ON THE
OPERATION
FOR
ANEURISM.

BY GEORGE NORMAN, ESQ. OF BATH.

COMMUNICATED

BY MR. ASTLEY COOPER.

Read Feb. 16, 1819.

AS a difference of opinion has existed among surgeons on the subject of the operation for Aneurism, some recommending the application of two ligatures, and the division of the artery between them, others proposing the single ligature as practised by Mr. Hunter, varying however the mode of its application, conformably to the views of the operation of the ligature on arteries, presented to them by the experiments of Dr. Jones and others, I take the liberty of offering to the Society a few instances in which the latter method has been employed; considering it to be desirable that every evidence should be collected on a subject of so much importance in the practice of surgery; and hoping

also that some other circumstances in the cases may be of sufficient consequence to render them not altogether unacceptable to the Society.

— Hicks, aged 50, who had been twenty years a coachman, was admitted into the Casualty Hospital September 7th, 1813, for an aneurism of the femoral artery, immediately below Poupart's ligament.

He had always enjoyed good health, but about a year ago he was attacked with giddiness of the head. He applied to Dr. Barlow, who had prescribed bleeding and purgative medicine, which soon cured him. He continued perfectly well until ten days before his admission into the hospital, when he had been suddenly seized with a severe pain in the upper part of the right thigh, extending down the inner side to the leg. He then first discovered a tumor about the size of a pigeon's egg, in the upper part of the thigh, which he observed to beat very much. He could not remember having used any exertion previous to these circumstances.

The pain became more violent, and the swelling increased so much, that on the following day he was unable to get out of his bed. He was bled, and in three days the bleeding was repeated, but the tumor rapidly enlarged.

In nine days from its first appearance, he was admitted into the hospital, having been brought a distance of fifty miles.

The tumor commenced at the lower edge of Poupart's ligament. It extended four inches downward, and measured seven inches in width. The man thought it had acquired this size in three days after its first appearance. The pulsation was not very distinct. The skin over the tumor was hot and red, and the pulse 108, hard and full. He was bled, and a solution of acetate of lead applied to the swelling. He was confined to bed, and by the 13th his pulse was reduced to 76. The skin over the tumor was less inflamed, but the size of the tumor remained the same, and the leg was swollen and œdematous.

On the 13th, the operation of securing the external iliac artery was performed, by making a longitudinal incision, in the manner recommended by Mr. Abernethy. A single ligature was passed round the artery, and it being ascertained that the vessel was no more detached from the surrounding parts than the ligature had separated it, was tied, and the parts brought together.

Seven hours after the operation the limb felt equally warm with the other ; his face was flushed ;

his pulse 96, and hard ; his breathing quick and laborious. Sixteen ounces of blood were taken from the arm.

On the 14th, he was free from pain ; his breathing natural, pulse 90, and soft. The heat of both limbs was ascertained by the thermometer to be the same.

On the 15th, he complained of great pain in the tumor, which was hot and very red ; his pulse 110 and hard ; his breathing frequent, and his skin hot. Sixteen ounces of blood were again taken from his arm, and a cold lotion applied to the tumor.

On the 16th, he was better and free from pain ; the redness of the tumor was diminished ; pulse 96 and soft.

17th. The tumor was less ; the redness of the integuments had disappeared ; the wound had united at every point, except that where the ligature was.

He went on well, the tumor gradually diminishing until the 25th, when its size was somewhat increased ; the skin over it was hot and red, and pressure on it gave pain. Cold lotion was again applied, some purgative medicine given, and his

diet was reduced for a few days. The pain and redness again subsided, but an evident pulsation could be felt in the tumor.

October 1st, the ligature came away; after this the swelling rapidly diminished, but a weak pulsation could be distinctly felt in it, which however gradually ceased, and he was discharged from the hospital November 1st, when the tumor was reduced to one fourth its original size, and the limb had nearly recovered its original strength.

I have had several opportunities of seeing this man since. The swelling soon entirely disappeared and the limb became as strong as the other. He has two or three times been affected with giddiness of the head, which has been always cured by bleeding; but for the last twelve months he has had no return of illness whatever, and was on Sept. 25th, 1818, when I last saw him, in perfect health.

