A CASE
OF
WOUND OF THE FEMORAL ARTERY
AND VEIN.

TRAUMATIC VARICOSE ANEURISM; LIGATURE OF BOTH
ARTERY AND VEIN; RECOVERY.

WITH REMARKS ON THE TREATMENT OF WOUNDS OF
THE FEMORAL ARTERY AND VEIN.

BY

W. J. WALSHAM, F.R.C.S.,

ASSISTANT SURGEON TO, AND DEMONSTRATOR OF PRACTICAL AND ORTHO-
PÆDIC SURGERY AT, ST. BARTHOLOMEW'S HOSPITAL.

Received December 12th, 1887—Read March 27th, 1888.

R. H. W—, æt. 19, a medical student and surgical dresser at St. Bartholomew's Hospital, was warded on January 27th, 1885, for a punctured wound in the upper third of the left thigh. He was preparing for a small operation in the ward, and was pulling out a drawer from the box containing the instruments, when the drawer, which worked stiffly, came out with a jerk. Several knives in their fall stuck in his trousers, and one was driven some distance into the thigh by the drawer striking against its handle. He was immediately placed on a bed and the hæmorrhage controlled by digital pressure, and subsequently by a pad and bandage, but before this was accomplished he lost about eight ounces of blood. On removing his clothes two wounds were discovered in the upper third of the thigh near the apex

of Scarpa's triangle, one wound being a little above the other, and the lower one appearing quite superficial. Each measured about half an inch in length, with its long diameter transverse.

As digital pressure on the upper wound, and pressure three quarters of an inch below it, completely controlled the hæmorrhage, whilst pressure on the femoral above failed to do so, a wound of the long saphenous vein was diagnosed by the house surgeon, Mr. Lankester, and a graduated compress was placed over the wound, and the limb firmly bandaged from below upwards. On the following day, January 28th, at the afternoon visit of Mr. Walsham, who was on duty for Mr. Willett, the bandages were removed and pulsation was seen to be communicated to the pad covering the wounds, the edges of which were found to be adherent when the pad was taken off. A soft distensile pulsating tumour, about the size of a small orange, was now discovered to the inner side of the two wounds. The pulsation was controlled, though not absolutely, by compressing the femoral artery above. A distinct bruit was heard along the course of the artery, and a venous hum could be heard and a thrill felt along the course of the femoral vein. A wound of the femoral artery and vein with the formation of a traumatic arterio-venous aneurism was diagnosed, and a consultation was held. It was decided that no operative interference should be undertaken at present on account of the excited state of the patient's circulation, but that firm pressure should be applied both over the tumour and along the course of the artery. A pad was accordingly placed over the tumour, and two pieces of firewood about six inches long, well protected with lint, over the course of the artery both above and below the tumour. The whole limb was then firmly and carefully bandaged from the foot upwards, the bandage terminating in a spica at the groin. The limb was raised and supported by pillows. Fifteen grains of bromide of potassium were given every six hours.

January 29th.—The patient passed a good night; the tumour was thought to be somewhat smaller, and the venous hum less marked. His temperature remained normal, but his circulation was still in a very excited state; the pulse could be felt almost everywhere on touching the limb.

On the 30th, the tumour continued in much the same condition, but on removing the bandages on the 31st it appeared to be nearer the surface, the pulsation was more marked, and the wound in the skin, which had become sealed, seemed likely to give way. Mr. Walsham decided, therefore, to operate at once, in which decision he was supported by his colleagues, who saw the case with him in consultation.

Operation.—The patient being placed under an anæsthetic, and the femoral controlled by digital pressure, a probe was passed into the upper wound, and entered a cavity containing effused blood. On enlarging the wound it was found that the digital compression did not sufficiently control the hæmorrhage, and the india-rubber tube of the Esmarch's apparatus was accordingly applied to the upper third of the thigh, and after a considerable quantity of effused blood had been turned out of the cavity a wound was discovered in the femoral artery in the middle of Hunter's canal. The wound was about three quarters of an inch long, and ran obliquely to the long axis of the artery. A ligature of kangaroo-tail tendon was placed above and below the wound, and the vessel divided between the two ligatures. Slight hæmorrhage continued after the artery had been tied, but no wound in the vein could at first be found. The Esmarch's bandage was accordingly temporarily loosened, but had at once to be re-tightened on account of the immediate increase of hæmorrhage. After considerable difficulty a wound in the vein was discovered; it ran obliquely along the course of the vein, and was nearly an inch in length. The vein was secured above and below the injured spot by two kangaroo-tail tendon ligatures, but not before a

piece of the artery between the ligatures had been cut away to gain sufficient access to the vein. On the removal of the Esmarch bandage the hæmorrhage was found to be effectually stopped, and the wound having been thoroughly cleansed of all clot and well irrigated with carbolic lotion, was brought together by silver-wire sutures and dressed with carbolised gauze, and a drainage-tube inserted. The operation, which was done under the spray, took nearly two hours. The limb was wrapped in cotton-wool, surrounded with hot bottles, and raised to an angle of 120° with the body. The patient was ordered tincture of opium $\text{m}\nu$ every two hours whilst awake.

On the following morning the note states :—Passed a fair night, temp. 102° ; the foot is warm, and retains perfect sensibility. The pulse in the posterior tibial artery is perceptible. There is no œdema. The discharge had come through the dressings at one spot; the dressings were not removed, but fresh layers of gauze applied.

On February 2nd, the wound was dressed; looking well; edges united by first intention, except in situation of drainage-tube. The condition of foot perfect.

On the 3rd, the wound was dressed and all stitches were removed; the edges at the lower part had given way. From this time the patient made an uninterrupted recovery, but a sinus in the situation of the drainage-tube remained for several weeks, and did not finally close till the latter end of March. The temperature on the evening of the day after the operation rose to 101.8° and on the next evening to 102° , but from this date fell to a little above normal, and continued practically normal from the sixth day. (See Temperature Chart.)

The greater part of the after-treatment was conducted by Mr. Willett, to whom my thanks are due for allowing me to publish the case.

Wounds of the femoral artery and vein are sufficiently rare, I venture to think, to make this case of considerable interest; and when taken in conjunction with the fact

that both the artery and vein were ligatured renders it, I hope, worthy of bringing before the notice of the Fellows of the Royal Medical and Chirurgical Society.

