

ON
COAGULA FORMED IN THE VEINS DURING
THE PUERPERAL STATE.

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COAGULATION of the blood within certain of the veins is a circumstance which occurs in almost all of those eminently fatal affections to which puerperal females are subject. The greater number of the appearances met with in the veins, in cases where death takes place in consequence of one of these puerperal disorders, are traceable to this coagulation, and the secondary changes which the coagula have undergone.

To enter into the history of the "phlebitis" controversy, to cite the various opinions which have been at different times entertained, and the numerous experiments and observations recorded by the several learned and ingenious writers on this subject, is not my present purpose. It may be stated, however, generally, that the old doctrines of effusion of lymph from the lining membrane of veins, the formation of pus by the same surface, &c., cannot be maintained in the face of the mass of evidence adducible against them. The writings of Prof. Virchow on "Thrombosis" and "Embolie," only lately published in a collected form,* contain an array of facts and observations on this very interesting subject, together with inferences, the logical nature of which cannot be denied. Virchow's opinions may be concisely summed up in these words:—"The history of those affections of veins to which the term phlebitis has been applied is in reality the history of the coagula (thrombi) formed within them, and of the metamorphoses through which these coagula pass."

I have referred more particularly to Virchow, because his works contain the fullest, latest, and most complete development of the subject; but observations made by several writers in this country might be mentioned, as tending in like manner with the researches of Virchow to remove the veil from the obscurity in which the subject of "phlebitis" appeared to lie. Arnott, Carswell, Gulliver, Henry Lee, and others, have supplied us with many important facts, since made available, in constructing a truer pathology of the affections of veins; while respecting the puerperal affections of veins in particular, Dr. Robert Lee's well-known researches exercised at an early period a most salutary influence in directing attention to the real phenomena of a class of affections till then very imperfectly understood.

In this paper I propose to consider coagulation of the blood within the veins as connected wholly and entirely with the puerperal state, to consider the phenomena of coagulation under these circumstances alone.

I shall limit myself at present to an attempt at answering the following question:—

WHAT ARE THE CIRCUMSTANCES PRECEDING, OR NECESSARILY CONNECTED WITH, THE ACT OF PARTURITION, WHICH MAY LEAD TO, OR FAVOUR THE FORMATION OF, COAGULA WITHIN THE VEINS?

These may be advantageously considered under the following heads:—

1. *The state of the blood itself during pregnancy.*—It is well known that the blood undergoes changes of a very marked character during pregnancy, and especially towards its termination. The amount of fibrin is increased, the number of the blood-corpuscles undergoes diminution, while the proportion of albumen is also a little less than usual.

It is reasonable to suppose, that blood which contains a higher proportion of fibrin than usual will part with a portion of it more readily than under normal circumstances, other con-

ditions favourable to coagulation being present (stasis, &c.), and a nucleus existing round which the fibrin may be deposited; but it does not appear probable that coagulation *en masse* would be likely to occur even in blood highly fibrinous, unless this process were otherwise assisted. Still, if there be a nucleus, such as a small coagulum, formed at any situation, excess of fibrin in the blood would favour its extension. Andral, who with Gavarret, first pointed out the increase of fibrin in the blood in the latter months of pregnancy, suggested that to this circumstance was due the liability of puerperal women to inflammatory affections. With a little alteration of the wording of Andral's suggestion, it may be here repeated in this shape: the hyperinotic state of the blood of pregnant women predisposes to the occurrence of those puerperal affections of which the so-called phlebitis forms a constituent part, in which, in point of fact, coagulation of the blood in the veins is the starting point.

The diminution in the number of the red corpuscles is next to be considered. Cazeaux considers that the condition of the blood present at this time resembles that of ordinary chlorosis. Dr. Tyler Smith alludes to the chlorosis of pregnancy constituted by this change in the blood as a pathological, rather than as a physiological event. Scanzoni speaks of chlorosis as being occasionally present under these circumstances. The truth probably is, that what in some cases appears to be a pathological state, is only an extreme physiological one. The question now is, however, has blood which contains a less number of corpuscles than usual any particular tendency to coagulate? Facts are wanting to reply to this inquiry. In reference, however, to the influence of chlorosis generally, a remark of Scanzoni's is interesting. It is to this effect: that in women in whom this chlorotic state was well marked, he had observed a great tendency to become affected with puerperal fever: as before stated, coagulation of the blood is a chief element in most of those affections classed generally under the head of puerperal fever. Another condition of the blood occasionally present in pregnancy—viz., *uræmia*, is considered by some authorities to increase the tendency of adhesion between the particles of fibrin and the vessel wall, and thus to favour coagulation.

