravasated. In the treatment of such cases it is necessary to bear in mind that the adhesive process cannot occur, but such is the nature of the injury, that inflammatory action is a greater or lesser extent invariably supervenes; it is, therefore, obvious that warm immersion application are to be resorted to, the effect of which is speedily to promote the healing process in the same way as in lacerated wounds.

The contusions which more particularly require notice are those in which the tisue are killed at the result of extensive injury, when, circulating and nervous function being destroyed, the parts are cold and senseless. That dead tissue cannot form part of the living organism is a well known fact, and it is, therefore, clear that tisue killed by contusion require removal, and for the attainment of this end Nature, in her wisdom, has supplied provided.
The death part soon becomes circumscribed by a ring of inflammation and it has been subject of speculation as to the manner in which inflammation is set up and the part removed. The death of the part implies an arrest of blood, to which its vessels are no longer permeable, the vessels around must therefore be charged with that blood which formerly supplied the now dead part. The venous fact of blood accumulating in the capillaries constitutes the foundation of inflammation, which is completed by the repeated impulse of blood from the heart, and consequent upon the accumulation of blood we necessarily have its usual effects, effusion from the distended vessel, secretions from the lymphatic vessels, and the lager of lymph so deposited forms a barrier between the dead and living parts, and closes the vessels, so that, when the dead tissue is removed, the occurrence of haemorrhage is prevented.

The increased flow of blood implies an augmentation of oxygen in the part which is the seat of inflammation, and according to the views of Liebig, we can comprehend how, by the free supply of oxygen, eneuma cause or death of the tissue occurs; that process implies dissolution of substance,
which we well know occurs at the circumference of
the part, and which must necessarily be removed as
soon as it is wholly detached. Subsequent to the re-
moval of the dead part, the remaining tissue is
filled up by granulations, and ultimately healed
by cicatrisation, as already explained in cases of
laceration, and the same treatment is, in fact, appli-
cable, in the one as the other. But we may add-
itionally, remark that the value of poultices on
extensive contusions is twofold: first, by evaporating
relief is afforded to the nervous excitement, and
secondly, by warming the communicated the removal
of the dead tissue is facilitated.

Having completed this brief and therefore
of necessity imperfect sketch of the peculiarities
which abound present, and their appropriate
removal, a few words more may not be misplaced
as to the Constitutional effects of wounds and the
measures to be adopted for arresting them.

In case of slight injury little or no systemat-
ic disturbance is observed. But when the wound is
extensive, symptoms of nervous and vascular excite-
ment, occasionally prevail, these are to be com-
bated by strict antiphlogistic regimen and
attention to the state of the digestive organs. Sedative agents, also, are imperatively called for, and even bloodletting may be resorted to in extreme cases. On this head, I would remark on the impropriety of withdrawing blood as a prophylactic, with the erroneous notion of preventing the ill effects of the injury. The nerves are the medium through which the general system is affected, and the vascular system is of secondary importance. Consequently, by bleeding soon after the injury is inflicted, we do not diminish the liability to systemic disturbance, but by debilitating the system we effectually prevent the possibility of countering the excitement with measures sufficiently energetic when it does occur.

I have already said, that in extreme cases alone is bloodletting to be resorted to, and for the obvious reason, blood is required to heal the wound, and consequently, the more that is expended by artificial evacuation, the less is reserved for structural consolidation.

One awful effect of wounds, viz., tetanus, I purposely omit, its importance, and the difficulties in accounting for its true pathology.
are motives which preclude me from attempting its introduction, while its consideration may be safely left to other and able hands than mine.

All of which is most Respectfully submitted.

Jno. B. Mann