AN ACCOUNT
OF
A NEW METHOD OF OPERATING FOR THE CURE
OF
EXTERNAL ANEURISM,
WITH SOME
OBSERVATIONS AND EXPERIMENTS
ILLUSTRATIVE OF THE
EFFECTS OF THE DIFFERENT METHODS
OF PROCURING THE
OBLITERATION OF ARTERIES.

By **PHILIP CRAMPTON, Esq. F.R.S.**

SURGEON GENERAL TO THE ARMY AND FORCES IN IRELAND.

COMMUNICATED BY
MR. B. C. BRODIE.

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EARLY in the last century the attention of all those who took an interest in the progress of scientific surgery, was attracted by the experiments of Messrs. Petit, Pouteau, and Kirkland, on the arteries of brutes. If those distinguished surgeons failed in establishing the theoretical points towards which their researches were directed, they at least had the merit of instituting an experimental inquiry upon the most interesting part of surgical

practice, and of exhibiting an exquisite example of the means by which such inquiries can most successfully be pursued.

The interest excited by these researches had in a great measure declined, when Dr. Jones pursuing the same line of investigation, arrived at results which have again engaged the attention of the physiologist and the surgeon, and have already materially influenced the opinions and practice in that part of surgery which relates to the treatment of diseased and wounded arteries.

From a series of well contrived experiments upon brutes, Dr. Jones was led to draw the following practical conclusion, namely,

“ That if the ligature does not completely cut through the internal and middle coats all round the artery, adhesion cannot take place between its internal surfaces, and therefore secondary hæmorrhage will take place as soon as the ligature has ulcerated through any part of the parietes of the artery*.”

This conclusion which has been adopted by some of the most distinguished surgeons in these countries, and which, if just, must so materially affect the practice in the treatment of diseased and wounded arteries, rests however upon no other

* Jones, p. 170.

foundation than several experiments made on the arteries of quadrupeds in *all of which* the internal and middle coats were ruptured by the application of the ligature. No comparative experiments, however, are related in order to shew that this operation of the ligature is so essential to the process of union that under these circumstances only can the obliteration of the artery take place. But all general conclusions drawn from the analogy, which is supposed to subsist between the arteries of quadrupeds and man, must be received with the greatest caution, since a few considerations will be sufficient to shew that this analogy is more apparent than real.

1. It may be stated in general, that the adhesive process is more quickly and certainly executed in all the parts of quadrupeds (with the exception of the skin) than in man.

2. In quadrupeds, wounds of the arteries in particular are so prone to unite, that no experimentalist has hitherto succeeded in producing an aneurism in this class of animals; the wounds of the arteries which have been inflicted with this view, healing like wounds made in any other part of the body*.

3. The arteries of quadrupeds are not liable to

* Experiments have failed to produce aneurism in dogs, horses, &c. Jones, p. 117.

that peculiar change of structure from disease which predisposes to aneurism, and which, among other causes, renders the operation of the ligature so uncertain in its effect upon the arteries of man.

Aneurism is accordingly a disease peculiar to the human species. It follows therefore, that although in animals the obliteration of an artery should constantly succeed to the division of its internal and middle coats by the ligature, no conclusion should be drawn with respect to the effects of this operation upon the arteries of man. It is true that the experiments of Dr. Jones perfectly illustrate the process of nature by which the injury inflicted by the ligature is repaired, and it is true that this process is precisely similar, whether it occur in the artery of a quadruped or a man; but the *difference* is, that the process which is always successful in the former, not unfrequently fails in the latter; and it has been shewn that the causes of this failure are to be found in some difference in the structure or actions of the arteries in the different animals.

I shall now endeavour to shew from a variety of observations and experiments upon the arteries of man as well as animals.

1. That the obliteration of an artery can very certainly be effected, independently of the rupture or division of any of its coats.

2. That this operation of the ligature, so far from being essential to the process, not unfrequently defeats it.

Numerous instances are on record of arteries being obliterated by the pressure of tumors. The subclavian and carotid have been found obliterated by the pressure of an aneurism of the arch of the aorta*.

In Mr. Freer's experiments, the pressure of a tourniquet for four days, was sufficient to effect the obliteration of the radial artery in horses†.

Mr. Hunter observed, that in dogs, the mere exposure of the tibial artery to the air for about an hour, excited such a degree of inflammation and thickening of its coats, as completely to obstruct the canal‡.