As the upper wound was situated in the course of the long saphenous vein, and pressure below and on the wound stopped the hæmorrhage, whilst pressure on the femoral artery had no effect, it was supposed that the long saphenous vein had been wounded, and it was not until the removal of the bandage on the afternoon of the following day that the grave nature of the injury became evident. The presence of a deep pulsating tumour in the situation of the wound, and the well-marked arterio-venous thrill and bruit then detected, made it certain that the femoral artery and vein had been wounded, and that a communication existed between them. The question at once arose, Should immediate steps be taken to secure the bleeding artery and vein, or should carefully applied pressure be first tried? In favour of the former plan it was urged that here was undoubtedly a wound of a large artery, and that the sooner it was secured the less danger there would be of further extravasation of blood and tearing up of the tissues, and that all risk of a sudden hæmorrhage from the giving way of the wound would be effectually avoided. On the other hand, it was evident that the femoral vein as well as the artery was injured, and might probably require ligature—a step that would add to the danger of the operation. Moreover, the superficial wound had become sealed; there was apparently a

considerable thickness of tissues between the surface and the extravasated blood, and some form of a sac, as evidenced by the pulsation, had already been formed by the condensation of the fasciæ and other tissues around. It was therefore decided to try the effects of pressure, and it was thought, moreover, that should this fail there would be less danger (in consequence of the collateral circulation having had time to become at least to some extent established) of gangrene supervening if both the artery and vein should subsequently require ligature. The further question was also raised—What, in event of the artery having to be tied, should be done with the vein? Should it be tied above and below the wound in its walls? Should the artery only be tied, and pressure applied to the vein, or should, supposing the hole in the vein to be small, the wall be nipped up and a ligature applied without obliterating its calibre?

I need not repeat what has already been said in the history of the case. Pressure failed, the artery was tied, and the rent in the vein was of such a nature that nothing was left but to apply a ligature to it above and below the wound. Before the operation was undertaken, however, I was considerably exercised in my mind as to which of the above methods of procedure it would be the best to adopt, and some difference of opinion was expressed by my colleagues who kindly saw the case with me in consultation. Since then I have made a somewhat extensive search through the literature of the treatment of wounds of the femoral artery and vein, and I venture to bring the question of the best treatment of such before the Fellows of the Society. I propose to discuss the question under the following heads:

1. Immediate simultaneous ligature of the artery and vein.
2. Continuous pressure without operation.
3. Temporary pressure in order to allow the collateral circulation to become established before resorting to ligature.

4. Ligature of the artery and application of pressure to the vein.

5. The question of the lateral *versus* the circular ligature of veins.

1. *Immediate simultaneous Ligature of Artery and Vein.*

When the wound of the soft parts leading to the injured vessels is large, death, I imagine, as in four of the cases tabulated in the appendix to this paper, will probably occur in a few minutes. To such the question of the propriety of immediate ligature obviously does not apply. Were such a case seen before death had actually occurred, ligature of both the artery and vein or amputation would be clearly the only course. In the case of a punctured wound, however, where the hæmorrhage can be controlled by pressure, it is not so evident that immediate ligature is the right treatment to pursue. Langenbeck,¹ as is well known, recommends that in wounds of the main vein the accompanying artery should be tied as well as the injured vein. He affirmed that when both vessels are tied not only does gangrene not follow, but there is less disturbance to the capillary circulation than when the vein or artery alone is secured. By the simultaneous ligature, he believed, an equilibrium is maintained between the arteries and veins until the collateral circulation is established.²

¹ 'Archiv klin. Chir.,' 1860, Band i, p. 543.

² Further, it has been shown (Cohnheim, 'Vorlesungen ueber Allgemeine Pathologie,' Bd. i, p. 122) that if in rabbits the main vein in one limb is tied, and in the other both the vein and artery, in the latter case there is no disturbance of the circulation, whilst in the former swelling and œdema occur. The condition of the capillary circulation under these circumstances has been demonstrated microscopically in the web of the frog. In the limb in which the vein only is tied the veins and capillaries are greatly dilated and congested, and the blood either circulates very slowly or complete stasis occurs, whilst oscillation of the blood current is observed in the arteries. On the other hand, in the limb in which both artery and vein are ligatured, although some of the capillaries may be found empty and the blood in them

The view of Langenbeck, however, that there is less risk of gangrene when the main vein is tied as well as the main artery, in that a smaller quantity of blood is conveyed to the part beyond, and less stress is thrown upon the over-charged vein, is not generally, I believe, accepted by surgeons, and was controverted at some length in a leading article in the 'Lancet'¹ of last year. The ligature of both vessels, it is there stated, has been successful in certain cases; but, on the whole, the mortality and the frequency with which gangrene has occurred have been greatly increased by this practice.

Ligature of the main artery, it is urged, is attended with two results which are unfavorable to the venous circulation; in the first place the local anæmia causes a general dilatation of the arterioles with compression of their attendant venules, and in the second place the force of the heart is dissipated in propelling the blood through the many anastomosing arteries. Moreover, Pirogoff,² Stromeyer,³ and Spence,⁴ among others, taught that sudden obstruction of both the artery and vein almost invariably leads to gangrene; and Braune,⁵ from experiments on the dead body, concluded that when the common femoral artery and vein were suddenly occluded gangrene must inevitably ensue. On the other hand, Mr. Annandale,⁶ in speaking of a case in which he tied the main artery and vein for arterio-venous aneurism, says, "The result of the operation in my case tends to prove that surgeons have taken too serious a view of the

at rest, there is no venous stasis and engorgement, and oscillation is not observed in the arterioles, whilst in other parts the circulation is carried on in a normal manner.

¹ 'Lancet,' Feb. 13th, 1886.

² 'Grundzüge der allgemeinen Kriegschirurgie,' vol. i, p. 440 (Leipzig, 1864).

³ Stromeyer, 'Handbuch.'

⁴ 'British Medical Journal,' 1875, vol. ii, p. 195.

⁵ 'Die Oberschenkel Vene des Menschen in anatomische und klinische Beziehung (Leipzig, 1871).

⁶ 'Lancet,' April 24th, 1875, p. 568.

risks likely to follow the ligature or obstruction of the principal artery and vein of the limb." The cases that have now been published and are collected in the accompanying tables go far, I think, to show that in this opinion he was probably correct. A distinction, however, must be drawn between immediate ligature of the main artery and vein for a wound of one or both of these vessels, and their deligation for aneurism or for a wound in the removal of a tumour where in either case, as the result of previous compression, the collateral circulation has had time to become established. And, further, account must be taken whether the vessels tied are the common femoral or the superficial femoral or popliteal. Thus, in twelve cases (see Table II) in which both artery and vein were tied immediately after the wound, gangrene is said to have occurred in four cases, and probably occurred in a fifth, as amputation in this latter was performed subsequent to the ligature. The remaining cases, except one¹ in which the cause of death is not stated, recovered without gangrene.

The above are the only instances I have been able to find in which the femoral artery and vein have been simultaneously ligatured for a wound of these vessels, without pressure for some days having been previously applied, and granting that they are too few to allow any reliable conclusions to be drawn from them, still they show, I think, that although there is a considerable risk of gangrene, especially when the common femoral is tied, this risk has been over-estimated.

¹ In this case it appears probable that gangrene of the leg would have ensued if the patient had not died of other causes, as there was loss of sensation in the leg, and it did not bleed on puncture. The patient, who was a heavy drinker, became delirious on the fourth day, and vomited violently.

