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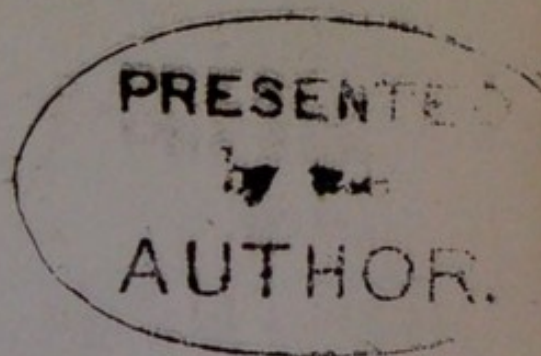
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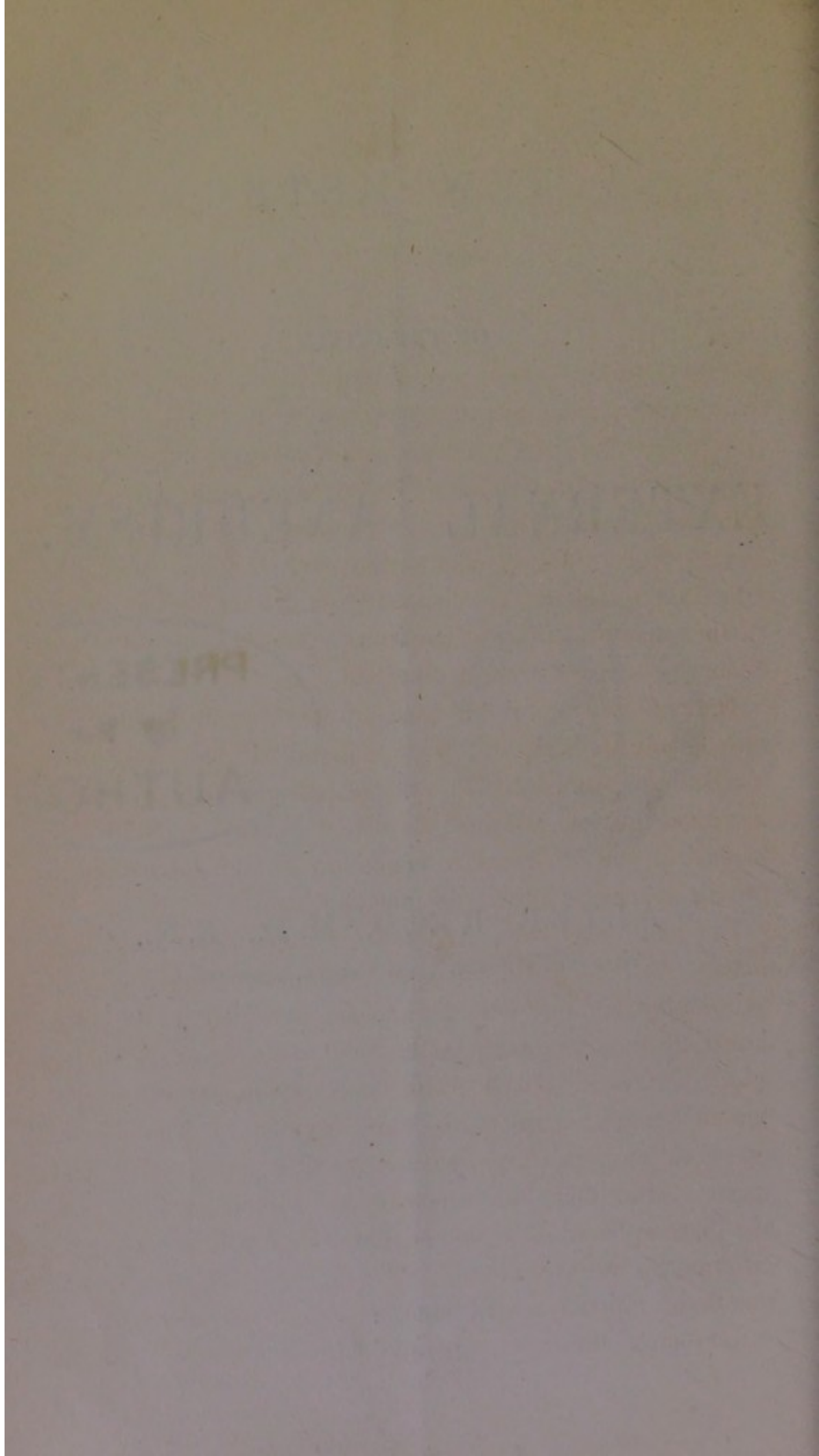
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A NEW METHOD OF TREATING EXTERNAL ANEURISM.