All the great arteries, the aorta inclusive, have been found obliterated in consequence of the effusion of lymph from their internal coat, and this independent of any injury which could produce the rupture of that membrane.

The cure of aneurism by compression (whether

* Hodgson, p. 110.—Medico-Chirurgical Transactions, Vol. I. p. 12.

† Observations on Aneurism, p. 14.

‡ Hunter on the Blood, &c.

mediate or immediate) affords an example of the obliteration of an artery, independent of any rupture of its internal coats.

The following experiments, selected from a great number which were performed upon the arteries of horses and sheep, will be sufficient to prove that in quadrupeds the obliteration of an artery can be as certainly effected without any perceptible injury being inflicted on its internal coat, as when that membrane is completely divided by the ligature.

EXPERIMENT I.

The carotid artery of a sheep was compressed by means of a flat tape one-eighth of an inch in breadth, passed through the holes of the "*presse artère*." The ligature was drawn no tighter than was sufficient to bring the internal surfaces of the artery into contact. At the expiration of 26 hours the ligature was withdrawn; 25½ hours afterwards the animal was killed. The artery presented the following appearances. About an inch and a half above and below the ligature, the parietes of the artery were thickened by the effusion of coagulated lymph between its coats; the area of the portion between the ligature and the head was considerably diminished; the canal was so completely obstructed at the place of the ligature, as to be impervious to water; but upon plunging one extremity of the artery into a vessel of water, and blowing strongly

into the other, the free escape of air-bubbles ascertained that the obstruction was not of a nature to resist any considerable degree of force. On slitting open the artery, a band of coagulated lymph slightly tinged with blood was found, adhering to the internal coat, and occupying its whole circumference. The band was about one-eighth of an inch in breadth, at the part of the artery that was touched by the tape, and about half as much more at the part corresponding to the foot of the "*presse artère*." The effused lymph was easily separated from the internal coat, the surface of which, though opaque, was perfectly smooth and unbroken; a long and slender coagulum of blood was slightly attached to the lower surface of the effused lymph.

EXPERIMENT II.

A slip of thin white iron one-eighth of an inch in breadth and about one inch in length, was passed under the carotid artery of a sheep, its extremities were lapped over each other in such a way as to form a flat oval in which the artery was included, and gently compressed. Great care, however, was taken not to contract the area of the vessel so much as completely to interrupt the current of the blood; the parts, when examined at the expiration of 60 hours, presented the following appearances. The artery for the extent of three inches was bedded in coagulated lymph. When the slip of tin was removed, the vessel retained a

flattened form at the place at which it had been compressed ; at this point the internal surfaces were in contact, but did not cohere ; the area of the tube seemed to be obliterated by a thickening of the coats, or to speak more correctly, by an effusion of coagulated lymph between the cellular and middle coat. The internal coat was somewhat corrugated and opaque, but it had not thrown out any lymph ; the diameter of the tube was sensibly diminished for nearly an inch above and below the part to which the compression had been applied, and the existence of a long coagulum in the lower portion of the artery ascertained that the obstruction had been complete.

That in man the division of the internal and middle coats not unfrequently prevents the obliteration of the artery, and gives rise to secondary hæmorrhage, may, I think, be collected from the following observations.

It seems to be well established, that ulceration or rupture of the internal and middle coats of an artery, whether it occur with or without a morbid dilatation of the tube itself, is the immediate cause of aneurism, and that the predisposing cause of this disease is to be found in certain morbid changes of structure, to which the arteries of man are peculiarly liable. But we effect by the ligature that very rupture of the internal and middle coats which is stated to be the immediate cause of aneurism ;

and this violence is inflicted on an artery in a condition the most favourable for the production of the disease. Why then (it will be inquired) does not aneurism more frequently succeed to the rupture of the internal and middle coats by the ligature? The answer is obvious. Sometimes this consequence is prevented by the adhesion of the newly ruptured surfaces : sometimes it is prevented by the sloughing or ulcerative process, which, by laying open the arterial canal, gives rise to fatal hæmorrhage : and sometimes aneurism actually does take place. Although the two former of these terminations are of the most frequent occurrence, still the records of surgery furnish abundant examples of the rupture of the artery at the place of the ligature, and the consequent effusion of blood into the sheath, or into the surrounding cellular substance. This is the affection which was formerly described as “ a swelling or dilatation of the artery above the ligature,” and was supposed to be produced by the pressure of the blood obstructed in its course.

