

AN
INAUGURAL DISSERTATION

ON

Inflammation

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BY

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To
Paul F. Eve M.D.

As
An humble tribute to moral,
mental and scientific
worth, the following
treatise is most
respectfully
inscribed

by

The Author.

Inflammation

Were I to attempt a full exposition of my subject it would largely transcend the ordinary limits of a Thesis and swell this unpretending treatise into a ponderous volume; I shall therefore endeavour only, to give a succinct account of Simple Inflammation, believing that all the purposes of a Thesis will be fully answered by such an attempt if properly executed. Of my success or failure in the latter particular, it is the province of those to whom this paper is to be submitted to determine

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Much ingenuity has been displayed in the invention of definitions of Inflammation which shall comprehend in the compass of a few words, all the essential elements of the disease. Complete success has not yet been attained, and perhaps never will be, because it is clearly impossible to describe in a sentence, what it requires a volume to unfold.

Perhaps the definition given by Professor Miller of Edinburgh is as convenient and unobjectionable as any other, and I shall therefore without attempting to assign any other reason, adopt it in the following treatise.

Inflammation, says Dr. Miller, may be defined: An alteration in the healthy structure and function of a part, accompanied by a perverted condition of the

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blood and capillary bloodvessels; ordinarily attended with redness, pain, heat and swelling; inducing more or less febrile disturbance of the system."

The transition from a state of health to true Inflammation is never sudden and abrupt, but consists of a series of changes that require time for their development, varying according to circumstances from a few hours to as many days or even weeks.

A proper understanding of the whole process of Inflammation will be facilitated by studying in order the several links that make up the concatenation of morbid changes of which it consists. Although each stage has its peculiar and distinguishing characters, the boundary lines which separate them are not very distinctly and clearly defined; and hence different authors

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have divided it differently and bestowed different names upon its various stages. We prefer Prof Miller's division to any other, as being more simple and more readily comprehended, we will therefore proceed to consider the subject under the following heads;
1st Simple Vascular Excitement; 2 Active Congestion; 3. True Inflammation.

When an irritant is applied to any portion of the body, say the virus of a wasp to the skin for instance; it comes in contact with the various tissues of which the part is made up, affecting each differently according to its function;

Perhaps the nerves of the part are chiefly affected at first, and hence the pain, this impression is conveyed to the nervous center and so reflected as to arouse the vascular action of the part, which may if the impression be sufficiently great, spread like a wave until the

whole circulatory system become involved, and thus Inflammatory Fever is set up. The time which intervenes between the application of the irritant whatever it may be, and the commencement of the Inflammatory process is called the period of Incubation, the length of which varies much in different cases.

The ^{initial} incitatory step according to the division we have adopted consists in an increase of vascular action of the part. At first the small arteries and capillaries, probably by a sort of spasm of their muscular coats, are diminished in caliber, and the blood is sent through them with increased velocity, and according to high authority there is an increased amount of blood in the part even during this contracted state of the vessels. But this appears to my mind clearly impossible, unless indeed this diminution of caliber is more than compensated by an increase of

the length and tortuosity of these small vessels, which we deem improbable, if not altogether impossible.

But this contraction is not persistent, and the coats of the vessels begin to yield to the increased force of the blood, and a state of relaxation and dilatation takes the place of contraction and diminution of caliber. The vessels not only regain normal size, but are distended beyond it, so that those which in their contracted condition admitted the red globules in "single files," now suffer them to pass in double file, or in platoons, bringing within the ~~reach~~ power of unaided vision, vessels that were before invisible to the naked eye. Nor is the velocity of the current still diminished, but on the contrary continues to be increased except about the center of the irritation, where its retardation begins, and from which it spreads,

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and as the dilatation increases the retardation becomes more and more decided. With this increased determination of blood the function of the part is exalted, the ^{fluid} parts more readily with its fluid portions than it does as it flows quietly through its channels in a normal condition of the parts. Hence if this change take place in a secreting organ, such as the kidney for instance, an increased flow of its natural secretion is the result. If it occur in a structure that cannot thus relieve itself of this turgescence, interstitial transudations and increase of nutrition are the consequences.

Now this the first link in the morbid series which we propose to consider, may be the only one completed, and the part may return to its original condition or pass into the second stage viz

I Active Congestion. If, instead of returning

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to the condition of health, the process which has been set up in the part observes a progressive tendency, the "vascular commotion" increases and involves the vessels on the cardiac side of the part implicated, and they seem to act with undue energy, and pour into the part an unusual supply of blood, by which the small bloodvessels are distended and so weakened that they are unable to send the blood on in its course as fast as they receive ^{it}, and consequently a partial stagnation takes place. The blood is literally dammed up in the part.