This aneurism appears to have arisen from plethora; and judging from the sudden appearance and rapid increase of the tumor to its full size, in three days, it seems probable that it was a rupture of the femoral artery, and that the tumor was occasioned by the extravasation of blood into the surrounding parts.

Twice after the operation he was threatened with serious inflammation of the aneurismal tumor, which probably, had it not been subdued by bleeding, would have prevented the success of the operation. And in a few days after the operation, when the collateral circulation in the limb was fully established, the tumor was again supplied with blood in sufficient quantity to produce a distinct pulsation, a fact of practical importance, as it shews, that though the ligature on the iliac artery stops the direct influx of blood into the tumor, and is the means by which the disease is cured, yet that there exists a necessity for employing strict rest, the antiphlogistic regimen, and in some cases the abstraction of blood, to assist nature in her operation of obliterating the aneurism.

Joseph Gerrish, aged 50, a tailor by trade, applied at the Casualty Hospital, April 1st, 1817, in consequence of violent pain and swelling of the right leg.

He was so lame that it was with the utmost difficulty he had walked to the hospital. His countenance was exceedingly anxious, he was much emaciated, his pulse very quick and weak. He said the swelling of the leg had begun a

fortnight before, but a few days ago he had experienced great pain in his thigh, and soon after the leg began to swell he had discovered a tumor in the upper and inner side of the thigh.

The tumor, on examination, proved to be an aneurism of the femoral artery, immediately at its passage under Poupart's ligament; the tumor was four inches in length, and three in breadth; it commenced at the upper part of Poupart's ligament; the pulsation was strong, and at the most prominent part a thrilling sensation was given to the finger, and at the same part the skin was hot and red. He had never, he said, made any very violent exertion. He had been for several years an invalid, having been affected for some winters with cough. He was ordered to keep cloths wet with cold lotion constantly applied to the swellings, and to keep his bed.

The three first days after his admission somewhat improved his situation; his pulse became slower and stronger, his countenance indicated less distress, and the redness of the skin on the tumor subsided.

On the 5th of April he complained of violent pain in the limb; the tumor had much increased since the evening before; it extended above Pou-

part's ligament to nearly opposite the superior spinous process of the ilium, and a pulsation could be plainly felt at its upper part.

The operation was proposed to him, but he could not be prevailed on to submit to it before the following day.

The operation was performed by making the incision in the direction of Poupart's ligament, as proposed by Mr. Astley Cooper, which I found to be a much more easy method of finding the external iliac artery, than the longitudinal incision practised by Mr. Abernethy, and which in the former case I had made use of.

And it appears to me that the objection made to Mr. Cooper's mode of operating in cases where the tumor extends high up, is by no means well founded, for the lower part of the bag of the peritoneum, lying on the edge of Poupart's ligament, must in every case be exposed and detached, in order to get at the artery which lies behind the posterior part of that membrane, and this is most readily effected by an incision in the direction of Poupart's ligament, whilst two thirds of the longitudinal incision are made on a part of the peritoneum which lines the abdominal muscles, and the lower portion only of the incision reaches that part of the membrane which is to be separated.

The consequences of this are, that the peritoneum is in much greater danger of being wounded, and that the probability of a hernia forming after the cure is much increased by the extensive division of the oblique muscles.

One ligature was passed under the artery, and tied as in the former case, the artery not being in the least disturbed. After the operation, tension of the abdomen and retention of urine supervened. The wound sloughed, and after twelve days of varying degrees of suffering he died.

In the evening he was free from pain ; pulse 108, but weak ; the limb felt equally warm with the other.

On the 7th, he was free from pain, and had slept well ; pulse 120, and small ; the abdomen was tense, but not painful on pressure ; the swelling of the leg was much diminished.