A case of rupture of the artery immediately above the ligature is described by Guattano, as having occurred to Acrell*. But in a case recorded by

* Cum vero inferiorem (scilicet ligaturam) contraheret ex inopinato arteria supra superiorem disrupta, &c. Guattani de Aneurism. It is unnecessary to multiply quotations in illustration of a fact, which is but of too frequent occurrence.

Mr. Warner*, the brachial artery gave way three times under the ligature, and at each time formed a distinct aneurism. It appears then,

1. That we are not warranted in concluding "that the internal and middle coats must be cut quite through all round the artery, in order to procure the adhesion of its sides†," but merely that adhesion may take place under such circumstances.

* "In a few days after the operation (amputation of the arm) the humeral artery became so dilated above the ligature, as to endanger its bursting. Upon this account it was judged necessary to perform the operation for aneurism, which was done, and the vessel was secured by ligature, above the upper extremity of its distended coats. After this operation, every thing went on seemingly well for some time, when suddenly the artery appeared again dilated, and was in danger of bursting above the second ligature. These circumstances made it necessary to repeat the operation for aneurism, and from this time every thing went on successfully till the stump was on the point of healing, when quite unexpectedly the artery appeared a third time, diseased in the same manner as before, for which reason a third operation was performed. The last operation was near to the axilla. The patient continued well from this time, without any relapse." Warner's Cases in Surgery.

Mr. Hodgson, in his valuable book on the diseases of the arteries, observes, "that the experiments of Dr. Jones, prove that the sudden laceration of the internal and middle coats of a healthy artery is not followed by the formation of aneurism." But it is to be observed, that Dr. Jones's experiments were confined to the healthy arteries of quadrupeds, in which it has been shewn that aneurism cannot be produced by any means hitherto employed. His experiments therefore cannot be considered as bearing upon the question.

† Jones, p. 170.

2. That *in man*, the rupture of the internal and middle coats by the ligature not unfrequently gives rise to aneurism*, and to secondary hæmorrhage.

3. That a very moderate degree of irritation applied to the *external* coat of an artery, aided by a sufficient degree of compression to bring its internal surfaces into contact, is sufficient to effect the obliteration of the canal.

4. That the permanent obstruction of the canal may be effected by such a process in a period not exceeding twenty-four hours. I shall now proceed to make application of these principles to the treatment of diseased and wounded arteries.

It is somewhat surprising that correct notions with respect to the nature and treatment of aneurism should have been entertained long before the discovery of the circulation of the blood, for

* I have said *aneurism*, because, in point of fact, every case of secondary hæmorrhage would become a case of secondary aneurism, but that the external wound leading down to the artery, gives issue to the blood as fast as it escapes from the ulcerated or ruptured vessel.

The operation for popliteal aneurism is on the other hand so full of uncertainty and danger, that hardly any cases can be mentioned in which surgeons have not been alarmed, and the patient in great danger from secondary hæmorrhages. It is an operation never performed but by surgeons of the first eminence, and yet more perhaps have died than have survived it. Hunter himself has lost his patients, and those whom he did save were endangered by secondary hæmorrhage.—J. Bell, p. 225.

although distinctions were made, founded on a real or supposed difference in the origin or seat of the disease, still it was generally admitted that aneurism was produced by the pressure of the blood, acting upon a weakened or ruptured artery, and that a cure was to be attempted by obstructing the blood in its course to the tumor. Some errors in the practical details in general rendered these attempts abortive, and it was reserved for Mr. Hunter to suggest an operation which should accord with views at once so simple and so just. But if Mr. J. Bell's spirited description of the danger attendant upon the Hunterian operation be somewhat overcharged, still all practical surgeons will admit that they look with anxiety for some means of averting dangers, the reality of which they have but too often had reason to lament. Accordingly we find Mr. Hunter himself, Sir Everard Home, Sir W. Blizard, and several other distinguished surgeons, both in these countries and on the continent, endeavouring by various contrivances to compress the artery from without, with a view of taking off the force of the circulation from the sac, without inflicting any injury on the diseased vessel. Their attempts, however, have not been attended with success, and the causes of failure are too well understood to render it necessary to insist upon them in this place.