IN the autumn of last year I pointed out, and illustrated by a practical example, a new practice in the treatment of aneurism. The case was reported officially to the Director-General of the Naval Medical Department, who communicated it to the *Lancet* of the 25th September, 1875. The report created some interest at the time, and I have since been urged to publish it in a separate form, giving further details of the case with fuller explanations as to the principles upon which its treatment was conducted.

The patient was a sailor, aged thirty-seven, belonging to a ship of war in harbour. He was admitted into hospital on the 10th of August, 1875, with a left popliteal sacculated aneurism. It had attained the size of a hen's egg and presented all the well-known characters of the disease, particularly as regards form, pulsation, and bruit.

The man was kept in bed on a light non-stimulating dietary until the 19th, when an attempt was made at cure by genuflexion, but without success, as it had to be abandoned on the 23rd, owing to the pain and œdema of the leg which it caused. On the 26th rapid compression was tried—one of Carte's compressors being applied to the femoral artery at the pelvic brim and another at the apex of Scarpa's space. After four hours continuous compression, the pain and distress being so severe as almost to lead to syncope, the instruments were removed. The pulsation in the tumour was found to have ceased, but it shortly afterwards returned. A number of attempts were afterwards made both by digital

and instrumental compression to arrive at a cure, but without success. The characters of the aneurism remained the same, and it was evident, that while the femoral was controlled by pressure, the collateral circulation carried into the sac a good supply of blood.

On the 10th of September I resolved to arrest the entire circulation in the limb after the manner introduced by Prof. Esmarch for the performance of bloodless operations on the extremities. I had already used it in several operations, and was struck by the manner in which every blood current in a limb could be arrested. My theory therefore was, that while the limb was in this condition, absolute stagnation of the blood left in the sac must be produced, and its coagulation follow as a consequence.

Accordingly, I proceeded next day to apply Esmarch's elastic bandage from the toes upwards to the aneurism in the popliteal space. Here it was passed lightly over the tumour, and then carried on rapidly, as high as the junction of the middle with the lower third of the thigh. The elastic tubing was then wound round the limb over the highest turn of the bandage which was now removed. The entire circulation below the tubing was thus arrested, and the limb, all but the aneurismal cavity, emptied of its blood. The parts assumed a deathlike pallor and gradually lost temperature.

After fifty minutes, the patient having complained of severe pain above the seat of constriction, a Carte's compressor was applied to the femoral at the pelvic brim, and the elastic tubing removed. The compression was used as a precaution in order to prevent the blood current through the main artery from breaking down and washing away the newly formed clot, which I expected to have formed in the sac, before it had time to become tough and solid, and the sac to contract over it.

I raised the compressor a few minutes afterwards, and could detect no pulsation in the aneurism, which felt quite hard. The instrument was re-adjusted and left in charge of the patient, who was a very intelligent man, and had become well accustomed to its use. He was ordered to apply the compression in an intermittent manner, and not to distress himself with it. He continued doing this at intervals, until the evening of the following day, when the apparatus was removed.