On the 8th, his pulse was 128, his tongue furred ; he was in no pain. The abdomen was still tense. He had passed no urine since the middle of the day preceding ; a pint of water was drawn off by the catheter, but the tension of the abdomen was not diminished ; the wound had not united ; there was a brownish red appearance of inflammation round it ; the swelling of the limb was much less, and the

aneurismal tumor was less tense and was reduced in size. He took nourishment freely, and decoction of bark with laudanum.

On the 9th, he was much the same ; pulse 120, and intermittent ; the abdomen still tense ; it was again necessary to pass the catheter.

On the 10th, there was less intermission of the pulse, and the abdomen was less tense ; he had passed some urine, but a pint was again drawn off ; the whole surface of the wound was in a sloughing state ; and the discolouration round it more extended.

On the 11th, he was better ; his pulse 96 and less intermittent ; he had passed sufficient urine.

12th. He was better than the day before ; the slough on the wound was separating, and the discolouration was less ; the tumor was reduced in size.

13th. He had passed a good night, and said he was better, but his countenance looked more sunk. A large slough had formed above the wound since the day before ; he suffered no pain, and the tension of the abdomen was gone.

On the 14th, he still said he was better, but looked much worse ; pulse 108 and intermitted ; he could take very little nourishment.

On the 15th and 16th he got gradually worse, and on the 17th, being the twelfth day after the operation, he died.

On examining the body, the fascia covering the abdominal muscles of the side on which the operation had been performed, was in a state of slough to the same extent; that the erysipelatous inflammation had appeared on the skin, and on opening the abdomen, the corresponding portion of peritoneum was of a dark purple. The peritoneal covering of the iliacus internus of that side was of the same colour, and was distended by the pressure of the aneurismal tumour, part of which was situated in that muscle, and extended as high as its origin from the spine of the ilium.

The cæcum was of a dark colour, and adhered slightly to the peritoneum; there were red patches on the external coat of the aorta at the bifurcation, and on both the common iliacs.

The left external iliac was not larger than the right, which had been tied; the right iliac was of a purple colour, and contained a red coagulum, which extended from the ligature to the internal iliac.

On removing part of the coagulum, the internal coat of the artery was seen of a dark red; the ligature was under the artery, which was no where

detached ; there was no appearance of suppuration except at the point where the ligature was applied ; there the vein adhered firmly to the artery.

The artery below the ligature was filled with a clot of blood to the extent of an inch, where the *arteria circumflexa ilii* was given off, and a little below that was the origin of the epigastric.

A little lower than that vessel the crural artery was dilated for the space of two inches, to the width of an inch and a half, whilst the crural vein adhered firmly to its inner side ; the *arteria profunda* was given off from the lower extremity of the dilated part of the artery, and below that the femoral artery was of its natural size and appearance.

The aneurismal tumor was situated behind the dilated part of the artery ; the lower part of it was formed by the *pectinalis* muscle, and the upper by the *iliacus internus*.

On opening the tumor more than a pint of blood, part fluid and part coagulated, was removed ; some firm coagula adhered to the sides of the sac, and one solid clot closed the opening from the artery into this cavity ; on removing this it appeared that the internal and middle coats of the artery had

been destroyed, and that the elastic coat dilated, formed the inner surface of the sac for about two inches, when its appearance was gradually lost in the muscular structure of the tumor.

There were some adhesions of the pleura on the right side of the chest, which contained from seven to eight ounces of opaque serum. There was no disease of the lungs, and no fluid in the cavity of the left pleura. The pericardium contained five ounces of serum, and there were some large flakes of coagulated lymph on the surface of the pericardium covering the heart; there was not any disease of the heart, of its valves, or of the large vessels.

This appears to have been a case of diffused aneurism, from ulceration of a portion of the artery, and it seems probable that no tumor existed till the blood had escaped into the muscles.

Two circumstances of practical importance are evinced in this case; one is the necessity of operating as soon as the nature of the disease has been ascertained, as every hour adds to the risk of the blood being forced into the surrounding parts to a greater extent than admits of reparation after the artery has been secured, and which occurred in this case after the patient was admitted into the hospital, and seems to be one reason of its unsuccessful issue;

though perhaps the disease of the right pleura and of the pericardium were sufficient to prevent the powers of the constitution from being successfully exerted for the cure.