In reflecting upon the process of nature by which the spontaneous cure of aneurism is effected, it

seemed to me that with a very little well directed aid from art, this process might be relied on for the cure of every species of external aneurism. For it seems to be well established, that the first and essential step in the spontaneous cure is the coagulation of the blood in the aneurismal sac, in consequence of the current through the ruptured artery being more or less obstructed. Sir Everard Home* and Mr. Scarpa† are of opinion that “ this obstruction is often effected by a peculiar position of the aneurismal sac, by means of which the sac being compressed by ligaments and tendons, makes such a fold as to compress with an equable force (as in artificial compression) the trunk of the injured artery at its entrance into the sac,” &c.

But it seems unnecessary to suppose any “ peculiar position of the sac,” for in every aneurism that has existed for any considerable length of time, the firm parietes of the sac would, if pressed down upon the artery, be sufficient to produce the obliteration of its tube, but that its area is distended by the whole force of the circulation. It follows therefore that when a cure is effected, whether by a process of nature or of art, the distending force, or force of the artery, must be diminished, or the resisting force or reaction of the sac must be increased.

* Transactions of a Society, &c. Vol. I. p. 139.

† Scarpa on Aneurism. Wishart's translation, p. 196.

To begin with the natural process.

When the cure is effected by nature, these changes may be produced in any of the following ways.

1. The force of the diseased artery may be weakened by a diminished action of the arterial system in general. So that the ordinary reaction of the sac upon the vessel may be sufficient to obliterate its tube, or the blood passing in a small and languid stream into the dilated sac, may there stagnate, or at least lose so much of its momentum as to deposit successive layers of coagula, which will at length convert the aneurism into a solid tumor pressing upon the artery*.

2. The pressure or reaction of the aneurism may be increased by its acquiring a sudden augmentation of bulk, in consequence of its coverings being attacked by inflammation. Accordingly in the generality of cases high inflammation, which in some instances has terminated in gangrene, has immediately preceded the spontaneous cure. Such cases are by no means of unfrequent occurrence. There

* It sometimes happens that nature deviates from the ordinary course of diseased operations, and forms a coagulum so complete as to fill up entirely the cavity of the sac, without there having been any previous stopping to the circulation by a vessel being rendered impervious, &c.

Baillie, Transactions of a Society, &c. Vol. I.

is at this moment in the Richmond Hospital under the care of Mr. Todd, a case of popliteal aneurism, in which this first step towards a spontaneous cure has actually taken place. The annals of surgery abound with such cases; but to illustrate this position it will be sufficient to refer to the instances of spontaneous cure of femoral aneurism related by Sir Everard Home*, and Guattano†, and of popliteal aneurism by Mr. Ford‡.

It is a curious fact, and affords a striking illustration of the wise provisions in the animal œconomy against accident and disease, that this first mode of the spontaneous cure seems to be confined to carotid and to internal aneurisms, which from their situation among soft and easily extensible parts are excluded from the benefits of what may be termed natural compression§; while in the cases of the spontaneous cure of aneurism of the extremities, that I have either myself observed or have found on record, sudden increase of pain, inflammation and swelling have uniformly preceded the mitigation of the symptoms, and have in fact been the first step towards a cure. I except those cases of aneurism which succeed to a wound pene-

* Transactions of a Society, &c.

† De Externis Aneurismatibus, Hist. V.

‡ London Medical Journal, Vol. IX.

§ See Mr. Petit and Dr. Baillie's cases of spontaneous cure of carotid aneurism, and M. Pelletan's and Mr. Hodgson's cases of spontaneous cure of subclavian and aortic aneurism.

trating the artery, for here the cure by a natural process is effected in a manner altogether different from either of those which I have attempted to explain.

When the cure of aneurism is attempted by a process of art, the intention is precisely the same, namely, to diminish the force of the artery, or to increase the reaction of the aneurism. The former is effected by the ligature of the vessel, the latter by the compression of the sac. In the present state of surgical knowledge, it is unnecessary to detail the objections to the treatment by compression, since the practice has fallen into disuse, and it is well known that the operation by ligature cannot be relied on when the coats of the artery are affected with steatomatous or earthy concretions; yet such a morbid condition of the artery is believed to be the predisposing cause, and is at all events the almost constant attendant upon aneurism. Ulceration of the artery, however, at the place of the ligature, has occurred, where no diseased condition of the coats could be detected, except at the place of the aneurism. In the case of John Lewis, a negro, who was operated upon by Mr. Birch, Mr. Cline (who examined the parts after death) observes, that “water injected by the iliac artery escaped freely from the wound, at the ligature where *the artery was open, and appeared to have ulcerated at that part.*” He adds, “on opening this part of the artery from the sac to the

ham, *it appeared quite sound and of its natural colour*.*"

But in fact secondary hæmorrhage is but too frequently observed to succeed the ligature of the femoral artery, even when the operation has been performed in consequence of a wound of that vessel, and where there was no reason to suspect a morbid condition of its coats†.