2. *The mechanical effects of the pressure of the enlarged uterus.*—During pregnancy, the enlarged uterus forms a tumour, which does not always adapt itself so as to allow of the circulation in the adjacent parts being carried on so uninterruptedly as in the non-parturient state. The pressure of the tumour affects the organs with which it is contact, and the large venous trunks which are situated immediately behind it. The veins of the rectum are frequently enlarged, giving rise to hæmorrhoids, and the veins of the lower extremities frequently become distended and varicose, and the extremities themselves œdematous, from the pressure exercised on the iliac veins. The dark colour of the vagina, due to the turgidity of the veins in that situation, has a like cause. The descent of the diaphragm being somewhat impeded, the right heart is liable to distension, and the passage of the blood to the lungs is interfered with, in consequence of the obstruction to the complete inflation of these organs. These, and many other conditions of an allied character, traceable to disturbance of the circulation, undoubtedly favour stasis of the blood in certain veins, and may, under some circumstances, lead to its coagulation. As pregnancy advances, these effects become more marked in degree. Cases are on record, in which coagulation would seem to have been thus produced in some of the large iliac veins during the latter part of pregnancy, the coagula having afterwards increased in size and extent, and produced serious consequences.

3. *Influence of pressure during the act of parturition.*—It now and then happens that the head of the child rests for a considerable time on the brim of the pelvis, in such a position as to retard the venous current passing from the pelvic organs and lower extremities, and this effect will of course more readily be produced if the head of the child be larger than usual, or the brim of the pelvis be contracted. Stasis of the blood in certain of the veins passing towards the main trunks thus pressed upon is an effect of this pressure, and if it continue for a sufficiently long time coagulation follows. Velpeau appears to have originated the idea that this circumstance was one of the causes which are occasionally efficient in producing the disease called phlegmasia dolens, an affection undoubtedly constituted by an obstructive affection of one of the iliac or femoral veins. The fatal results which frequently follow labours in which the difficulty just alluded to has to be encountered are perhaps too exclusively attributed to the manual and operative measures necessarily had recourse to in the delivery of the child

* Gesammelte Abhandlungen. 1856.

under such circumstances; certain it is that prolonged pressure, such as is occasionally exercised on the vessels behind the uterus, and even on those in the substance of the uterus itself, by the powerful expulsive efforts of this organ, particularly when the liquor amnii has been evacuated, must have a very considerable effect in retarding the circulation in the neighbouring vessels. That the result may be actual coagulation in the vessels subjected to the pressure, and perhaps even injured by it, it is not difficult to conceive.

The more important of the causes now under discussion have yet to be mentioned.

(To be continued.)

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I RESUME the consideration of the *causes* leading to, or favouring, the formation of the coagula in question.

4. *Deficient contraction of the uterus, and of the venous plexuses near it, after delivery.*—The condition of the pelvic visceral veins at or near the period of parturition is peculiar. Large venous plexuses exist around the uterus, in the broad ligaments, &c., in the non-puerperal state, but these undergo a very considerable increase in size during pregnancy. The unusual functional activity of the uterine system is thus necessarily accompanied by an increased capacity of the veins composing these plexuses. Physiologically, therefore, and under normal conditions, these veins are much larger than usual during pregnancy. But this is not all: the uterus itself, and especially that part of it to which the placenta is attached, is full of large venous sinuses: vessels which in the non-impregnated state of the organ are scarcely visible are now extraordinarily increased in bulk, and the quantity of blood passing through them is very great. While the fœtus is still organically connected with the mother by means of the placenta, the blood passes through these large veins with the same facility as in other parts of the system. After delivery, however, the placental supply is no longer needed; the arteries supplying the uterus with blood shrink, in accordance with certain developmental laws, and nature has provided a means for producing a corresponding diminution in the calibre of the uterine

veins and sinuses, in the contraction of the uterus itself. These veins are probably infinitely more dependent on this latter process, as regards their contraction, than on any inherent tendency of the vessels themselves to contract. As is well known, contraction of the uterus does not always occur so soon after expulsion of the fœtus as is desirable; its involution is delayed. The blood contained in the large sinuses or veins then stagnates, (supposing hæmorrhage does not take place,) and coagulation, or a tendency to such coagulation, of the contents of the vessels is produced. The extra-uterine venous plexuses normally undergo, after delivery, a great diminution in their size, according to Virchow; and, if this contraction be delayed, or do not take place, a tendency to coagulation is thus also produced.

In reference to the influence of imperfect contraction of the uterus, on coagulation, several obstetricians have remarked on the frequency with which puerperal affections of veins occur in cases of retarded involution of the uterus.