2. *Continuous Pressure without Operation.*

Where the communication between the artery and vein is at all large, the chances of success from this method appear to be very small. In the case under consideration the tumour steadily increased, notwithstanding that careful pressure was applied; and an external hæmorrhage, if the wounded vessels had not been secured, would inevitably have occurred in a few days. In the thirty-six cases that I have collected and tabulated (Tables III and V) in none was this method completely successful, inasmuch as in all an arterio-venous aneurism formed, and only one of these aneurisms¹ was cured by the continuance of the pressure. In another case² pressure so far succeeded in that the aneurism became partially consolidated, but an untimely examination displaced the clots and ligature had to be resorted to. Of course it may be argued that in these cases pressure was not efficiently employed, and in some no doubt it was not. But in many, as in my own case, it is specified that every attention and care was observed, and although in others full particulars are not given, there is reason to believe that no pains were spared. In all of the cases, with the exception of the two mentioned above, operative treatment of some kind had ultimately to be undertaken, or such palliatives as elastic compression to be employed. It is true that in some instances the

¹ In this case Trélat succeeded, by long-continued instrumental pressure, in converting an arterio-venous aneurism, the result of a punctured wound of the femoral artery and vein, into a simple arterial aneurism; and this was subsequently cured by a continued application of pressure. Nélaton has succeeded four times in converting a varicose aneurism at the bend of the elbow into a simple arterial aneurism by direct pressure (Holmes's '*System of Surgery*,' vol. iii, p. 92).

² In Mr. Coote's case the aneurism had become consolidated and pulsation had ceased, but owing to the tumour having been examined somewhat prematurely, and perhaps roughly, by visitors, the clots were disturbed, pulsation recommenced, and the artery and vein had to be tied. Death occurred after amputation from secondary hæmorrhage ('*St. Barth. Hosp. Rep.*,' 1874, vol. iii, p. 544).

inconvenience from the arterio-venous aneurism at the time the case is reported was very slight, as, for instance, in the cases published by Messrs. Thomas Smith,¹ Hulke,² and Pick³, but in others, the patient's state was such a miserable one that he was willing to consent to any operation, whatever the risk.

Further, even in cases where soon after the injury the inconvenience is slight, it is questionable what the ultimate condition will be. Thus in Mr. Cock's case⁴ it was two years before the superficial veins were dilated, but still surgical interference became necessary, although eleven years had elapsed. Again, in Beaumont's case⁵ the communication between the artery and vein existed for ten years and a half before a tumour formed by the giving way of the weakened artery, but an operation then became imperative. "The treatment of arterio-venous aneurism," says Mr. Erichsen,⁶ "is exceedingly unsatisfactory," a statement which I believe is endorsed by most surgeons who have had these cases under their care, and is fully borne out by the cases published in Tables III and V. An operation of some sort was performed in thirty-one out of the thirty-six cases there collected and seventeen died. So impressed with the difficulty and danger of the treatment of arterio-venous aneurism, especially of the femoral artery and vein, is M. Polaillon⁷ "that the formation of one," he says, "ought in all instances to be prevented by immediate ligature wherever it is suspected that a communication between these vessels exist." "If the aneurism is already formed," he continues, "we should act as soon as possible, for in temporising great and perhaps insurmountable difficulties may be met with. If, therefore, it is a fact that the only

¹ 'St. Barth. Hosp. Rep.,' vol. xii, p. 157.

² 'Clinical Society's Transactions,' vol. viii, p. 175.

³ 'Med. Times and Gazette,' 1883, vol. ii.

⁴ 'Med.-Chir. Trans.,' 1851.

⁵ 'Med. Times and Gaz.,' July 17th, 1867.

⁶ 'Science and Art of Surgery,' 8th edit., p. 463, vol. i.

⁷ 'Gaz. Méd. de Paris,' 1886, vol. iii, p. 265.

result of pressure without subsequent operation is to leave in the great majority of cases the patient with an arterio-venous aneurism, the difficulties and dangers of treating which increase in consequence of the dilatation of the artery and vein the longer operative treatment is delayed, it follows, I think, that pressure should not be continued for more than a few days unless signs of evident improvement ensue—in short, that pressure should only be kept up till the collateral channels have had time to enlarge.” But of this more under the next section. Further, pressure long continued is in itself not unattended with danger. Thus in Case 7 (Table V) the pressure caused cellulitis for which incisions had to be made, and the patient succumbed to septicæmia; whilst in Ward’s case (Table III), after nine days of pressure secondary hæmorrhage occurred, and the artery and vein had to be tied in the midst of a sloughy wound.

3. *Temporary Pressure till the Collateral Circulation has had time to become established before resorting to Ligature.*

Although, as has been shown, there is considerable risk of gangrene of the limb occurring when the main artery and vein are suddenly occluded, this risk appears to be reduced to a minimum when, owing to partial obstruction of a vein, either from pressure applied by the surgeon, or pressure produced by the growth of a tumour, the collateral vessels have become enlarged. Thus Grillo,¹ of Naples, tied the femoral vein with the femoral artery in fifteen cases of aneurism without a single bad result, and Hunter, as is well known, in his first three operations tied the artery and vein by a common ligature. In twenty cases here tabulated (Table III) in which the artery and vein were tied for a wound of one or both of the vessels, but not until some days or even some months

¹ Lidell’s article in Ashhurst’s ‘International Encyclopædia of Surgery,’ vol. iii.

or years had elapsed, gangrene occurred in only five cases; and in four other cases (Table IV) in which the vessels were tied in consequence of a wound in removing a tumour of the thigh pressing on the vessels, no gangrene ensued; and in two of these, and probably in three, the ligatures were applied to the common femoral trunks. In four out of the five cases in which gangrene did occur a satisfactory explanation is forthcoming; in the fifth the details are too meagre to argue either one way or the other. Thus in Case 12, Table III, the collateral circulation had not become established notwithstanding the time (nine days) that had elapsed since the injury, for although the limb was warm at the time of the operation the pulse was not felt in the tibials, and subsequently, at the post-mortem examination, the profunda artery was not found to have enlarged, and the profunda vein was plugged.¹ In the second case (No. 13, Table III) the gangrene was due to the compression of the common femoral vein by the accidental slipping of a clamp which had been placed on the femoral artery above the ligatured end as a precaution against secondary hæmorrhage. In the third case (No. 17, Table III) it was necessary to tie the profunda artery as well as the femoral, and at the post-mortem examination the long saphenous vein was found plugged. In the fourth case (No. 20, Table III) secondary hæmorrhage occurred subsequent to the ligature of the superficial femoral vessels, for which the common femoral was tied. Besides the above twenty cases Mr. Holmes, in his "Lectures on Aneu-

¹ This fact is explained on the supposition that most of the blood brought to the divided femoral extremity found its way back to the divided femoral vein; that the pressure was thus relieved, and that the profunda received only its usual supply of blood. For three days there was no sign of interference with the circulation, but at that time gangrene appeared and spread with great rapidity. This was explained by the recent phlebitis of the profunda vein, which was filled with a pink firm coagulum. The inflammation of this vein, so vital to the support of the circulation, was probably the result either of the irritation of the operation or injury by the ball ('Med. and Surg. Hist. War of the Rebellion,' vol. ii, part iii, p. 213).

rism,"¹ refers to a case in St. George's Hospital Tables, in which the femoral vein was tied as well as the artery, and yet no gangrene ensued; and further, to a case of Mr. Perry's of arterio-venous aneurism, in which the femoral vein was plugged with coagula, and the profunda vein was so compressed as hardly to transmit any blood; still the trunk veins anastomosing with the saphenous had so completely carried on the circulation that there was not only no gangrene but no oedema of the limb. From a consideration of these cases I think it is evident that gangrene, which appears to be the chief risk after immediate ligature, is reduced to a minimum when, as the result of carefully applied pressure, the collateral circulation has become established. But it has been shown in the former section that pressure in itself holds out little chance of ultimate success, and at the best will merely leave the patient with the external wound healed but with a permanent arterio-venous aneurism. If these premises are sound it follows that the safest treatment in punctured wounds of the thigh implicating the femoral artery and vein is to control by pressure the circulation through the wounded vessels for a few days until the collateral channels have become enlarged, and then to cut down upon and tie the artery and vein above and below the wound.