As my chief object is to shew the connection between secondary hæmorrhage, and the division of the internal and middle coats of an artery by the ligature, I omit the consideration of the severe constitutional affection, which, to a greater or lesser degree, constantly succeeds to this operation, and which, in some instances, has even terminated fatally‡. The experiments of Dr. Jones, which

* Transactions of a Society, Vol. I. p. 171.

† Deschamps, Observations sur la ligature des artères blessées.

‡ The constitutional affection would, in some instances at least, seem to depend on the extension of inflammation along the internal coat of the artery; but it would however appear, that the constriction of any living and sensible part by ligature is an injury that excites in general high constitutional irritation. I have witnessed two instances in which the application of a ligature to a hæmorrhoid proved fatal, and I once saw Tetanus induced by the application of a tight ligature to a large wart on the inside of the thigh.

In Mr. Travers's brilliant operation for the cure of an aneurism by anastomosis in the orbit, the irritation excited by the constriction of the carotid artery had very nearly proved fatal, and the death of Mr. Ramsden's patient after the ligature of the subclavian

have been so ably followed up by Mr. Travers, opened new and important views in the treatment of aneurism: for since many of the dangers attendant upon the constriction of a great artery, are referable to the continued irritation which is excited by the ligature, and to the ulcerative or sloughing process by which it is detached, it seemed reasonable to conclude that the mere division of the internal and middle coats, and the subsequent removal of the ligature before the sloughing process had commenced, would exclude some of the chief dangers of the operation.

But it is to be observed that the division of the internal and middle coats is the fundamental principle of this operation, and I have endeavoured to shew (1) that this division of the internal and middle coats is precisely the *kind* of injury which a diseased artery is least able to bear with impunity: accordingly secondary hæmorrhage or *even aneurism** is not an unfrequent consequence of this operation.

And (2) that the obliteration of the artery can very certainly be effected by other and less hazardous means.

clavian artery, seems to be referable to this cause, rather than to the presence of a "polypous concretion in the cava superior which hung pendulous into the auricle."

* See p. 9. Warner's case, &c.

According, however, to the views which I had taken of the process of nature in the spontaneous cure, it appeared to me that a cure might be effected by a process of art, which should in no degree endanger the integrity of the artery. Intermediate compression, or compression from without, (maintained for a sufficient length of time to allow the blood in the aneurismal sac to coagulate) had been tried and was found ineffectual. It remained but to try the effect of the immediate compression of the tube, regulating, however, the operation in such a way as to employ no greater degree of pressure than would be sufficient to interrupt the circulation of the blood, and to maintain it no longer than might be required for the completion of the process of coagulation. Whether or not this slight and temporary compression would be competent to effect the obliteration of the artery at the place of the ligature was a distinct consideration. Such a result might perhaps be inferred from Experiments I. and II.; but its occurrence could not be considered as necessary to the success of the operation, which is sufficiently assured from the moment that the blood has coagulated within the aneurismal sac.

I shall now briefly state, in the order in which they occur, the changes which it appears to me are likely to be produced by an operation conducted upon the above principles.

In the first place, it must be considered that the

aneurismal sac is, at the instant preceding the obstruction of the artery, distended not only by the whole force of the circulation (whatever that may be) but by that force multiplied as often as the area of the opening of the artery is contained in the internal surface of the sac. Without entering into a calculation, the *data* of which are so uncertain, it will be admitted that the muscular and ligamentous parts by which the sac is invested, must be distended far beyond their state of rest, or that natural degree of tension into which they have a constant disposition to return. On the instant, then, that the blood is obstructed in the artery, the coverings of the sac, relieved from the force by which they were distended almost to bursting, will suddenly react; a part of the fluid contents of the aneurism will be driven back into the flaccid and nearly empty artery, and the firm parietes of the sac, pressed down upon the unresisting tube, will obliterate its area. In this way, all communication being cut off between the artery and the sac, the blood stagnating in the aneurism will gradually coagulate, the more fluid parts will be absorbed, and the more solid will be condensed by pressure, until the whole sac and its contents are reduced to the situation of a firm tumor pressing upon the artery. The subsequent changes which terminate in the obliteration of the arterial tube, by the adhesion of its surfaces, and the removal of the coagulated blood by the process of absorption, are well understood.