The other is that in some cases of aneurism the operation may be performed though the tumor may extend higher up than where it is necessary to pass the ligature round the artery, provided it has been clearly ascertained that the disease commenced below ; for in this case the tumor, at the time of the operation, extended as high as the bifurcation of the aorta.

The dissection shews, that the process for the obliteration of the artery and the separation of the ligature was going on satisfactorily, and that had the patient lived, the single ligature would have answered as well as in the former case.

John Lacey, a boy not quite fourteen years of age, was admitted into the Casualty Hospital on the evening of the 28th of August, 1817. The account that I received of him was, that one month before, he had been wounded by another boy, who had forced a hay-fork into the upper and outer part of his left thigh. He bled so profusely at the time, as to induce his friends to believe that he would

bleed to death, before the surgeon to whom they sent (and who lived at the distance of more than half a mile) could arrive.

The hemorrhage, when he came, had however ceased. He dressed the wound, and applied the tourniquet loosely, with directions to the friends how to tighten it if the bleeding returned.

Blood was discharged at the wound for two days after, but not in sufficient quantity to excite alarm. On the third day it again burst out, and subsided, which induced the surgeon to have the boy removed to the town where he himself resided, that he might be near in case of sudden hemorrhage, and that he might have the assistance of another surgeon.

The bleeding returned two or three times, but not in such a degree at any one time, as to induce the surgeons to think it necessary to make any attempt to secure the vessel. At length all hemorrhage ceased for ten or fifteen days, and the wound appeared to be going on well.

But on the evening of the 27th, exactly one month after the accident, a more profuse bleeding than any of the former occurred, and though it again ceased, the quantity of blood lost was so great, and the boy was so much reduced, that the

surgeons thought it right on the following morning to endeavour to secure the artery.

An incision was accordingly begun a little above the wound, and carried through it, down the outer part of the thigh, to the extent of seven inches. After dividing the fascia to nearly the same extent, several clots of blood were removed, which left a cavity situated in the muscles of the upper part of the thigh, from the bottom of which an immense flow of blood issued as soon as all the coagula were removed, but the wounded vessel could nowhere be discovered.

A tourniquet was applied at the highest part of the thigh, and the patient, accompanied by one of the surgeon's assistants, was brought to the hospital at Bath, a distance of eight or nine miles.

I saw him soon after his arrival; he was much emaciated and very pale; his pulse small and very quick; both feet were cold, the wounded limb was of an icy coldness, and the leg œdematous.

On removing the tourniquet and bandage, the blood began to flow freely, but pressure on the artery in the groin commanded the hemorrhage. The opening in the outer part of the thigh was large enough to admit the whole hand. The wound made by the hayfork was a little below the tro-

chanter, but all trace of the direction in which the instrument had passed, was lost in the immense cavity formed among the muscles by the extravasated blood. The finger, when passed into the upper part of the cavity, reached the spot where my assistant compressed the artery in the groin.

Under these circumstances, I was unwilling to hazard any attempt to find the wounded artery, more especially as the very reduced state the boy was in, rendered it certain that he could not survive any farther loss of blood, and as the passing of the finger to Poupart's ligament rendered it possible that the wound of the artery was high up. I therefore, whilst the assistant's thumb compressed the vessel, made an incision in the direction of the upper edge of Poupart's ligament, and passed a single ligature round the external iliac artery.

After tying the ligature, I found that though the violence of the hemorrhage was restrained, yet that a larger quantity of blood continued to flow from the wound in the thigh than was consistent with the boy's safety.

I therefore exposed the femoral artery two inches below Poupart's ligament, and finding that when I held the artery between my finger and thumb all bleeding ceased, I tied a single ligature round the artery.

About four ounces of blood were lost during the whole time. The boy was now faint, his hands and feet cold, no pulse could be felt at the wrist, and he breathed very faintly. After swallowing some warm wine he recovered a little, the pulse at the wrist returned, and he spoke, but there was no farther hemorrhage. All the coagulated blood was removed from the cavity of the thigh, the parts brought as near together with adhesive plaster as could be affected, the boy placed in bed with the limb wrapped in flannel, and thirty drops of tinct. opii. given to him in some warm wine.

