On the pathological changes produced in the shoulder-joint by traumatic dislocation : as derived from an examination of all the specimens illustrating this injury in the museums of London / by William Henry Flower.

TREATMENT

OF

ANEURISM BY COMPRESSION.

E I.—On the 12th of September 1867, I was consulted by J. G., 32, on account of swelling of the left limb, extending as high as knee, accompanied with a varicose state of all the superficial s of the foot and leg, and a sense of pain resembling rheumatism ting the heel. These symptoms at once led to my examining popliteal space, with the expectation of discovering a popliteal rism. It was fuller than natural, but there was neither a ur nor any unnatural pulsation of the artery. The pulse, in from the knee downwards, was scarcely discernible. There no want, however, of free arterial circulation in the limb, as obvious from the colour of the extremity, and the rapidity with h the veins filled when emptied by pressure upwards. The that the venous engorgement was purely due to varix, was er encouraged by the immediate subsidence of all venous ful- on Mr G. assuming the recumbent posture. His history was f rheumatism, with two attacks of rheumatic fever. He had, ermore, an aortic bruit with the first sound, but no evidence of ardiac structural alteration beyond the lesion of the aortic ori- Excluding the idea of an aneurismal affection, these symp- appeared to point to an extensive varicose dilatation of the of the limb, deep as well as superficial; the distended con- of the deep veins producing the neuralgic pain in the heel long the course of the anterior and posterior tibial nerves. ordingly recommended bathing the limb with warm water, ıe employment of an elastic stocking.

eard nothing further of my patient from this date until the end bruary 1868, except that he was well in every respect, but ıe limb continued to give rise to uneasiness.

I had an opportunity of again seeing him on the 1st of March 1868, when I heard from himself that the limb had continued swollen since I saw him before, the swelling having decidedly increased of late, while the pain had commensurately incommoded him. On again examining the popliteal space, I now found it occupied by a pulsating tumour. This extended from beneath the gastrocnemius, as high as above the upper extremity of the adductoro-vascular canal, and bulged between the ham-string tendons, forming a rounded prominence posteriorly. On applying the stethoscope there was a double bruit in the tumour; the pulsation was powerfully distensile; compression of the femoral and common femoral arrested these last symptoms and diminished the tumour to fully one-third; but when the obstructing pressure was removed, these symptoms were at once, and more characteristically reproduced. Firm pressure over the tumour diminished its bulk, but not so characteristically as when obstructive pressure was employed to the common femoral. The limb was fully one-third larger than before, and nearly twice the circumference of the healthy limb. The surface of the limb below the knee was of a leaden colour, and the venous return was seriously compromised. The leg could be extended completely, but could only be bent to a right angle upon the thigh. These changes in the limb were traced to an accident which occurred two months before when in Ireland. He stated that, at that period, when coming out of a house in the country after a heavy fall of rain, he had slipped upon the moist and polished surface of a flight of limestone steps, and had strained himself, as he expressed it, in checking his fall and regaining his footing.

The aneurismal nature of the swelling, its large size, its acute activity, the absence of any considerable fibrinous clot, the serious venous engorgement of the limb, were all points of manifest importance in determining upon the course of treatment to be adopted. The natural impatience of the patient to recover as soon as possible, to escape confinement—to be well, at all events, in time to return to Ireland to be present on the occasion of the Prince of Wales's visit to Dublin—had also to be considered. It was plainly out of the question that he should delay his treatment till after the visit to Ireland, and it was also impossible for him safely to return to his ordinary active mode of life until at least three months had elapsed; as under any plan of treatment it was impossible, in a shorter period, that the absorptive removal of the tumour could have so far progressed as to render him free from the risk of suppuration of the sac should he begin incautiously to move about. I desired him to confine himself strictly to bed, to lay the limb upon a pillow with the knee flexed, to keep to a restricted diet, and take 10 grains of iodide of potassium three times a day. I also ordered a belt and shoulder-straps connected together, and with a slipper, by means of which continued flexion of the knee might be maintained accord-

ing to the method of Mr E. Hart. I further desired a bag of shot, 12 lbs. in weight, to be placed upon the hollow of the groin.

9th March.—The flexion and shot-bag compression of the groin has now been maintained for five days. He complains of the forced flexion being excessively irksome, but says the pressure of the shot-bag in the groin gives him no uneasiness. The general swelling of the limb is much diminished; the pulsation in the tumour and tension of sac is less marked. Bruit still double and distinct. The shot-bag to be increased in weight to 36 lbs., and to be laid partly on the groin, partly on the lower part of the abdomen. Iodide of potassium increased to 1 drachm three times a day.