5. *The existence of the normal "physiological" coagula, which after delivery close up the orifices of the uterine veins at the seat of placental attachment.* The separation of the placenta from the uterus necessarily involves a solution of continuity in the venous canals, up to that time occupied in returning the blood to the mother from the maternal portions of the placenta. The necessary closure of the divided vessels is accomplished chiefly by the agency of the contraction of the uterus itself, the arrangement of the vessels being such as to favour this process, when the size of the uterus diminishes. But the contents of the vessels have also a share in the perfecting of the closure in question, the blood within them coagulating and forming a plug by which the occlusion is completed. The formation of such coagula within the veins at this position is favoured by two circumstances: there is stasis of the blood within the veins, and, in many cases, exposure of the same to the action of the air. It will readily be seen that the size of the coagula occluding the veins, and the degree of contraction of the uterus, must have an inverse ratio the one to the other. If the contraction be delayed, or be from any cause imperfect, the calibre of the veins is not reduced to the same extent, and the coagula necessarily formed are of larger dimensions than under the opposite combination of circumstances; they will also extend farther towards the heart. Again, the vessels thus unnaturally open are also more liable to be affected by any morbid action which may be going on in the mucous membrane with which they are then directly connected. The formation of a limited coagulum, plug, or thrombus within the uterine veins at the point of attachment of the placenta after delivery, would thus seem to be a usual physiological event. Virchow considers that the existence of these "physiological" coagula have no small share in forming the extensive and marked coagulation in the large veins of the pelvis and parts adjacent to the uterus, so frequently met with after death from puerperal causes. The larger the coagula are in the first instance, the greater will be their effect in producing subsequent coagulation in the neighbouring veins. Imperfect uterine contraction obviously exercises an unfavourable influence in a like direction.

The causes mentioned under the last two heads are, for obvious reasons, often combined. They are probably the most important "moments" in the production of coagulation in the veins during the puerperal state, to which the others mentioned occasionally act as subsidiary.

6. The next circumstance to be attended to as capable of playing an important part in the process now under consideration is, *the occurrence of hæmorrhage from the uterus after parturition.* Post-partum hæmorrhage, depending, as it for the most part does, on deficient contraction of the uterus, tends of itself to relax that organ, and thus to interfere with that perfect subsequent involution of the uterus so essential to the safety of the patient. Hæmorrhage is thus not only an effect, but a cause of deficient uterine contraction. In cases of post-partum hæmorrhage, actively and successfully treated, the uterus is made to contract, and coagula of more than average size have no time to form or space to form in; but when this is not the case, and the treatment is only partially successful, the uterus contracting a little, and again becoming distended, these are just the conditions likely to favour the formation of large coagula in the veins in the first place, and their increase in size and extent subsequently. When the hæmorrhage ceases, a coagulum forms at the orifice of the vessel. Now, when the loss of blood has been excessive, the clot so formed will, from its looseness and want of consistence, less completely close the vessel than when the clot has been formed from blood having the normal proportion of fibrin and blood corpuscles,

and it becomes a question whether this imperfect closure of the orifice in question may not subsequently allow of the admixture with the circulating fluid of those deleterious and septic matters which are occasionally formed on the internal surface of the uterus after delivery. This leads us to consider—

7. *Certain conditions of the internal surface of the uterus following on parturition,* as influencing the formation of coagula. Mechanical injury of the uterus owing to the use of instruments, &c., may be followed by inflammatory action in the uterine substance. This inflammation may pass away speedily, leaving the bloodvessels of the uterus comparatively little implicated. The internal surface of the uterus may take on an unhealthy kind of inflammation in consequence of such mechanical injury, or independently of it. The veins of the uterus corresponding to the seat of attachment of the placenta become under such circumstances also affected, the morbid action passing directly from the surface of the uterus to the interior of the veins. The precise kind of action which is thus induced in the veins of the uterus it is difficult to define. It is sufficient for the present purpose to state that coagulation of the blood in the veins leading from the affected surface is found to be present, and to be one of the effects produced in such cases, and it is probable, on certain experimental data, that such coagulation is often a primary effect of the action of the inflammatory products on the blood within these veins.

I have thus endeavoured as far as possible to eliminate what appear to be the chief determining causes of coagulation of the blood in the veins during the puerperal state. The further history of these coagula, the enumeration of the veins affected, and the changes which the coagula subsequently undergo, these are subjects which I propose to consider at an early opportunity. Some of the many practical deductions necessarily resulting therefrom will then receive their due share of attention.

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