Thus it would appear that when a ligature is applied above the seat of an aneurism, the first and essential step towards a cure is effected by the coagulation of the blood in the sac. The obliteration of the artery in consequence of the action of the ligature upon its coats, is a subsequent process, which can in no other way influence the success of the operation, than as it may give rise to secondary hæmorrhage or to constitutional disturbance. Let us now examine how far this opinion with respect to the changes which are induced by the temporary compression of the artery above the seat of aneurism, is conformable to the observations of others. Mr. Hodgson, whose extensive researches and accurate observations have thrown so much light on the pathology of aneurism, has remarked that “in *all* the preparations which he has examined, and in all the cases which he has met with on record, in which the parts were dissected after a complete and radical cure of aneurism had been effected by the modern operation, the cavity of the sac has been found obliterated, *and both extremities of the artery, from which the aneurism arose, were also obliterated* to the origin of some important branch.” He excepts Mr. Astley Cooper’s case*, “in which the femoral artery was converted into a solid cord from the origin of the profunda to the commencement of the tibial arteries. But in all the other dissections after the modern operation for popliteal

* Medico-Chirurgical Transactions, Vol. II.

aneurism, the femoral artery has been found to be obliterated for the space of three or four fingers' breadth at the place where the ligature was applied. *Below that part it was pervious, and continued so for some distance, when the obliteration again commenced, and continued throughout a considerable extent of the popliteal to the origin of the inferior articular arteries."* In Mr. Hunter's first patient, who died fifteen months after the operation, "the femoral artery was impervious from its giving off the arteria profunda as low as the part included in the ligature. Below this part the femoral artery was pervious down to the aneurismal sac, and contained blood, *but did not communicate with the sac itself, having become impervious just at the entrance*."*

Mr. Hodgson refers to five cases in which similar changes were observed to have taken place. The simple explanation of these facts is that the artery is obliterated at the two points of compression, namely, at the place of the ligature and at the place of the aneurism. The occurrence of pulsation in the ham after the artery has been tied on the fore-part of the thigh, would seem to militate against this doctrine, but it is to be observed,

1. That pulsation corresponding with the action of the heart cannot be communicated by the ob-

* Transactions of a Society, &c. Vol. I. p. 153.

structed artery to the blood in the sac, since that portion of the artery contained between the ligature and the tumor can be filled only by the reflux blood pouring in slowly from anastomosing branches.

2. The absolutely inactive state of the artery between the ligature and the sac can be satisfactorily ascertained; for by laying the finger upon the naked vessel, immediately above and below the place of the ligature, it will be found that a strong pulsation exists in the upper, and none whatever in the lower portion of the vessel. This inactive state of the artery beyond the ligature is, however, to be observed only in cases of aneurism; for in the healthy carotid or femoral artery of a sheep or horse, a pulsation can be felt on either side of the ligature; it is, however, much more distinct in the portion of the artery between the ligature and the heart.

3. In Mr. Pott's case, as related by Sir E. Home, pulsation recurred in the ham after the ligature had been applied to the popliteal artery *immediately above the aneurismal tumor*.

The conclusion is, that secondary pulsation must be attributed either to the imperfect construction of the arterial tube by the ligature, or to the opening of some large anastomosing branch into the cavity of the sac. It would appear from the following cases, that the temporary compression of an artery,

upon whatever principle it may act, may be successfully employed for the cure of aneurism.

CASE I.