4. *Ligature of the Artery and application of Pressure to the Vein.*

In the case now before the Society the wound in the vein was so extensive that it was at once evident that nothing short of ligature above and below it would be of any avail in stopping the hæmorrhage. Had the wound been small, however, I question whether I should not have trusted either to pressure or to the lateral ligature, since I was strongly advised by several of my colleagues

¹ 'Lancet,' 1874, vol. ii, p. 544.

not to apply, if it could possibly be avoided, a circular ligature to the vein (on account of increasing the risk of gangrene); indeed, I hoped that on securing the artery the venous hæmorrhage might perhaps stop of its own accord, or at any rate be controlled by slight pressure over the wound. Langenbeck, as is well known, taught that ligature of the accompanying artery is often in itself sufficient to arrest hæmorrhage from a wound of the vein, and Dr. Lidell in his article on 'Injuries of Blood-vessels' in Ashhurst's 'International Encyclopædia of Surgery' quotes several cases in support of this view. The first surgeon to adopt the practice appears to be Gensoul,¹ who deliberately tied the femoral artery for the purpose of arresting hæmorrhage from the femoral vein, and similar successes are reported by Ward,² Cock,³ and Halford.⁴ The last-named surgeon further demonstrated that in the rabbit hæmorrhage from the femoral vein could be effectually arrested in this way. He placed a ligature loosely around the femoral artery, then opened the vein lower down, and found that the bleeding, which was profuse, immediately stopped on tightening the ligature. This experiment was repeated fifteen times with the same result. I have also myself seen several cases at St. Bartholomew's Hospital of accidental wound of the femoral vein while tying the femoral artery, in which the hæmorrhage ceased, or was quite easily controlled by pressure when the artery was occluded. In the case now brought before the Society, in which, however, the wound in the vein was large, and in the cases reported by Drs. Pilcher,⁵ Gerster, Rose, and Kraske,⁶ the ligature of the artery had no appreciable effect in controlling the hæmorrhage, and other means had to be resorted to. In

¹ 'Gaz. Méd. de Paris,' series 2, 1836.

² 'London Medical Gaz.,' 1845, N.S. 1, p. 987.

³ 'Lancet,' 1853, vol. i, p. 296.

⁴ 'Med. Times and Gaz.,' 1862, vol. i, p. 667.

⁵ 'New York Med. Journ.,' 1884, p. 618.

⁶ 'Centralblatt für Chirurgie,' 1880, p. 687.

eight cases collected by Mr. Pearce Gould¹ of wound of the femoral vein treated by compression there were six deaths, but as no details are furnished too much stress, as Mr. Gould himself says, should not be placed upon them in considering the effects of pressure in the treatment of a wound of this vessel. In the St. Bartholomew's Hospital cases referred to above, in which the vein was accidentally pricked in tying the femoral artery, no harm ensued when the ligature was withdrawn and the artery tied higher up. Where, however, the artery was tied at the same spot as that at which the vein was pricked, thrombosis of the vein and death from blood-poisoning I believe invariably followed. These cases, it should be mentioned, occurred at a time when the ligature round the artery was left hanging out of the wound, and before the days of antiseptic surgery. Arguing from these facts it would appear that there is some risk, to say the least, in a case of wound of the artery and vein to tie the artery above and below the wound and to leave the vein untouched, or to trust to pressure alone. If the wound of the soft parts could with absolute certainty be rendered and kept aseptic, the hole in the vein would probably, if small, heal up without further trouble, but when it is considered how likely the external wound is to suppurate, either from having been infected by the inflicting instrument or from the almost unavoidable bruising and tearing of the tissues by the extravasated blood, and the necessary manipulations in tying the artery, it does not seem that such practice can be generally recommended, and there is always a further danger, as mentioned by Mr. Gould, of the venous hæmorrhage, when apparently stayed, bursting out during some expiratory effort, an accident that happened to his patient.

¹ 'Lancet,' vol. i, 1887, p. 258.

5. *The question of the lateral versus the circular Ligature in wounds of large Veins.*

The lateral ligature, says Malgaigne,¹ is disavowed in theory and condemned in practice ; Professor Gross² pronounces the lateral ligature highly dangerous, and considers it ought to be excluded from modern surgery. Dr. Lidell,³ in his article on "Punctured Wounds of Veins" in 'Ashhurst's Encyclopædia,' after referring to a successful case, continues, "Nevertheless it (the lateral ligature) should not be imitated because of the great risk of secondary hæmorrhage." Mr. Pearce Gould, in his article in the 'Lancet,' says, "The relative value of the circular and lateral ligature is the same in the femoral as in other situations, and although many successful ligatures of large veins are recorded, the fatalities are too numerous to warrant its repetition except in the case of punctures and very small wounds." I do not know to what fatal cases Mr. Pearce Gould alludes, but Prof. Gross, Dr. Lidell, and Malgaigne apparently base their view of the dangers of the lateral ligature chiefly on a fatal case related by Travers, and on cases reported by Nélaton as occurring in the practice of Roux, cases, it may be remarked in passing, which happened at a time when suppuration in wounds was exceedingly common, and secondary hæmorrhage consequently far from rare. On the other hand, Messrs. Erichsen and Bryant both recommend that in small punctured wounds of large veins the lateral ligature should be applied, and I believe that several of my colleagues are in favour of it. The investigations of the subject here undertaken would lead me to the conclusion that the danger of lateral ligature has been over-estimated. I have collected sixteen cases of wounds of large veins thus treated (all I could find published), including those of

¹ 'Gaz. des Hôp.,' 1853, p. 88.

² 'American Journal Med. Science,' April, 1867, p. 318.

³ Ashhurst's 'International Encyclopædia of Surgery.'

Travers and Roux. In thirteen cases the treatment was completely successful. In Guthrie's celebrated case, in which death occurred from exhaustion, the internal jugular vein, to which the lateral ligature had been applied, was found pervious at the post-mortem examination, and without a mark indicating the situation of the ligature. The four cases which have come under my own observation dispose me to regard lateral ligation in a favorable light. One of these was a wound of the subclavian in removing a tumour of the clavicle ; the three others were wounds of the internal jugular vein in excising a tumour in the neck. In one of the latter (my own case) the hæmorrhage was very profuse. The wall of the vein, however, was nipped up by forceps, a silk ligature applied, and the ends cut off. The wound healed without any trouble in a few days. The other three cases were also successful. Considering the risk of gangrene when the common femoral artery and vein are tied in their continuity before time has been allowed for the collateral circulation to become established, I should feel inclined, supposing the wound in the vein to be of moderate size, to apply the lateral ligature rather than the circular. But where the collateral circulation has become assured, and for wounds of the superficial femoral vein where the risks of gangrene are less, the circular ligature above and below the wound is probably the safer course, inasmuch as it is impossible in all cases of these injuries to be absolutely sure of obtaining healing of the soft tissues by the first intention.