11th March.—The shot-bag of 36 lbs. occasions no uneasiness, and keeps the pulsation in the tumour still more distinctly in check, but does not entirely command it. The shot-bag, attached by hooks to the rail of a cradle placed over the limb, so that the extremity of the bag compressed the artery on the brim of the pelvis, seemed more efficiently to control the circulation, but not to arrest it entirely.

16th March.—The pelvic portion of the Carte's apparatus was employed, the compressing pad having been removed, and an 8 lb. weight, with a channel through the centre, adapted to slide upon the screw-rod, being substituted for the elastic compression effected by the screw. This completely controlled the circulation through the common femoral.

17th March.—The pelvic saddle occasions great annoyance. He also complains of the weight hurting him over the bone. The weight shifted to the site of the bifurcation of the common femoral.

18th March.—He complains of the discomfort of the saddle as perfectly intolerable, and explains that the pressure on the groin can quite easily be borne, but that the saddle is what he cannot tolerate. The whole apparatus removed, and the shot-bag substituted.

19th March.—The thigh-piece of the Carte's apparatus applied with a 12 lb. weight instead of the screw pressure. The extremity of the weight is applied so as to act upon the bifurcation of the common femoral.

21st March.—The weight has been constantly kept on, except when the surface of the thigh has been dusted from time to time with fuller's earth. The tumour is less, and when the weight is accurately applied, there is no pulsation or bruit in the sac, and no tension in the tumour. The weight rises and falls with each systole and diastole.

22d April.—The compression, by means of the 12 lb. weight, has now been kept on for a month; and although the circulation is absolutely commanded during the waking hours, he expresses himself as very doubtful what takes place during sleep, as he has several times found himself lying on his face on coming to consciousness in the morning.

Vespere, 9 P.M.—The apparatus, applied as before, is directed to

be watched night and day by two of his relations—one hand being constantly upon the weight, the other upon the tumour, so as to make certain that no displacement can take place without the compression being at once adjusted to check it.

24*th April*, 3 P.M.—All pulsation in the tumour and all bruit has ceased. The superior internal and external articular arteries ramifying over the condyles, the anastomotica magna, and the long branch of the external circumflex, can be felt beating distinctly in the neighbourhood of the knee. The pressure has been maintained so as to prevent all pulsation in the sac for forty-two hours. He complains of pain around the knee and down the limb; the foot and leg feel colder than the sound limb; and markedly so than before. The limb was rolled in cotton-wool, and the compression desired to be continued till next morning.

25*th April*.—Weight removed; pain is much diminished. No trace of pulsation anywhere in sac.

26*th April*.—Last night he got out of bed and hopped into the drawing-room; as he did so, he complained of a sudden feeling of pulsation, experienced in the upper part of the sac. The pulsation, and a modified bruit, are quite distinct in the upper quarter of the sac; the increased pulsation in the anastomotica magna is quite distinct, but the vessels over the inner and outer condyles cannot be distinguished. Weight and apparatus reapplied; the 8 lb. weight, however, being substituted for the 12 lb.

6*th May*.—Pulsation has gradually extended till now; the whole sac pulsates as at first. There is, however, only a single bruit to be recognised. Patient says the 12 lb. weight is more comfortable and easily managed than the 8 lb. one. The 12 lb. weight to be applied, and constant surveillance of the compression maintained by day and night.

7*th May*.—The pulsation and bruit in the sac have ceased, and the vessels over the inner and outer condyles are again to be felt. The weight, with absolute compression, has been maintained for twenty-eight hours on this occasion.

12*th May*.—As a means of keeping the patient quietly in bed, the weight worn steadily till to-day, without, however, any watching, except what the patient himself was able to employ. The tumour is rapidly diminishing; and, instead of occupying the whole boundaries of the popliteal space, it is recognised as an ovoid hard swelling, quite fallen away from the outer and inner ham-string tendons, and can be traced upwards beneath the inner ham-string muscles as a fusiform mass, diminishing from below upwards.