On the 12th of October, 1814, Francis M'Donnell, of the Tyrone regiment, was transferred from the regimental Hospital at Kilbeggen to the King's military infirmary near Dublin. I received the following memorandum respecting his case from Surgeon Sinclair: "For three months past, M'Donnell has complained of pain in the calf of his leg, which did not interfere with the discharge of his duty, until the night of the 20th of September last, when he was seized, while asleep on the guard-bed at Longford, with the most excruciating pain in the ham, which he found upon examination to be swelled and throbbing violently, &c." The only additional circumstances which it seems necessary to notice are the following. He was about 39 years of age and of a robust make; his countenance, however, was sallow, and expressive of the greatest anxiety. His pulse was upwards of 120, and remarkably full and strong. He had not slept for many nights, and was occasionally delirious. The aneurism was of an unusually large size: it not only distended the ham to the utmost, but forced up the calf of the leg, and formed a large and pul-

sating tumor under the fascia of the vastus internus muscle, immediately above the inner hamstring. Forty ounces of blood were taken from his arm, his bowels were freed, and an evaporating wash was applied to the tumor. He passed a better night, and at half past twelve on Saturday, the 14th of October, the operation for aneurism was performed in the following manner: the femoral artery was laid bare at the usual place by an incision not exceeding three inches in length, and a tape, one-eighth of an inch in breadth, was passed under it by means of the aneurism needle. The ends of the ligature were passed through the holes in the foot of the "presse artère *," and then crossed through the hole in its stalk. The artery was gently compressed by drawing the two ends of the ligature in an opposite direction, until Mr. Stringer†, who kept his hands applied to the tumor from the commencement of the operation, announced that the pulsation had ceased. The ligature was then secured by passing a small peg of wood through the hole in its stalk, and a small dossel of lint was laid on each side of the instrument in order to steady it in the wound (a precaution which I have ascertained to be unnecessary), and the sides of the wound were gently approximated by two or three strips of adhesive plaster. The operation was completed in about twelve minutes.

* See Plate I. fig. 2.

† Surgeon to the King's Infirmary.

The man made no complaint when the ligature was drawn, and when he was laid upon his bed he said "he was now as well as ever." In about twenty minutes, however, he complained of an excruciating pain in the calf of his leg. He was ordered 35 drops of laudanum. At half past two o'clock he still complained. I determined, therefore, to relax the ligature, as well to ascertain how far the pain was excited by its pressure, as to observe what progress had been made in the process of coagulation. The peg was withdrawn from the hole in the stalk of the instrument, and the ligature was thus left at liberty to yield to any impulse that it might receive from the artery. I watched for five minutes with my hand upon the tumor, and as the pulsation did not recur, the peg was replaced, so as to secure the ligature at the degree of tension which it now possessed. The pain abated immediately; but in about ten minutes it returned with nearly equal severity, but it was now confined to the ankle and heel. At about six o'clock in the evening he vomited freely, and the pain immediately abated. His pulse at eight o'clock in the evening was 84, full and soft. Temperature of the right foot 86 degrees, of the left 82. Sunday, 15th (noon) had considerable pain during the night, but at five, *a. m.* it ceased altogether, and he slept for two hours. He is now free from pain or uneasiness of any kind, pulse 96: has had four stools from some purgative medicine which he had taken in the morning. He says that "the limb felt cold

until two in the morning, it then became warm and comfortable." Temperature of the left foot behind the ball of the great toe, 84 degrees; at the great toe itself, 80.1; of the right foot and great toe, 77 degrees. I relaxed the ligature completely: no pulsation at the ham. (Monday, 16th) half past eight o'clock, *a. m.* pulse 65: slept six hours tranquilly; is quite free from pain or uneasiness of any kind: no pulsation in the tumor: pulse 80, soft and full: temperature of each foot at the toes, 80 degrees: the instrument lies loosely in the wound, indicating by its motion the pulsation of the artery on which it lies. (Tuesday, 17th, noon) slept eight hours: makes no complaint: I withdrew the instrument and ligature without difficulty and without inflicting the slightest pain: the lips of the wound still further approximated by slips of adhesive plaster.

From this day every thing with respect to the aneurism proceeded in the most favourable manner. On the 14th day from the operation the man went about the ward on crutches. The state of his general health, however, did not keep pace with the improvement in the local disease. For many weeks afterwards he was harassed by severe pains in the calf of the leg, the ankle, and heel, accompanied with great weakness of the limb. The pain at length subsided, and he went to his regiment about two months after the operation. Here a new train of symptoms supervened, which but too clearly pointed to the existence of an aneu-

rism of the aorta. I was not, therefore, surprised to learn that a few months afterwards he died suddenly while on furlough among his friends.

CASE II.