CONCLUSIONS.

The conclusions that I venture to draw, with some diffidence, from a consideration of my own case, and a review of the cases bearing upon it, are :

1. That when a large artery and vein, as the femoral, are involved in a punctured wound of the thigh, the safer course is to apply pressure in the way described above

for a few days to allow the collateral circulation to become established, and then to cut down and tie the proximal and distal extremities of both the artery and vein.

2. That immediate ligature (*i. e.* before the collateral channels have had time to enlarge) of both the femoral artery and vein, especially of the common femoral, for a wound of these vessels is liable to be attended with gangrene, although this risk is probably less than has been generally assumed.

3. That ligature of both vessels when in consequence of pressure, as of a tumour, the collateral circulation has become established, is attended with much less risk of gangrene.

4. That when the femoral artery and vein are wounded, ligature of the artery and pressure on the vein, if the wound is a mere puncture, is a safe treatment provided that the nature of the injury allows of reasonable prospects of the external wound being kept aseptic and uniting by the first intention.

5. That when the wound in the vein is too large to permit of treatment by pressure, the walls may be safely nipped up, and a ligature thrown around them without obliterating the calibre of the vessel; but that this procedure should only be resorted to, as in the former case, where there is a reasonable prospect of the wound healing by the first intention.

6. That, considering the grave risks of gangrene which attend the sudden obliteration of the common femoral vein, the lateral ligature should, in this situation, for all small and moderate-sized wounds which require immediate ligature, be the treatment adopted.

TABLE I.—Six Cases of the Femoral Artery and Vein. *Ligature not employed.*

No.	Reference.	Surgeon.	Sex, age.	Nature and situation of wound.	Vessels implicated.	Immediate treatment and results.	Later treatment; vessels ligatured.	Date of ligature after injury.	Remarks.	Death or recovery.
1	Int. Encycl. Surg. iii, p. 176; Surg. Hist. War Rebel., vol. ii, part ii, p. 78 (H. Clinton)	—	M.	Pistol-shot, right thigh, lower third	Superficial femoral artery and vein severed	No treatment	—	—	Death in a few minutes	D.
2	Int. Encycl. Surg., p. 177; Surg. Hist. War Rebel., vol. ii, part ii, p. 85 (W. Neff)	—	M.	Gunshot wound, both thighs	Femoral artery and vein wounded	Tourniquet	Condition too serious for operation	—	Death in a few hours	D.
3	Surg. Hist. War Rebel., vol. ii, part iii, p. 13 (Bailey)	—	M.	Gunshot wound, thigh	Femoral artery and vein wounded	Expectant plan of treatment	No details given	—	Cause of death not stated	D.
4	Surg. Hist. War Rebel., vol. ii, part iii, p. 13 (Clarendon)	—	M.	Gunshot wound, thigh	Femoral artery and vein wounded	Expectant plan of treatment	No details given	—	Cause of death not stated	D.
5	Surg. Hist. War Rebel., vol. ii, part iii, p. 64, Case 38	Bliss	M. 30	Gunshot, right thigh	Femoral artery and vein wounded, profuse hæmorrhage	Compression ?	No details given	6th day	Amputation; pyæmia; death 27th day	D.
6	Surg. Hist. War Rebel., vol. ii, part iii, p. 55, Case 72	Burditt	—	Gunshot wound, left thigh	Femoral artery and vein severed	—	No details given	9th day	Amputation; death same day; shock and gangrene	D.

TABLE II.—*Twelve Cases of the Femoral Artery and Vein. Immediate Ligature.*

No.	Reference.	Surgeon.	Sex, age.	Nature and situation of wound.	Vessels implicated.	Immediate result.	Vessels ligatured.	Date of ligature.	Remarks.	Death or recovery.
1	St. Petersburg med. Wochen., 1884	Wahl	M. 20	Pistol-shot, lower third, right thigh	Superficial femoral artery and vein wounded	Arterio-venous murmur heard at bleeding spot	Superficial femoral artery and vein tied above and below wound	1 hour	Secondary hæmorrhage 6th and 12th day; wound opened; proximal ends tied again	R.
2	Berl. klin. Wochen., 1881, Jan. 17, p. 33	Tillmans	M. 26	Punctured wound, knife, middle third thigh	Superficial femoral artery and vein wounded	Hæmorrhage into limb	Superficial femoral artery and vein tied	3 hours	—	R.
3	New York Med. Journ., 1884, Nov. 29th, p. 617	Pilcher	M. 34	Punctured wound, knife, upper third thigh	Superficial femoral artery and vein wounded just below origin of profunda and long saphenous	Profuse hæmorrhage	Superficial femoral artery and vein tied above and below wound	At once	No bad symptom; slight œdema when first began to use limb	R.
4	Lancet, 1873, vol. ii, p. 737	Goodall	M. 18	Punctured wound, thigh, 4 in. below Poupart's ligament	Superficial femoral artery and vein severed	—	Superficial femoral artery and vein tied	At once	No œdema or other bad symptoms; wound healed in 3 weeks	R.

No.	Reference.	Surgeon.	Sex, age.	Nature and situation of wound.	Vessels implicated.	Immediate result.	Vessels ligatured.	Date of ligature.	Remarks.	Death or re- covery.
5	Volkmann's Sammlung klin. Vorträge, No. 29, 1875— 80, p. 754	Rose	M. 25	Punctured wound under Poupart's ligament, right thigh	Common femoral artery and vein wounded	Loud and rough blowing murmur	Common femoral artery and vein tied at site of wound	At once (22 hours)	Wound healed first intention; no cedema	R.
6	Lancet, 1883, vol. i, p. 106	Clement Lucas	M. 35	Incised wound of thigh, middle third	Superficial femoral artery and vein, and long saphe- nous nerve divided	—	Superficial femoral artery twisted; vein tied	At once	<i>Gangrene</i> 5th day; amputation 9th day at seat of injury	R.
7	Centralblatt, 1880, 43, Oct. 23rd, p. 689	Volkmann (reported by Kraske)	M. 21	Shot, upper third, right thigh, in duel	Common femoral artery and vein wounded be- low Poupart's ligament	Profuse hæmor- rhage	Common femoral artery tied; also vein as hæmorrhage did not stop	At once	Limb became cold and paralysed; superficial veins dilated; <i>gangrene</i> 2nd day	D. 11th day.
8	Beitrag zur Kenntnis der Aneurisms, Diss. Zurich, 1881	Rose (reported by Bloch)	M. 22	Stab with knife, right thigh, just below Poupart's ligament	Femoral artery and vein wounded	Tumour formed immediately without pulsa- tion; no pulse in artery below	Femoral artery and vein tied 1½ centimetres below origin of profunda	At once (2 hours)	<i>Gangrene</i> ; delirium (chronic drinker)	D. 7th day; throm- bosis of femoral vein.
9	Beitrag zur Kenntnis der Aneurisms, Diss. Zurich, 1881	Rose (reported by Bloch)	M. 53	Stab with knife, middle third, left thigh	Superficial femoral artery severed; vein wounded	Leg livid and swollen	Femoral artery and vein tied just above ad- ductor magnus opening	5 hours	Delirium (a heavy drinker); loss of sensation in leg; no bleeding on puncture	D. 4th day; clots in femoral vein.