4*th February* 1869.—I saw this patient to-day. There is no trace of the large tumour in the popliteal space, except some slight thickening of the tissues; and no pulsation can be felt below the crossing of the sartorius muscle, except that of the anastomotica magna branches, which, with the long branch of the external circumflex, anastomose with large arterial branches over the inner and

outer condyles of the femur. The varicose enlargements in the calf and leg are much as before the development of the aneurism, but the general swelling is much less, and all pain in the heel and limb has disappeared.

Case II.—Peter Gorrie, æt. 50, was admitted to the Royal Infirmary on the 10th of July 1868, on account of a pulsating tumour in the left groin. He was recommended to my care by Dr Farquharson of Stockton on Tees, where he had been occupied as an engineer. I am indebted to Mr A. Bennett's notes of this case for the following particulars:—

History.—The swelling appeared in his groin six weeks previous to his admission into hospital. When first noticed it was about the size of a plum; but it has gradually increased in size, and has been attended with a considerable degree of pain and numbness along the inner side of the left thigh and leg. When first observed pulsation was recognised in the swelling. He has been abroad for several years, and has suffered from ague.

Present Condition.—Upon examination, a tumour the size of half an orange is seen to exist in the left groin about an inch and a half below Poupart's ligament in the line of the femoral artery, extending downwards for about two inches. It has a distinct visible pulsation, which is distensile in its character, separating the fingers from each other, when applied smoothly over its surface. On applying the stethoscope to the swelling, a distinct single systolic murmur is audible. Pressure applied to the common femoral or external iliac is attended by subsidence of the swelling and disappearance of pulsation and bruit, which are more strongly marked just when the controlling pressure is withdrawn. His pulse is irregular from an occasional intermission. Careful examination of the chest revealed no cardiac or aortic physical lesions.

11*th July.*—To-day at 12.30 compression by a 12 lb. weight was applied to the common femoral artery immediately above the tumour by means of the same apparatus latterly employed in Mr G.'s case. By this means all pulsation and bruit in the sac were immediately arrested. To have 30 grains of iodide of potassium every four hours. The dressers to take it in turns to sit by the patient controlling the position of the weight by the indications afforded by the tumour.

Vespere.—Patient complains of pain caused by the pressure of the weight. To have 40 minims of the solution of morphia.

12*th July.*—Slept tolerably during the night. There is still pulsation felt in one portion of the sac on the removal of weight, but this is limited, the rest of the swelling feeling hard and pulseless. Weight continued.

Vespere.—Has slept for several hours during the day, and makes no complaint of pain.

14*th July.*—Having been absent from town since the 11th inst., I saw this patient now for the first time since applying the pressure.

On removing the pressure of the weight, I at first imagined the pulsation in the tumour still continued, but more careful examination showed me that the sac was consolidated, and the pulsation corresponded only to the line of the superficial femoral artery where it ran over the anterior surface of the tumour. The scarf skin was slightly ruffled where the weight had compressed the artery. Compression has been maintained for seventy-two hours in all. The pressure and apparatus removed, and fuller's earth dusted over the surface.

20*th July*.—The tumour rapidly disappearing. The superficial vessels in the groin and abdomen pulsating distinctly. Still complains of pain down the thigh as far as the knee.

1*st Aug*.—The patient has been out of bed for some days; the tumour can hardly be recognised.

4*th Aug*.—Dismissed cured.

I have brought these two cases of aneurism, treated by compression, before the Society, because I believe them to be the first cases in which this method of treatment has been successfully employed in Edinburgh, and because in the treatment of them I have employed a new modification of compression by weights, which it appears to me is more easily borne by the patient than any other plan which as completely commands the circulation through the main trunk towards the aneurismal sac.

So far as I know, in modern times, compression was never attempted in this city in the treatment of aneurism, except in three cases by the late Professor Miller. Two of these were cases of popliteal aneurism, one of axillary aneurism; in all the compression was abandoned for ligature. The apparatus employed by Mr Miller was that of Dr Carte, and leaden weights laid over the trunk of the afferent vessel. I am informed that some years ago a case of popliteal aneurism occurred in a soldier at Piershill, in which the surgeon, educated in the Dublin school, successfully employed compression. The apparatus used was that of Dr Carte.

I had occasion once, some years since, to make trial of compression by Carte's apparatus with elastic bands in a case of popliteal aneurism in a female, but was forced to abandon its use in consequence of the suffering experienced by the patient, who, before anything else was employed, died suddenly from the bursting into the pericardium of a small aortic aneurism situated close to the origin of the right coronary artery.