The pulsation never showed any sign of return. The collateral circulation appeared to establish itself at once, as could be seen by the vigorous pulsation of several small vessels round the knee, and from there being no marked difference, after a short time, between the temperature of both legs. The patient complained only of some darting pains up the outer side of the leg, although it was afterwards found that there was some defect in the innervation of the muscles and parts supplied by the peroneal nerve. He told me that he noticed these symptoms after the attempt at cure by genuflexion. It was clearly due to pressure of the tumour upon the nerve in the popliteal space.

The case thus became one of popliteal aneurism successfully treated, and a note taken in May, 1876, eight months after the cure, may best explain its further progress. "There is a small lump in the left popliteal space which can only be distinguished when compared with the opposite side. The femoral pulsates as far as Hunter's canal, below which it is occluded. Several small vessels beat round the joint, notably one about two inches from the inner edge of the patella. No sign of gangrene has ever made its appearance. The defect in innervation has passed off, and the patient says that the one leg is as good as the other. He now suffers from a troublesome bronchial affection."

I have endeavoured to avoid unnecessary details in the above report, and, at the same time, to omit nothing which might prove essential to a proper study of this interesting case.

The first question which presents itself is :—How far was the success due to the novel method of treatment adopted ? I am not prepared to deny that the attempt at cure by compression must have had some influence on the result ; indeed, the cure was at one time nearly accomplished by this means, and could it have been continued would no doubt have been complete. The aneurism, however, very soon reverted to its original condition. Compression seemed, in fact, to defeat itself by opening up the collateral circulation and enabling it to carry free currents of blood into the aneurismal sac, thus preventing that repose of its contents necessary to their coagulation, either rapidly, or more slowly by the deposition of fibrinated laminae. Nevertheless, whatever may have been its effect in this way, it was of great service as regards the final result, for when the sac and the vessel became plugged by clots, the traffic of the blood through the collateral channels had become so well established, that the limb, on the removal of the constricting apparatus, at once resumed its normal temperature and appearance, and no sign of defective or disturbed nutrition occurred.

Some have asked the question—Can you empty the limb of its blood and yet keep the aneurismal sac full ? I believe this can be done in the manner pursued in the case, viz :—by bandaging as lightly as possible over the tumour, or even skipping it by one or two adroit turns of the roller and leaving its surface free. Moreover, a sacculated aneurism may be likened to a flask, with walls more or less rigid ; it cannot be emptied of its fluid contents unless they be displaced by air passing in, or else by collapse of its walls. The

cavities of aneurisms in individuals who have died before the walls have given way are usually found to contain blood, which must have coagulated immediately before or shortly after death.

There can be no doubt that the cure arose from the rapid coagulation of the blood left in the sac, consequent upon its complete stagnation. It is a fact of which there is ample evidence both clinical and pathological, that aneurisms frequently terminate in this manner; the question is: How long does blood take to coagulate when in a state of complete stagnation in an internal cavity? This point is important in practice, since it must determine the time during which the limb is to be kept bloodless, supposing the blood to be in a normal condition as regards coagulability. I regret that I have no evidence to offer, except that afforded by the case recorded. Experiment also is wanting. I had intended to keep the limb bloodless for an hour, knowing that I could do so with safety, but, as it proved, fifty minutes were enough and possibly a much shorter period might have sufficed. We know, at any rate, that the circulation in a limb may safely be held in abeyance for considerably over an hour. In a protracted operation for necrosis of the femur I kept the limb bloodless for an hour and ten minutes without any subsequent injury to the circulation. Cohnheim, according to Esmarch, did so in warm blooded animals for six or eight hours without any permanent disturbance to the circulation following. So that one may reasonably hope to do so long enough to ensure coagulation in an aneurismal sac conveniently situated for the purpose.