10	International Encyclopædia of Surgery, vol. iii, p. 177 (Gross)	Gross	M.	Gunshot wound, middle third, thigh	Superficial femoral artery severed	Hæmorrhage stopped by finger	Superficial femoral artery and vein tied	24 hours	4th day, swelling and cedema; 5th day, secondary hæmorrhage arrested by pres- sure; 8th day, <i>gangrene</i> ; 9th, death. Distal liga- ture had slipped; muscles infiltrated with pus	D.
11	Surg. Hist. War Rebel., part iii, vol. ii, p. 49, Case 107 (South)	Dougherty	M.	Gunshot wound, right thigh	Femoral artery and vein	—	Femoral artery and vein tied	Same day	Amputation of thigh; <i>presumably</i> <i>gangrene</i> ?	D. 30th day.
12	Beitrag zur Kenntnis der Aneurisms, Diss. Zurich, 1881	Rose (reported by Bloch)	M. 27	Stab by knife, right thigh, upper third	Profunda vein and artery; hæmorrhage	Femoral artery tied; hæmor- rhage continued	Profunda artery and vein; also superficial femoral artery and vein	Soon (a few hours)	No disposition to <i>gangrene</i> ; ex- tremity continued warm and pulse- less; no nervous disturbance	R.

TABLE III.—*Twenty Cases of Femoral Artery and Vein. Treated first by Pressure, afterwards by Ligature of both Artery and Vein.*

No.	Reference.	Surgeon.	Sex, age.	Nature and situation of wound.	Vessels implicated.	Immediate treatment and results.	Vessels ligatured.	Date of ligature after injury.	Remarks.	Death or recovery.
1	Unpublished	Walsham	M. 19	Punctured wound, middle third, right thigh	Superficial femoral artery and vein	Pressure; wound healed; arterio-venous aneurism formed	Superficial femoral artery and vein in Hunter's canal	4 days	No bad symptom	R.
2	Brit. Med. Journ., 1875, i, p. 713	Czerney	M. 20	Knife stab, lower third, thigh	Superficial femoral artery and vein	Instrumental and digital compression; arterio-venous aneurism formed	Superficial femoral artery and vein	8 weeks	—	R.
3	Lancet, 1875, i, p. 568	Annandale	M. 10	Wound with scissors, popliteal space	Popliteal artery and vein	Pressure and bandages; arterio-venous aneurism formed in 3 days	Popliteal artery and vein tied	3 mos.	—	R.
4	Berlin. klin. Woch., 1883, 2, p. 19	Ebenau	M. 21	Punctured wound; shot, middle third, right thigh; profuse hæmorrhage	Superficial femoral artery and vein	Pressure; elastic bandages; arterio-venous aneurism formed in a week	Superficial femoral artery and vein in Hunter's canal	3½ mos.	—	R.
5	St. Petersburg med. Woch., 1883, No. 7, p. 53	Wahl	M. 23	Punctured wound, middle third, left thigh	Superficial femoral artery and vein	Pressure by bandage; arterio-venous aneurism soon formed	Superficial femoral artery and vein	12 years	Great swelling of veins for 5 years before ligature	R.

6	Med. and Surg. Hist. War of Rebel., vol. ii, pt. iii, Case 20, p. 47 (Coble)	—	M. 20	Gunshot wound, left thigh	Superficial (?) femoral artery and vein	Pressure; diffuse femoral aneurism formed	Superficial femoral artery and vein	7 weeks	—	R.
7	Lancet, 1874, vol. ii, p. 546 (Hamilton (Richmond Hospital))	Hamilton (Richmond Hospital)	M.	Stab, thigh	Superficial femoral artery and vein	Compression; arterio-venous aneurism formed	Superficial femoral artery tied above and below wound; vein also tied (?)	2 mos.	—	R.
8	St. Barth. Hosp. Reports, vol. iii, p. 443	Coote	M. 42	Punctured wound, right thigh	Superficial femoral artery and vein	Pressure; arterio-venous aneurism formed; afterwards instrumental pressure; consolidation	Superficial femoral artery and vein	2 mos. 17 days after injury; 1 month after opening of sac; pres- sure	Aneurism was consolidated; inju- dicious examina- tion; pulsation recommenced, then ligature and opening of sac; secondary hemor- rhage; amputation and death	D.
9	Guy's Hosp. Reports, ser. ii, vol. viii, p. 223	Bransby Cooper	M. 15	Wound of thigh with penknife	Superficial femoral artery and vein	Pressure; arterio-venous aneurism formed	Superficial femoral artery and vein	10 days	No tendency to gangrene; no fall of temperature; no oedema; pyæmia; femoral vein had not been entirely included in the ligature	D.
10	Bull. et Mém., 1883, t. ix, p. 285	Nélaton	—	Gunshot wound, right thigh	Superficial femoral artery and vein	Compression; arterio-venous aneurism formed in a few days	Superficial femoral artery and vein tied above and below sac; sac opened; plug of charpie in wound	1½ mos.	Ligature separated 8th day, septic suppuration; 12th, secondary hemor- rhage; cautery and perchloride of iron; repeated hemorrhage	D.

No.	Reference.	Surgeon.	Sex, age.	Nature and situation of wound.	Vessels implicated.	Immediate treatment and results.	Vessels ligatured.	Date of ligature after injury.	Remarks.	Death or recovery.
11	Bull. et Mém., 1883, April, p. 264	Verneuil	M. 17	Punctured wound, popliteal space	Popliteal artery and vein	Pressure; wound healed quickly; arterio-venous aneurism formed (aneurismal varix)	Compression digital and direct; popliteal artery and vein tied; sac opened; four muscular veins tied also; hemorrhage continued; all tissues tied between artery and bone	3 years	No gangrene; secondary hemorrhage 23rd day; cauctery	R. Slight oedema and dilated veins.
12	Surg. Hist. War Rebel., part iii, vol. ii, p. 45; also in Int. Encycl. Surg., vol. ii, p. 213 (Rapp)	Thompson	M. 20	Gunshot wound, left thigh	Superficial femoral artery and vein wounded	Profuse hemorrhage; arterio-venous aneurism formed; 9th day hemorrhage from wound	Ligature of superficial femoral artery and vein	9th day	Gangrene 12th day (3rd day after ligature); profunda vein plugged; profunda artery not enlarged	D. next day.
13	Med. Times and Gaz., 1860, vol. i, p. 216	Hilton	M.	Gunshot wound, right thigh, 3 in. below Poupart's ligament	Wound of superficial femoral artery; vein seen full of flowing blood	Ligature of artery; hemorrhage 7 days after from vein	Ligature of vein	7th day	Gangrene commencing, due to clamp which was placed on artery slipping and compressing vein above profunda	D. 13th day.
14	Surg. Hist. War Rebel., vol. ii, part iii, p. 48, Case 59	Pineo	M.	Gunshot wound, right thigh, May 25	Wound of femoral artery and vein	Not stated; no details	Femoral artery tied both ends; vein included in ligature	June 12th, 17th day?	Cause of death not stated	D. next day.