It may, perhaps, seem strange beyond belief that, in a surgical school such as that of this city, the first cases of the successful treatment of aneurism by compression should occur fully twenty-six years after this method of practice became an established procedure in Dublin, and after it has become generally accepted by the whole civilized world.

I believe that two causes have chiefly operated to prevent the more general employment of compression in the treatment of

aneurism by the surgeons of this school. 1*st*, The comparative rarity of cases of popliteal and femoral aneurism, since the introduction of railways throughout the kingdom has done away with posting and post-boys. 2*d*, The determined opposition, on purely speculative grounds, afforded to the employment of compression by those whose practical opportunities were greatest.[1]

Accordingly, upon commencing the treatment of Mr G.'s case, I had personally no such practical experience of compression as could serve to guide my procedure, and worked somewhat in the dark. The experience thus gained at once afforded a standard by which I could direct the management of Gorrie's case; and I feel confident that, had I Mr G.'s case to treat again, I could secure complete consolidation of the tumour within forty-eight hours. In Mr G.'s case the flexion treatment, combined with the partial compression effected by the bag of shot, undoubtedly did some good; though I am quite ready to admit that perfect repose in bed, with bandaging the limb, and the elevation of it upon pillows, might very possibly have effected as much.

The compression during the first month, when the method of applying the 12 lb. weight was adopted, without constant watching by an assistant, although calculated to keep the aneurism in check, was quite unsatisfactory, so far as the induction of consolidation was concerned, and might, I believe, have been continued for months in the same fashion without any further benefit accruing from its employment. The compression effected by the same apparatus, but under the constant supervision of assistants who watched the tumour, the weight, and the position of the patient sleeping and waking, so as to secure a uniform interruption of the circulation through both the superficial and deep femoral, speedily produced a very different result. This continuous and accurate compression was commenced on the 22d of April at 9 P.M., and within eighteen hours afterwards the pulsation and bruit were both so modified as to indicate a marked change in the condition of the contents, and within forty-two hours from its commencement the consolidation was complete. Indeed, the assistant in attendance for the last six hours of that time told me that it was impossible to recognise whether the compression was complete or not from anything to be felt in the sac, and that the application of the fingers along the line of the superficial femoral below the situation of compression could alone be relied upon as affording any certainty as to the efficiency of the compression. We may, I think, reasonably regard these forty-two hours as the essential period during which consolidation

[1] "So long as it is my sincere persuasion that ligature of the artery is preferable to pressure for the cure of popliteal aneurism, I shall deem it my duty to pursue this method, though it may not perhaps be the best suited for the lowest capacity of surgical skill. Let every man act according to his powers; but let no one who feels it necessary to choose inferior means throw blame upon those who are able to practise a higher exercise of their art."—*Syme, Edinburgh Monthly Journal*, 1847, pp. 569, 570.

occurred, and incline to the belief that the previous intermittent compression was of no material importance in conducing to a curative result. I think this view of the matter is strengthened by a consideration of the sequel, for after twenty-four hours more of the weight, during which no pulsation or bruit could be recognised, an unwary movement of the limb in hopping from one room to the other was followed by a partial recurrence of the aneurismal symptoms, which, in the course of the next ten days, extended themselves over the entire sac in spite of the employment of interrupted compression of the femoral by means of an 8 lb. weight; while the constant compression, when again maintained for twenty-four hours under the surveillance of an assistant, secured for a second time the complete and permanent consolidation of the sac.

Acting upon this impression, I had the compression carefully and sedulously watched in Gorrie's case from the very commencement, so as to avoid the possibility of any direct circulation through the sac —of sufficient strength, at all events, to produce a palpable impulse to the fingers of the assistant. And the result here quite justified my anticipations, for in twenty-four hours after the application of the weight the consolidation of the sac was complete; the pulsation which led to the maintenance of the compression for forty-eight hours longer proving to be limited to the superficial femoral artery, where it ran over the sac. I believe, therefore, as the result of my experience in these two cases, that the compression, to prove quickly successful, must not be intermittent but persistent, and must continually act upon the main trunk leading to the aneurism with sufficient strength and force to interrupt all circulation through that vessel as completely as if it were secured by a ligature.