On Monday, 27th of February, 1815, I was invited by my friend Mr. Dease to assist at an operation for popliteal aneurism: the following were the principal circumstances of the case. Mr. Smith (the subject of the disease) was about 26 years of age, and had hitherto been remarkably healthy. In August last he perceived a small pulsating tumor in the ham, which at first was attended with but little pain and only with occasional lameness. In December last, it began to increase rapidly, and the pain became intense. In January he took to his bed, and when Dr. Dease visited him for the first time in the beginning of February, he found him greatly emaciated: his pulse was 126, and remarkably full and bounding. He said, "he felt as if his whole body was shaken by the strong pulsation of his arteries." A few days before, Mr. Adrian had, by a contrivance, similar to Sir W. Blizard's, endeavoured to compress the artery from without, but by no force that could be borne was he able to stop the pulsation at the ham: the attempt was therefore abandoned. The operation was performed by Dr. Dease at 12 o'clock on

Monday the 27th of February. The artery was laid bare at the usual place, and the "serre artère" was applied as in the case of M'Donnell. Mr. Smith was not sensible of any peculiar sensation when the artery was compressed by the ligature. At half past five, *p. m.* the ligature was completely loosened. In about a minute, a deep and obscure pulsation was discerned in the tumor: it became more distinct at every moment. The ligature was immediately tightened and the pulsation ceased. At half past twelve on the following day (28th, twenty-four hours after the operation and nineteen since the circulation had been last interrupted) the ligature was again completely loosened. We waited with great anxiety for nearly an hour, but the pulsation returned no more. It was determined, however, that the instrument should be allowed to remain in the wound, and an intelligent assistant who remained constantly in the room was directed to tighten the ligature in case the pulsation should recur. His pulse was 100, and much more soft: he said he had a sensation of numbness, but not of coldness, in the limb. Wednesday (29th) quite free from pain: slept until six o'clock this morning; he had then some bilious vomiting, but his stomach is now settled. At half past five o'clock, the instrument which lay loose in the wound was withdrawn without difficulty or pain. From this period his recovery was rapidly progressive: in less than three weeks the wound was healed, and the tumor was so much reduced as to be visible only in

the most extended position of the limb. In April his health was perfectly re-established, and he was able to walk abroad, supporting himself on a single crutch, and laying the foot lightly to the ground.

P. S. Since the preceding observations were written, a case of the greatest interest has occurred in one of the hospitals of this city, and which I am permitted to communicate to the Society.

“ On Friday, the 23d of February, 1816, the femoral artery was tied (in the manner recommended by Mr. Travers) for an aneurism of the posterior tibial artery. On Monday, the 26th, the case appeared to be doing well, all pulsation having ceased in the tumor, and the temperature of the limb being natural, a slight attempt was made to loose the knot, which, proving ineffectual, was not persevered in. On Wednesday, the 28th, at eight o'clock *a. m.* the ligature, appearing to lie loosely in the wound, was withdrawn without resistance, the loop remaining perfect : a violent hæmorrhage came on at one *p. m.* the same day.

“ The artery was secured again about three inches higher up. No alteration in the temperature of the limb followed this operation. On Friday night the patient became delirious, and died on the following morning.”

On dissection the artery was found to be completely divided at the place of the first ligature: its extremities had retracted to the extent of three quarters of an inch. The mouth of the upper extremity of the tube was circular, its area was not contracted, nor were its coats thickened; but it was imperfectly obstructed by a coagulum about half an inch long, which seemed to adhere partially to the internal coats. There was no appearance of lymph having been effused from the cut edge of the divided coats. The lower extremity of the tube presented similar appearances, with this difference, that it was more perfectly obstructed by a coagulum.

It would seem then,

1. That the division of the internal and middle coats had been effected in the usual way by the application of the ligature.
2. That the complete division of the tube in consequence of the sloughing or ulceration of the external coat had taken place *at least* on the morning of the fifth day; for, on that day, the ligature with its loop lay loosely in the wound, and was withdrawn without resistance.
3. That, *after the division of the tube*, hæmorrhage was delayed by the presence of a slightly adherent coagulum.

The striking feature in this case is the occurrence of hæmorrhage on the fifth day; how far this accident is to be attributed to the attempts, however cautious, to withdraw the ligature from an artery already weakened by the division of its internal middle coats, I do not pretend to determine; but that a vessel so circumstanced is not in a condition to bear violence or even disturbance of any kind, will I believe be readily conceded.