15	Surg. Hist. War Rebel., vol. ii, part iii, p. 48, Case 65	Norris	M. 18	Gunshot wound, right thigh, April 6	Femoral vein ruptured	Not stated; no details	Femoral artery tied at middle portion; vein above and below rupture	April 25th, 19th day?	Recurrent hæmorrhage, May 5th (10th day after ligature)	D. May 7th.
16	Surg. Hist. War Rebel., vol. ii, part iii, p. 47, Case 44	—	M.	Gunshot wound, right thigh, July 17th	Wound of femoral artery and vein	Not stated; no details	Femoral artery tied at proximal end; vein proximal and distal end	July 23rd, 6th day	<i>Gangrene</i>	D. July 27th.
17	Lancet, 1853, vol. i, p. 296	Adams and Ward	M. 20	Punctured wound, middle third, left thigh; considerable hæmorrhage	Superficial femoral artery and vein, also profunda artery	Graduated compression; secondary hæmorrhage 9th day; wound sloughy	Superficial femoral artery tied; vein divided transversely to allow it to collapse; profunda artery also tied	9th day	<i>Gangrene</i> 6th day. Saphenous vein found plugged	D. 11th day.
18	Deuts. Zeits. f. Chir., 1875, B. v, p. 174 (Rabe's cases)	Langenbeck	M. 20	Punctured wound with knife	Superficial artery and vein	Pressure? arterio-venous aneurism formed	Superficial femoral artery and vein	12th day	No gangrene, but œdema. Death probably due to pulmonary embolism	D. 7th day.
19	Pennsyl. Hosp. Rep., i; Deuts. Zeits. f. Chir., 1876, B.v, p. 176 (Rabe's cases)	Morton	M. 21	Punctured wound	Superficial femoral artery and vein	Pressure? arterio-venous aneurism formed	Superficial femoral artery and vein	8th day	No bad symptoms	R.
20	Chir. Klin., Wien, 1868, p. 158	Billroth	M. 19	Punctured wound, upper third, left thigh	Superficial femoral artery and vein	Pressure for six weeks by a barber; arterio-venous aneurism formed	Superficial femoral artery and vein	6 weeks	Secondary hæmorrhage; ligature of common femoral, then <i>gangrene</i>	D.

TABLE IV.—*Four Cases in which the Femoral Artery and Vein were Ligatured for Wound inflicted during the Removal of a Tumour.*

No.	Reference.	Surgeon.	Sex, age.	Cause.	Vessels implicated.	Ligature.	Remarks.	Death or recovery.
1	Handb., B. ii, p. 989; also Berl. klin. Woch., 1881, Jan. 24, p. 55	Stromeyer	—	Removal of tumour, anterior crural nerve	Piece of femoral artery and vein removed with tumour	Artery and vein tied above and below wound	No gangrene	R.
2	Beiträge zur Chirurgie, Volkmann, p. 249	Volkmann	F. 46	Removal of myxoma, left thigh, as big as child's head	Piece of femoral artery and vein below origin of profunda removed with tumour	Artery and vein tied above and below wound	No gangrene	R.
3	Int. Encycl. Surg., vol. iii, p. 213; also Berl. klin. Woch., Jan. 24, 1881	v.Oettingen	—	Removal of tumour of thigh	Wound of common femoral vein during operation	Double ligature of common femoral vein; leg became cyanotic; artery then tied; cyanosis disappeared	No sign of gangrene; septicæmia, fatal on 5th day	D.
4	Chir. Klin., Wien, 1867-70, p. 325 (Billroth); also Berl. klin. Woch., 1881, Jan. 24, p. 56	Billroth	M.	Removal of cancerous glands from thigh	Wound of common femoral vessels	Common femoral artery and vein tied	No sign of gangrene; septicæmia, fatal on 2nd day	D.

TABLE V.—*Sixteen Cases of Femoral Artery and Vein. Treated by Pressure.*
Followed by Formation of Arterio-venous Aneurism.

No.	Reference.	Surgeon.	Sex, age.	Nature and situation of wound.	Vessels implicated.	Immediate treatment and results.	Later treatment.	Date of later treatment.	Remarks.	Death or recovery.
1	Brit. Med. Journ., vol. i, 1887, p. 1271	Godwin	M. 29	Punctured wound, bamboo stick, right thigh, 1½ in. above patella; penetrated 2 in.	Superficial femoral artery and vein wounded; much extravasation	Pressure; wound healed in 14 days; arterio-venous aneurism formed	Digital pressure	—	No alteration in aneurism	R.
2	St. Barth. Hosp. Rep., vol. xii, p. 157	Smith	M. 14	Punctured wound, middle thigh, pen-knife	Superficial femoral artery and vein wounded	Pressure; wound healed in few days; aneurismal varix formed	Pressure	21 days	Venous murmur heard still	R.
3	Clin. Soc. Trans., vol. viii, p. 175	Hulke	M. 44	Explosion of pistol, wound upper third thigh	Superficial femoral artery and vein	Pressure; wound healed in 2 days; pain and throbbing; aneurismal varix formed	Pressure, direct and indirect	—	Discharged wearing elastic stocking; aneurism not improved	R.
4	Med. Times and Gaz., 1883, vol. ii	Pick	M. 28	Pistol shot, right thigh, upper third	Superficial femoral artery and vein	Wound drained and bandaged; healed in a month; aneurismal varix formed	Pressure and elastic bandage	1 month about	Aneurism continued	R.
5	L'Union Méd., 1884, ser. 3, vol. xxxvii, p. 973	Schwartz	M. 18	Punctured wound of thigh, much hemorrhage	Superficial femoral artery and vein	Pressure; 2dury hemorrhage; compression again; arterio-venous aneurism formed	Compression, elastic bandage, Esmarch's bandage	9 mos.	Aneurism not improved or very slightly	R.