This does not, however, imply a return to the views of the older surgeons, who seem to have imagined, in the use of compression, that inflammatory cohesion of the coats of the artery at the point of compression should be aimed at. This, most assuredly, is not what is required, nor should it be desiderated; all that is necessary to secure consolidation is the absolute interruption to the direct circulation of blood through the aneurism until sufficient blood clot has been deposited to occupy the entire sac. No doubt it may be argued, that while continuous compression, sufficient to maintain such a degree of interruption of the circulation, is very desirable, it is not absolutely essential; and that the partial deposition of fibrine effected in an hour or two, repeated as frequently as the comfort and convenience of the patient will permit, will secure in the long-run an equal favourable result; or, as Mr Jolliffe Tufnell puts it in his Clinical Lectures on the Treatment of Aneurism by Compression:—

"When, however, the patient may be particularly irritable, and consequently not inclined to bear a degree of pressure sufficient to control pulsation altogether, no effort to enforce this should be made, but a wave of blood should be permitted to pass through the sac; for, although consolidation of its contents may be thereby somewhat

retarded, still experience proves that total obstruction to the direct flow of blood is not absolutely necessary for the cure of an aneurism, and *that it may be induced by a degree of pressure upon the trunk of an artery sufficient to diminish without entirely interrupting the current of blood through the sac.*"[1]

It certainly may be so, but assuredly Mr G.'s case cannot be held to support that opinion; for what was observed there after all circulation throughout the sac had ceased upon the 24th? Two days afterwards, a sudden strain of the limb in some way permitted the circulation to recommence through the upper part of the sac, which ten days of interrupted compression did not prevent from becoming general throughout the sac, and which only yielded to the continuous maintenance of uninterrupted compression for a renewed period of twenty-eight hours.

It may perhaps be well to consider the changes which led to the reproduction of the circulation through the sac in Mr G.'s case after consolidation had apparently become complete. It will be recollected that the aneurism was originally, in its upper part, fusiform in its outline, and that it extended upwards as high as the upper extremity of the adductoro-vascular canal. In fact, when I first detected the aneurism in Mr G.'s case, from a certain degree of want of definiteness of outline, which the sac seemed to present at its upper and inner margin, there was a doubt in my mind whether or not the aneurism had become diffuse, and the blood had sought its way up along the course of the vessel. I believe, however, that this was due to a considerable amount of serous effusion, and formed part of the œdema which affected the limb more completely and generally below the knee, for it disappeared within the earlier period of treatment, when the compression was effected by means of the shot-bags. To my mind there is no doubt that the origin of the anastomotica magna was involved in the commencement of the sac, and I am therefore inclined to think that the re-development of the symptoms of aneurism in the upper part of the sac should be referred to the movement of the limb in hopping, giving rise to the displacement of the coagulum within the sac, and the insinuation of blood from the superficial femoral into the anastomotica magna. This at first comparatively limited establishment of circulation between the coagulum and the sac speedily gave rise to further extension of the aneurismal symptoms within the old limits, and this too in spite of the employment of some degree of pressure—a degree, however, which failed to prevent the modified current finding its way through the normal channel.

I believe, accordingly, that to treat an aneurism successfully by compression in as short a period as possible, the pressure applied to the main trunk must suffice entirely to interrupt the circulation through that vessel, and that this interruption to the normal circula-

[1] Practical Remarks on the Treatment of Aneurism by Compression, by Jolliffe Tufnell, M.R.I.A., etc., etc. Dublin, 1851. P. 71.

tion through the sac should be as continuous as possible. Mr Tufnell's original statement seems, in cases of aneurism manifesting any degree of activity, to be the safe one as a guide in practice: "Make your command over the circulation complete, but do so with the minimum amount of pressure by which this object can be gained."[1]

Here a further subject is brought up for consideration in the amount of pressure which will be required to determine a complete temporary arrest of all circulation in the vessel at the point of compression. The mode of applying the pressure will modify this quantity more materially, so far as practice is concerned, than anything in the part or circulation. We saw in Mr G.'s case that a 36 lb. bag of shot modified the flow of blood through the vessels in the groin, without, however, entirely arresting the circulation, while an 8 lb. weight, accurately adjusted by means of the arch and rod, sufficed completely to check all pulsation in the sac. There was, therefore, a great disparity of effect: 8 lbs. advantageously adjusted, was sufficient; 36 lbs. lying over the groin, and thus losing its effect by diffusion, was insufficient. The advantage enjoyed by the 8 lb. weight chiefly consisted in the smallness of the extremity, by means of which the compression of the artery was effected; but what it gained in this respect it lost in being much less easily tolerated by the patient than the diffusely-acting 36 lb. shot-bag, or than the same weight with a larger surface of application. When employed, however, with such a surface for its compressing point as made it quite comfortable to the patient, the 8 lb. weight proved insufficient to control completely the circulation through the artery lying beneath it. There was, therefore, an obvious relation between the power of tolerating compression effected through surfaces of varying extent and different forms.