He slept well in the night, and on the 29th he appeared tolerably well; he was pale, his pulse small, 140 in a minute. The whole limb was warm and less swollen; he said he did not feel pressure made on the foot, but in the upper part of the leg and the knee sensation was perfect.

In the evening the limb was quite warm, and the feeling of the foot restored; he complained of fulness, and there was some tension of the abdomen.

He continued to improve gradually until September 5th, when there came on a very large discharge of matter, mixed with blood, from the wound in the thigh, which arose from a large collection of coagulated blood in the lower part of the thigh finding its way into the wound.

On the 6th, he appeared better, the limb, which had been more swollen for two days, was less. The discharge from the wound was diminished; pulse 130.

On the 7th, he had been attacked with a violent diarrhœa; the discharge from the wound was increased; the ligature on the femoral artery came away.

On the 8th, the diarrhœa continued; he had passed a restless night; the foot of the affected limb was cold, and had dark patches on it; pulse 144.

9th. He had vomited frequently; pulse 150; there were vesications on the foot; the leg was warm, but much swollen.

10th. The vomiting had ceased, and he appeared rather better; pulse 134; the vesications on the foot increased.

11th. He slept almost the whole day; his countenance much sunk; pulse 138; the whole foot was dead.

12th. He was delirious; pulse very small; countenance more sunk.

13th. Delirium still continues; pulse at the wrist scarcely to be felt.

14th. He had taken some nourishment ; pulse fuller, and his countenance a little improved ; the integuments for four inches up the leg were dead, and there was a large sphacelated patch on the inner side of the leg.

15th. He was rather better ; pulse 108 ; he got some sleep, and the delirium had subsided.

16th. He was still better ; pulse 108 ; the wounds in the thigh looked better ; a line of separation had formed between the foot and the living part of the leg.

17th. The ligature from the external iliac artery came away.

19th. His countenance and pulse had improved ; the foot was separating from the leg.

In the three next days his general health farther improved ; the foot was almost separated from the leg ; the sphacelated parts in the leg were much separated, but a large patch of slough had appeared on the inner side of the knee.

On the 25th, the bones of the tarsus were nearly detached from the tibia ; the sphacelated part of the leg had separated, so as to expose two thirds of the fibula ; large sloughs had formed over the

sacrum, and the posterior spinal process of the ilium was exposed; pulse 108.

26th. He appeared better; he had slept well; his appetite was pretty good. The limb was amputated above the knee; the femoral artery, and two others nearly as large (one immediately below the femoral, and the other under the bone) required to be taken up. The boy bore the operation well, and was not sunk by it.

On the 27th, he had slept nearly all night; he was free from pain; pulse 124; his countenance was much improved, and he had taken a considerable quantity of nourishment.

By the 30th he was much improved; the stump was opened; it had united, except at one point, whence some matter issued from a sinus in the thigh.

October 3d. The stump had made considerable progress; the wounds in the thigh were nearly healed; the sloughs on the back had separated, and left large healthy sores.

12th. All the ligatures had come away from the stump, which was healed except a small opening, communicating with the sinuses in the thigh; the sores on the back were much less; pulse 98; he sat up part of the day, for the first time.

November 8th. He was so far recovered that he sat up the whole day. The sores on his back were reduced to an inconsiderable size ; the stump and the wounds in the thigh were nearly well.

By the end of November all the sores were well, and his health exceedingly improved. He shortly after returned to his home.

It appears to me, that the hemorrhage which occurred after the ligature was placed on the external iliac artery, arose from the blood carried into the femoral artery by the epigastric and circumflexa ili : that the second ligature was placed below those arteries, and that the wound in the femoral artery was below the second ligature ; for had the wound in this vessel been situated between the two ligatures, there seems to be no reason why the blood from the epigastric and circumflex arteries should not have flowed into the wound, even more readily than before, from its passage through the femoral artery being stopped by the lower ligature.