Nor is this all; the blood itself undergoes a change. It becomes more viscid, the red corpuscles become less distinct, and there seems to be an increase of that vital contraction which the blood has for the various structures which it is destined to

to build up. The lymph corpuscles are increased in number, and the red globules are no longer confined to the central current, but straggle out into the "still layer" or "clear lymph spaces", and adhere to the walls of the bloodvessels, and thus contribute to the retardation of the circulation. Ligor sanguinis, altered in its character, transudes through the coats of the vessels. The amount of fibrine is also increased, and its plasticity is augmented, and by its interstitial deposition the part is hypertrophied and softened, thus inducing structural changes inconsistent with a proper performance of function. If the action continues to advance forward, it passes from this, the second, to the third link in the morbid series v.iz:

III True Inflammation. In this stage the coats of the vessels have completely lost their tonicity, and

become "passive tubes;" and as a consequence of this condition and the altered state of the blood itself, its circulation is retarded more than in the second stage, and about the center of the disease may be entirely stagnated.

The integrity of the vascular walls is impaired, or they become softened and attenuated, giving rise either to profuse exudation of *Liquor sanguinis* or effusion of blood, or both may exist together. The texture of the part is softened by these effusions into it, and the formative force has yielded to the aggressive hand of disease, and in its stead, a tendency to disintegration is established.

In the part inflamed as before stated the blood is either greatly retarded or entirely stagnated, but there is an increase of action around it, and the blood instead of being transmitted directly on its course through

the seat of inflammation, it is forced to seek its destination through collateral vessels, thus augmenting the amount of their labour and while they retain sufficient energy they do not suffer the circulation to lag, but they probably succumb, after a while, to the increased labour thrown upon them and thus the area of disease is widened.

A broken balance between deposition and absorption obtains. The small veins and lymphatics cease to perform their functions as absorbents, and as a consequence collections of fluid, (if the part inflamed be a serous membrane,) or superficial or interstitial effusions occur.

The blood is also altered in its character, containing an undue quantity of albumen, as well as a superabundance of liquor sanguinis. There is also an increase of fibrin

while the red corpuscles are diminished in number, and their tendency to stick together or in masses is increased. Both the red and white corpuscles exhibit a disposition to adhere to the walls of the vessels, contributing to the stagnation of the blood. Although these changes in the blood may be, and most probably are, at first confined to the part inflamed, yet if kept up, the whole mass of the circulation ~~will~~ will sooner or later become involved.

In our definition of inflammation we said that it was characterized by redness, pain, heat and swelling; these we will now notice more in detail.

1st Redness. The cause of the redness is simple and easily explained; it depends upon the undue amount of blood in the part. While the red globules, as we have already seen ad-

here to the walls of the arteries and become
 dammed up in the part, the liquor sanguis,
 still preserving its mobility, flows on and
 leaves them with all the colouring matter
 they contain, to increase the intensity of the
 inflammatory here. The degree and char-
 acter of the redness varies under different
 circumstances. The greater the vascularity
 of a part inflamed, ceteris paribus, the more
 intense the redness by which it will be char-
 acterized. It may be circumscribed and circu-
 lar, as in phlegmons, in which it also
 fades out as you depart from the center, and
 is lost in the natural hue of the healthy parts
 surrounding it. In erysipelas on the contrary,
 it may cover a large surface, but its bounda-
 ries are abrupt and well defined. Sometimes
 it occurs in streaks, as when the veins or
 lymphatics are inflamed. The tint also va-

ries according to circumstances. The redness of acute Inflammation is of a bright scarlet red, while that of chronic is of a dark dusky character. Other differences occur but need not be mentioned here.

But redness may, and often does exist in the absence of all inflammation, and therefore must be conjoined with other symptoms in order to be of any value in a diagnosis. The blush of modesty though very similar in hue to that of Inflammation is very different in other respects. While the redness produced by Inflammation is persistent, that which characterizes the blush of shame is evanescent, and flitting.

Of Swelling. The swelling results from the accumulation of fluids, (of the blood and its constituents,) in the part. It is in part owing to the distention of the vessels by their contents, and

in part to the escape of a portion of these contents into the surrounding structure. And this latter is perhaps the chief cause of the tumescence. These effusions differ with the stage of the disease, and also in different portions of the area of inflammatory action.