It must be admitted that when the limb, with the exception of the aneurismal cavity, was emptied of its blood in the way described, the blood in that cavity must have arrived at a state of complete repose, unsettled by any current

passing into, out of, or through it ; and I maintain that this is a result which cannot, as a rule, be accomplished by ligature or any form of compression of the vessel leading to the aneurism, owing to the influence of the collateral circulation. Mr. Holmes, in his Lectures on the Surgical Treatment of Aneurism, shows clearly by references to the experiments and observations of Broca and others, that when the current through the main artery of a limb is interrupted, those carried on by the collateral circulation take its place almost immediately and feed the aneurism though not with the same force. Hence, I may observe, the main point in the treatment adopted in my case.

As regards the conditions under which blood coagulates I quote from Herman's Human Physiology, which is the most recent authority accessible to me on this subject. After explaining that fibrin does not exist in the living blood, but originates in the process of dying, through the operation of a ferment, the Author says :—"The phenomena accompanying its death are the result of the cessation of an influence exercised constantly upon the blood during life by the living walls of the vessels. The blood does not coagulate so long as it circulates in the vessels, so that every portion of it constantly comes in contact with their living walls ; nor does it coagulate if, after being drawn, it is in contact with a living vessel (as, for instance, when frog's blood is placed over mercury in contact with a pulsating frog's heart). On the other hand, it coagulates after it has been drawn from the vessels, or in the vessels after their death, or even in living vessels, if at any point stagnation of the blood occurs, so that the central layers are removed from the influence of the walls."

If these views are correct, then the principles upon which the aneurism became consolidated are at once explained, for not only had we complete stagnation, which might of itself

have proved sufficient, but it must also be kept in mind that the surrounding tissues, as well as those constituting the walls of the aneurism and the popliteal artery, were in a peculiar condition, differing little either in appearance or in reality from those of a corpse during the first few hours after death. The influence therefore of this death-like condition may have assisted in causing the coagulation or death of the blood.

I am unable to come to any conclusion as to the effect of the reduction of temperature observed in the case. It is true that increase of temperature favours, and reduction retards, the coagulation of the blood outside the body, and exposed to air. This, although known before, was conclusively shown by Scudamore in a well conducted series of experiments. But this observer, according to Dr. Richardson, came also to three other conclusions in the course of his investigations, viz :—

“ 1. That at a reduced temperature *in vacuo* coagulation is hastened. 2. That atmospheric air being simply excluded in a stoppered bottle, the temperature not being reduced, coagulation is retarded. 3. That all communication with atmospheric air being prevented, the temperature not being reduced, coagulation is much retarded.” If this be so, then it would appear that the reduction of temperature hastened the coagulation of the blood enclosed in the aneurismal cavity ; and it is well to remember in practice that temperature can easily be regulated in similar cases by artificial means.

I have confined myself simply to the case which came under my notice, and have endeavoured to offer a rational explanation of phenomena observed. I do not presume to found a new practice in the treatment of a grave and formidable malady upon the results of a single case, for however sound the theory of it may seem, its precise value can only be fixed by an extended experience.

The main purpose, therefore, of this pamphlet is to make the case more fully known with the view of provoking experiment. The method is at least simple and requires neither surgical dexterity nor expensive apparatus for its trial, while the rapidity and completeness of its success, in one instance at least, are probably unprecedented in the annals of surgery.

The question of its safety requires a little consideration. When Hunter made the great discovery that by tying the vessel some distance on the cardiac side of an aneurism, he could cure the disease by lessening, not suspending, the commotion of the blood in the sac, and thus filling it up by the gradual deposition of laminated fibrine, he laid down the doctrine that this was the only safe way in which an aneurism could be filled up and cured. This doctrine was hardly called in question until recent times, and was first rudely shaken by Murray, of Newcastle, who cured an abdominal aneurism by five hours continuous compression of the aorta under chloroform, and showed that the disease could be dealt with safely by the rapid coagulation of the blood *en masse*. Subsequent experience also has led many surgeons to abandon Hunter's doctrine, and to view the cure of the disease in this way as not more hazardous than the other. On this and other grounds I am inclined to think that the manner in which I propose to deal with aneurisms in certain situations is as safe, and perhaps safer, than any method hitherto known to surgery.