The quantity of blood which these arteries supplied, shews how essential their anastomosis with the internal mammary, and with the branches of the internal iliac, is to the continuance of the circulation in the limb, when the external iliac has been tied.

To the loss of this assistance I attribute the failure of the circulation in this case, though as the foot retained its heat for some days, there is some reason to believe that the circulation would have been permanently re-established had not the diarrhoea, which unfortunately occurred, produced so great a prostration of strength in a subject already so much reduced by frequent hemorrhage, as to leave scarcely any hope of his recovery.

The success of this case after the amputation, teaches the surgeon not to decline an operation in the most extreme case, where inevitable death awaits the patient if it be neglected.

Aaron Henton, aged thirty-six, a bargeman, was admitted into the Casualty Hospital, October 7th, 1817, with an aneurism in the right ham. He said that about a week before he was suddenly seized with a pain in the right ham, and the next day perceived a small swelling, which in the space of one hour became nearly as large as a man's fist, which was about the size of the tumor at the time of his admission. It was not circumscribed, but its appearance was gradually lost in the surrounding parts; the limb was much swollen, and he walked with great difficulty; pressure on the tumor diminished its size about one half, when the femoral artery was compressed in the groin. The man's

countenance bore marks of exceeding distress and anxiety ; he had not slept for three nights ; he was bled, and cloths wet with a saturnine lotion applied to the leg and tumor.

On the following day the swelling of the leg was somewhat diminished, but the man had not slept.

A single ligature was passed under the femoral artery, in the middle of the thigh, by means of a blunted crooked needle, without separating the vessel from any of the surrounding parts. After the ligature was tied there was no pulsation in the ham.

On the 9th, he had slept nearly all night ; the swelling of the limb was gone ; the leg and foot were warm, and the veins of the leg full ; the tumor was rather diminished, but there was an obscure pulsation in it.

Three days after, on the 12th, he was going on well ; the tumor was diminished, but a pulsation could still be felt in it ; cloths wet with a cold lotion were applied to the ham.

19th. He was going on well, but the tumor was not much lessened ; there was still a pulsation in it, but less evident than when it was last examined. The wound in the thigh had not united by the first intention, but was granulating kindly.

23d. Fifteenth day. The ligature came away ; it was then doubtful if any pulsation could be felt in the tumor, but its size was not diminished. Pressure was made on the swelling, by means of a compress of linen, and a bandage kept constantly wet with a cold lotion.

Nov. 8th. The tumor was considerably diminished ; the wound in the thigh was well, and the man's health much improved. The pressure was continued for some time ; the tumor gradually disappeared, but was not sufficiently reduced for him to leave the house till December 22d, when the swelling which remained was hardly the size of a walnut.

It seems probable, from the rapid increase of the aneurism after its first appearance, that the popliteal artery suddenly gave way, and that the blood was effused into the surrounding parts.

The tumor was sufficiently supplied with blood the day after the operation for a distinct pulsation to be felt, which continued for many days after ; shewing that though a ligature on a distant part of the artery stops the immediate current of blood into the tumor, yet that when the collateral circulation becomes established, the aneurism partakes of it, and that in some cases farther assistance is necessary to repair the evil. For I much doubt if in this case the disease would have been cured

by the ligature on the femoral artery, had not the obliteration of the aneurism been assisted by a continued and pretty powerful pressure.

This man was again admitted into the hospital, May 29th, 1818, with an aneurism of the left popliteal artery; it was of the size of an egg, and perfectly circumscribed.

The man said he had discovered it about a week before; that it then had a pulsation, and that it had gradually increased. The leg was not much swollen; his countenance more sunk, and very sallow; his health much worse than when he left the hospital.

The femoral artery was tied with a single ligature, in the same manner as that of the other side, on the 6th of June.

The pulsation of the tumor ceased, and could never afterwards be felt. The swelling rapidly decreased, but the man's health was very slow in recovering.

On the 31st of August, he left the house, at which time there was no appearance of the tumor in the ham last operated on, and a hard tumor only the size of a hazle-nut in the ham of the right side;

his health was then much better. I saw this man November 14th, when his health was completely restored.