Miller exhibits this by means of a diagram, consisting of three circles, one within another. The first encloses the "soft fluctuating swelling" produced by suppuration. The second marks the limits of the fibrinous deposits, rendering the part tense and resisting, but less elevated than the first, which it surrounds. Exterior or to these we have oedematous swelling, the result of an infiltration of serous fluid into the intervascular spaces. The outer circle presents the same condition that obtains in the first stage of Inflammation, or perhaps it would be more

Correct to say the first stage of effusion, while the the second and central ~~are~~ are in more advanced stages of inflammatory action.

The tumescence may be beneficial, or injurious. It may prove hurtful if it occur in an organ contained in an unyielding case, such as the brain, or under the perosteum, within joints &c. It may also press upon contiguous and important organs and give rise to pain, danger and death. Or it may occlude passages whose patency is important to the well being of the individual, as the trachea oesophagus &c.

But it must be remembered that to be indicative of Inflammation, the swelling must be associated with other indications of that process. There is swelling in her

sia, oedema and other conditions altogether unaccompanied by Inflammation.

3 Heat. Although there is actually an increase of heat in a part inflamed as will be shown by the thermometer, it is not so great as the heightened sensibility of the nerves of the part would indicate to the patient himself. It is said occasionally to rise ~~to~~ as much seven or eight degrees of Fahrenheit's scale above the normal temperature. This we presume is rare. The increase of heat simply depends upon an excited condition of the calorific function of the part. Animal heat is maintained by the slow combustion of the disintegrated tissues, and as the conditions which favour this process are increased, the necessary result is an increase of the function.

Like the other symptoms or signs of In-

flammation which we have noticed, heat alone is not diagnostic of that condition, and must be appreciated with other signs before it can be of any value. In hectic fever the patient complains of burning in the palms of the hands and soles of the feet, and in fevers totally unaccompanied by Inflammation there is of great morbid heat.

4th Pain. This, like the other signs of Inflammation is by no means infallible, though perhaps less likely upon the whole to deceive us.

Pain is probably the result of pressure in part and partly of a perversion of sensation. That it, ^{is} not wholly produced by pressure, may be inferred from the difference in regard of pain, between erysipelas and oedema, peritonitis and ascites, the mechanical condition of the parts in all these being similar. But that it is in part so produced, will appear when we recol-

lect that it is greater or less according to the amount of tension produced by it; thus the pain of pneumonia is trifling, compared to that of a common whitlow, although the Inflammation in the one case may be so extensive as to threaten, and even extinguish life, while in the other it is comparatively insignificant.

As a general rule the more highly a part is endowed with nerves of sensation, the more painful will be its Inflammation. The pain of Inflammation of the parenchyma of an organ, is never so great as that produced by Inflammation of its investing membrane.

The degree of pain is, in some instances greatly modified by the portion of membrane involved; thus in phthisis and other chronic affections, there are often extensive ulcerations of the mucous coat of the ileum & colon, almost totally unrelieved by any pain

while such a condition of the membranes of the mouth, or about the anus, is generally very painful. This difference depends upon the different sources of their nervous endowments, the one being principally dependent on the sympathetic, and the other upon the cerebrospinal system for their nervous supplies.

Pain varies also in character, as well as degree under a variety of circumstances; thus in pleuritis, it is sharp and lancinating; while in the lungs, it is dull and heavy. The pain is not always felt in the real seat of disease, but distant often from it, and might thus mislead the practitioner. In hip joint disease for instance, the pain is generally felt in the knee and, in hepatitis there is more or less pain in one or the other shoulder. The pain of Inflammation is

sometimes remittent, but never intermittent, in this respect differing from that of Neuralgia, which may one moment, ^{be} intolerable, and in the next totally absent.

Pain, though upon the whole salutary, for it stands as a sentinel at the gates of the citadel of life to warn us of the approach of danger, is occasionally so great as to require special treatment, for it may be so severe as to destroy life itself.

Having thus passed rapidly in review the different local signs of Inflammation, our limits will only permit us as briefly as possible to notice the results, or terminations of the process, which are usually reckoned five viz:
1st Resolution; 2^d Metastasis; 3^d Supuration; 4th Ulceration; 5th Gangrene.

1st Resolution; When Inflammation is about to terminate in resolution, the excited condi-

tion of the part begins gradually to recede; pain and heat begin to subside, the redness to disappear and ultimately the swelling; the vessels regain their wonted tone and caliber, and recover their control of the circulation, which though at first vacillating, becomes uniform and regular. Absorption resumes its function and removes all extravasated materials, and finally health being entirely restored, the part resumes its healthy action. If the general system participated in the febrile orgasm of the part, that also disappears with the local symptoms.