No.	Reference.	Surgeon.	Sex, age.	Nature and situation of wound.	Vessels implicated.	Immediate treatment and results.	Later treatment.	Date of later treatment.	Remarks.	Death or recovery.
6	Bull. et Mém. Soc. de Chir. de Paris, 1884, vol. x. p. 332	Trélat	M. 15	Punctured wound with knife in middle left thigh; profuse hæmorrhage.	Superficial femoral artery and vein	Compression 15 days; wound healed; arterio-venous aneurism formed	Elastic bandage, direct compression, indirect pressure; arterio-venous converted into ordinary aneurism	About a month ?	Arterial aneurism cured by continued pressure. Trélat remarks the wound in vessels was probably small, hence the success	Cured.
7	Progrès Méd., No. 30, 1882, p. 582	Caraf	M. 32	Gunshot wound, thigh, upper third	Superficial femoral artery and vein	Compression 2 days; arterio-venous aneurism formed next day; digital, shot-bag	Digital compression; instrumental continued; shot-bag for 12 days	—	Phlegmon; incisions; sepsis; enormous abscess	D. 7 weeks.
8	Edin. Med. Journ., July, 1869	Spence	M. 15	Wound, upper third thigh	Femoral artery and vein	Pressure; wound healed 10 days; arterio-venous aneurism formed after walk	Ligature of the artery above and below sac	1 month and 4 days	—	R.
9	Gaz. Méd. de Paris, 1886, vol. iii, p. 265	Polaillon	23	Punctured wound, upper third right thigh; profuse hæmorrhage	Superficial (?) femoral artery and vein	Compression for 4 months; wound long in healing; left the hospital with arterio-venous aneurism (aneurismal varix)	Compression; electro-puncture; septicæmia	7 years	Bruit prevented sleep	D.
10	Int. Encycl. Surg., vol. iii, p. 247	Cutter	M. 16	Wound, inner part left thigh, 2 in. below Poupart's ligament; penknife	Femoral artery and vein; profuse hæmorrhage	Pressure; wound healed in a week; arterio-venous aneurism formed 8 years after from fatigue	External iliac tied; still later common iliac	8 years	Peritonitis; aneurismal varix at <i>post-mortem</i>	D.

	Hennen's Military Sur- gery, 3rd edit., p. 185	Hennen	M.	Wound with musket ball	Wound of femoral artery and vein	Pressure; wound healed 61 days; arterio-venous aneurism began to form in 3 weeks	External iliac tied	—	Gangrene	D.
11			24							
12	Gaz. Méd., 1841, p. 172	Lallemand	27	Punctured wound, middle third thigh, profuse hæ- morrhage	Wound of femoral artery and vein	Pressure; wound healed; arterio- venous aneurism soon formed	Femoral artery tied, then external iliac	5 years	Recurrent hemor- rhage	D.
13	Amer. Journ. Med. Sci., 1838, xxii, 329	Morrison	—	Stab in thigh	—	—	External iliac tied	—	—	D.
14	Gaz. Hebd., 1864, tome i, p. 166	Gayet	19	Punctured wound, upper third right thigh	Common femoral artery and vein sup- posed to be wounded	Pressure 5 days; digital pressure; secondary hemorrhage; arterio-venous aneurism formed	External iliac tied	23 days	Peritonitis; sepi- cæmia; profunda artery and vein found wounded; femorals found intact	D. 10 days.
15	Med.-Chir. Trans., 1851, p. 327	Cock	17	Punctured wound, lower third thigh	Popliteal artery and vein	Carefully ap- plied pressure 12 days; secondary hemorrhage; ligature of femoral artery; wounds healed; arterio-venous aneurism formed	Incision into abscess, formed in connection with aneurism; profuse hemor- rhage	11 years	Amputation	R.
16	Med. Times and Gaz., July 27, 1867, p. 87	Beaumont	45	Punctured wound, pocket- knife; pro- fuse hemor- rhage	Superficial femoral artery and vein	Pressure not stated; wound healed in a few days; arterio- venous aneurism formed	Died under chloroform pre- paratory to ligature of external iliac	10½ years	Aneurism gave no trouble for 10 years; then en- larged suddenly from strain in riding	D.

TABLE VI.—*Sixteen Cases of Large Veins treated by the Lateral Ligature. Successful 13. Unsuccessful 3.*

No.	Reference.	Surgeon.	Sex, age.	Cause.	Vessels implicated.	Ligature.	Remarks.	Death or recovery.
1	Cornack's Monthly Journ. Med. Sciences, 1844, p. 783	Wattman, 1823	—	Removal of tumour of neck	Longitudinal opening of 24 lines in internal jugular vein	Lateral ligature	Ligature separated 12th day	R.
2	Legonest's Traité de Chirurgie d'Armée, 1863, p. 429	Bégin	—	Removal of tumour of neck	Wound of internal jugular vein	Lateral ligature	—	R.
3	Metropolitan Hospital (unpublished)	Walsham	—	Removal of cancerous glands	Puncture of internal jugular vein; profuse venous hæmorrhage	Coats around wound nipped up, and lateral ligature applied; ends of ligature cut short	No further trouble	R.
4	St. Barth. Hospital (unpublished)	Callender	—	Removal of tumour of neck	Wound of internal jugular vein	Lateral ligature	No bad symptom	R.
5	Ashhurst's Int. Encycl. Surg., p. 189	Lidell	—	Dissecting out deep-seated tumour of neck	Puncture of internal jugular vein	Lateral ligature	—	R.
6	St. Barth. Hospital (unpublished)	Langton	—	Removal of tumour of neck	Wound of internal jugular vein	Lateral ligature	—	R.
7	Int. Encycl. Surg. (Dr. Lidell)	McClellan	—	Removal of tumour of groin	Wound of internal saphenous vein at its entrance to femoral	Lateral ligature	—	R.

8	B. II. et Mém., 1871, Oct. 18th	Despres	—	Gunshot wound, middle third thigh	Suppuration and secondary hæmor- rhage from femoral vein	Lateral ligature	Separated 6th day	R.
9	Malgaigne's Anatomy, p. 342	Blandin	—	Removal of can- cerous glands	Axillary vein wounded	Lateral ligature	—	R.
10	Malgaigne's Anatomy, p. 342	Bérard	—	Not stated	—	Lateral ligature	—	R.
11	Malgaigne's Anatomy, p. 342	Richet	—	Not stated	Femoral vein	Lateral ligature	Cicatrization of wound in 8 days	R.
12	Gazette des Hôpitaux, 1858, p. 88	Roux	—	Operation on neck	Internal jugular vein	Lateral ligature	Secondary hæmorrhage on separation of ligature	D.
13	Gazette des Hôpitaux, 1858, p. 88	Roux	—	Operation on neck	Internal jugular vein	Lateral ligature	Secondary hæmorrhage	D.
14	St. Barth. Hospital (unpublished)	T. Smith	—	Removal of clavicle for sar- coma	Punctured wound of subclavian vein	Lateral ligature	Recovery without a bad symptom	R.
15	Malgaigne's Anatomy, p. 344	Travers, 1816	—	Tying femoral artery	Punctured wound of femoral vein	Lateral ligature	Secondary hæmorrhage on 12th day, at sepa- ration of ligature	D. Ex- haus- tion.
16	Diseases and Injuries of the Arteries, 1830, p. 328	Guthrie	—	Cut throat	Wound of internal jugular vein ; carotid also injured	Lateral ligature	The internal jugular vein was found pervious, and without a mark indicating the seat of previous wound and ligature	D. Ex- haus- tion.

(For report of the discussion on this paper, see 'Proceedings of the Royal Medical and Chirurgical Society,' New Series, vol. ii, p. 361.)