In the second operation in this case the ligature was of catgut, and the ends were cut off close after it was tied. Part of the wound appeared to have united by the first intention, but matter afterwards formed, and it was a considerable time before the ulcer healed. The ligature was never seen to come away, but from the circumstance of the suppuration I should apprehend it must have done so.

John Morgan, aged thirty-eight, a pauper resident in the poor-house of Walcot parish, in consequence of complete deafness, shewed me on the 5th of March, 1818, a pulsating tumor in the right ham, the size of a small orange, which he said he first discovered three days before, and that it had rapidly increased to the size it then was. His pulse was hard and full; he was bled, and a cold lotion applied to the tumor.

March 7th. A single ligature was passed under the femoral artery, as in the last case; the ligature was catgut, and the ends were cut off.

On the following day, there was no pulsation in the tumor. The man was going on well. When the wound in the thigh was opened, it appeared to

have united, but in two days separated. A long and troublesome suppuration ensued, and the wound was not healed till the latter end of April; the ligature was never seen to come away.

In these two cases the ingenious proposal of Mr. Lawrence, to procure a permanent adhesion of the parts over a ligature, did not succeed, for the wounds were longer getting well than in the ordinary way; and in some amputations, in which I have tried the plan, I have been equally unsuccessful; for though union by the first intention appeared to have taken place, yet one, two or more small sinuses have formed, and continued open many weeks, through which some of the ligatures were seen to come away in one instance, six months after the operation.

The tumor in the ham was very slow in being absorbed, and I applied pressure, after some time, by means of a wet compress and bandage. In this case the pulsation was never renewed after the operation. The man has continued well since.

In all these cases a single ligature only was employed, and in every instance it came away satisfactorily, without any suppuration or sinus in the course of the artery, and without the occurrence of secondary hemorrhage.

I have also, in two cases of wounds of the

brachial artery (in situations where it was impossible to get at the wounded vessel, without dividing the muscles of the arm) tied the artery higher up with a single ligature.

In both instances the cure was completed by making pressure on the part of the artery which had been wounded, with a wet compress and bandage, and in both cases the ligatures answered perfectly.

In addition to these cases I have, in more than twenty instances, tied the carotid arteries in sheep for Dr. Parry, in experiments made by him on the arteries of living animals, and in no instance did secondary hemorrhage occur.

I am aware that the analogy between the arteries of animals and men may not be correct.

I once detached the carotid artery of a sheep completely from the surrounding parts, for the space of four inches, and tied one ligature in the centre of the detached portion, expecting that secondary hemorrhage would ensue, from sloughing of the artery, but that case did as well as any of the others, a result that would scarcely have occurred in the human subject.

But I consider that the success of these cases goes a considerable way in proving that secondary

hemorrhage is not more likely to ensue where one ligature is used ; and I am inclined to believe, that if the artery be not removed from its situation, or more detached than the ligature separates it, that hemorrhage is less likely to occur than in the ordinary way of applying two ligatures, and dividing the artery between them ; and certainly a greater portion of the wound may be expected to unite by the first intention over one ligature than over two, and the risk of sinuses forming in the course of the artery must be materially lessened.

The only case of secondary hemorrhage which has occurred to me after the operation for aneurism, was one of the popliteal artery, in the year 1807, when the femoral artery was tied with two ligatures, and divided between them. The upper ligature came away on the thirteenth day after the operation, the lower one on the fifteenth, and the day after a profuse hemorrhage came on, and the patient lost above a pound of blood. Pressure, with a compress and wet bandage, was continued for some time, and the wound healed.

It may be worth remarking, that in a short time after, an aneurism formed in the opposite ham, and in a few days acquired the size of a small walnut. I advised the patient to go into the country where he resided, and to return in about a month, for the second operation to be performed.

He returned in two months, when the tumor had become solid, and had lost all pulsation. It was soon after entirely absorbed.

I saw this man last year, in perfect health, ten years after the cure of the aneurism. A proof that the formation of aneurism, even in two arteries, may happen, without any farther defect of the arterial system.

December 4th, 1818.