§ Metastasis: This is the subsidence of the disease in the part originally the seat of its action, and its establishment in another. This result is most apt to take place in gout, rheumatism, erysipelas &c. If the change be from one organ to another not more important to life, it is

of but little moment; but if it be from an external to an internal vital organ, it becomes a serious matter, and demands the closest attention of the surgeon. Rheumatism on account of its propensity to seize upon the heart when it disappears from the joints, thus is one of the most important diseases we are called upon to treat. Some authors call metastasis a termination of Inflammation, while others maintain that it is only an extension. Without entering into the controversy we will only state it as our belief, that the truth lies between the two extremes; for when it disappears from its original seat, it has beyond all doubt terminated in that part; but then it has been continued, if not extended in the part to which it has been translated.

3 Suppuration. This, though not invariably is generally a result of Inflammation. If

the Inflammation be of a high grade, and pass rapidly from its first stage to its acme, no barrier is set up against its diffusion, and it is infiltrated into the surrounding tissues; but ordinarily a sac is formed by the condensation of the cellular tissue of the part, and confines and encloses it. When suppuration is about to occur in an extensive inflammation, the patient is affected with a rigor; and when pent up, ^{in an} internal organ for a length of time, causes hectic.

It has been pretty satisfactorily ascertained that Pus is blood in an altered and disorganized state, furnished at first by the bloodvessels, and afterwards secreted by the pyogenic membrane, as the sac which encloses it is called. It contains all the essential elements of blood, and M. Gendrin traced its metamorphosis in the inflamed foot of a

frog. These experiments I have not the space to detail. Pus is said to be laudable or healthy, and unhealthy, according as it presents a certain character, or departs from it. Healthy pus is of a cream like consistency and of a yellowish white colour, opaque and often tinged with green. The other characters of pus I can not attempt to notice.

4th Ulceration is defined to be molecular death. The tissues are gradually softened and disintegrated, not in mass, as in sloughing but "molecule by molecule;" and thus broken down they mix with the pus or other fluid, and are eliminated. Hunter was in error in supposing ulceration to be a process of absorption, and the only proof that need to be adduced is the fact that the disintegrated tissue may be demonstrated in ulceration of many of the tissues, and especially of

bone, and the additional fact that absorption is always in abeyance during inflammation of a part, and ulceration is the result, perhaps always, of Inflammation or at least never exists except in connection with it.

All tissues are not equally liable to ulceration. Skin is probably more subject to it than any other, and mucous membrane and areola tissue scarcely less so. It seldom attacks vascular, nervous, or fibrous tissues, and it is fortunate that the two former are comparatively exempt since their integrity is so important to the wellbeing of the individual. It is also well that certain parts are protected by fibrous tissue from the advance of ulceration; but inconvenience and trouble may result from the same fact as when Pus is formed beneath strong fibrous sheaths, or bands, and its escape thus prevented.

5 Gangrene; This is the transition from inflammation to complete death or mortification and I have preferred this term, because in my opinion it is truly a termination of Inflammation, and is a link between the latter and that condition known as sphacelus, or complete death. When death or mortification commences Inflammation ceases.

When gangrene occurs as the result of Inflammation, say of the skin for instance, the inflammatory action is usually intense and high, the surface of the skin is of dark red colour, and the pain and tenderness are severe; as the inflammation advances, a livid appearance, the cuticle is elevated by serum in the form of blisters, which are called technically phlyctenae. The skin itself next perishes, and the pain and tenderness are lost. If the mortification be extensive the general system suffers

and the powers of life are reduced, or perhaps fail altogether. The pulse becomes feeble, irregular and intermitting, the countenance and the skin cold, and there is no longer a capability of exertion, and in a few days or sooner the patient dies.

If the constitution does not thus suffer, or the patient survives the shock, after a great or a less length of time, the separation of the dead part begins to take place by a process called sloughing, which is the first step towards recovery.

If gangrene occur as the result of diffuse cellular inflammation, it will be preceded by an abundant infiltration of serum.

In some instances this fluid is of a yellow colour, and not unfrequently the skin and conjunctivae seem to be tinged with the same hue, giving the patient a jaundiced appearance.

though the urine does not contain any of the colouring matter of bile. The constitution sympathizes as already described. The mortification soon extends to the skin, involving it to a greater or less extent, and if it be great the patient soon sinks, the vital powers being unequal to so severe a shock.

Allowing for difference of function of various structures, the foregoing will apply pretty nearly to all cases in which inflammation of the soft parts, or any of them, results in gangrene.

My limits compell me to close without even a reference to the treatment of Inflammation. I have been able only to take a very cursory view of my subjects, in every respect, and regret that I am under the necessity to omit a consideration of the treatment the, proper conduct of which,

is the chief aim of our study of its different phases, phenomena and results.