To avoid detail, I may mention that, after making several experiments upon this subject, I became convinced that the curve, of the form of the larger extremity of an egg, turned from a mass of lead 3½ inches in its short or transverse diameter, was perfectly tolerable when weighted to 12 lbs., which was more than sufficient to check all circulation through the common femoral or superficial femoral in any part of the groin above the crossing of the sartorius, and this quite independently of any ordinary amount of adipose tissue overlying the course of the artery.

The situation in which this compressive weight acted most efficiently was, of course, over the horizontal ramus of the pubes, or over the common femoral below that point; but in the former position it was irksome, in the latter it was more difficult of retention than at a lower point corresponding to the bifurcation of the common femoral, where naturally the hollow of the groin is deepest, when the thigh is slightly flexed, abducted, and rotated outwards; or, in other words, when the patient lies on his back with the knee

[1] Op cit., p. 71.

slightly flexed, and laid upon its outer side upon pillows. Here the artery under pressure is forced into the angle between the pectineus muscle and the neck of the bone, while the anterior crural nerve is less exposed to compression than at any lower point. This practical observation differs somewhat from the statement of Mr Tufnell: "The weight appears a simple instrument, and so it is; but do not on this account let it be lightly regarded. It is a most efficient means of controlling pulsation, and has no drawback of which I am aware, unless its being applicable only to one spot of the artery—viz., that where it crosses the pubes, and where a bony point for counter-pressure exists—can be regarded as such."[1]

In the second case, that of Gorrie, the compression admitted of no variation from the one spot immediately above the upper border of the tumour practically corresponding to the lowest part of the external iliac and commencement of the common femoral artery. Though there was no opportunity for moving the pressure from point to point in Gorrie's case, I found no occasion in Mr G.'s case to resort to this, except during the first day, when compression was applied, the pressure occasioning really no intolerable annoyance in either patient. Certainly, in both there was a slight degree of uneasiness of the cutaneous tissues produced by the pressure, but nothing, they both assured me, to what might be experienced from a corn; and even this subsided within six hours after it had commenced. In Mr G.'s case, the cool season, the shaving of the surface, and the diligent dusting with purified fuller's earth, saved him from any abrasion; in Gorrie's, there was slight ruffling of the scarf skin, chiefly due to the extreme heat of the weather at the time, and the very copious diaphoresis of the surface throughout the whole seventy-two hours while the pressure was continued, which rendered the effect of the powder less satisfactory than it should have proved.

In Mr G.'s case, when commencing the use of compression, I felt somewhat uneasy as to the effects it might have upon the venous circulation of the limb, but was gratified to find throughout the whole progress of the treatment a steady improvement shown in the diminishing turgescence of the varicose veins, and also in the improved colour of the limb. There was some very appreciable lowering of the temperature of the foot and leg for fully a day, on both occasions, when consolidation of the sac became complete, and the blood commenced to seek its way to the leg and foot through the anastomosing vessels alone; but the degree of paling and coldness did not approach to what I have observed after ligature of the femoral artery. In Gorrie's case, where the aneurism was obviously developed from the profunda femoris at its origin from the common femoral, there was, of course, no such change in the vascular supply as to present manifest symptoms or to afford ground for any anxiety.

The high point to which the aneurism in Mr G.'s case ascended

[1] Op. cit., p. 51.

upon the vessel, involving the origin of the anastomotica magna, made me particular in examining the condition of the limb both after the consolidation became complete, and also more recently, when I had an opportunity of examining the patient. The superficial femoral could be traced on both occasions with facility as far as the crossing of the sartorius. Below this point there was nothing more than the pulsation of a vessel, about the size of a crow-quill, which could be recognised, but the branches of the anastomotica magna could be felt over the vastus internus and in the adductor magnus muscle. There was also some puffiness of the lower and middle thirds of the thigh. There was, however, none of the redness of the surface over the anterior aspect of the thigh, which I have seen after ligature of the superficial femoral. I could trace no vessel lying along the surface of the tumour—a point insisted upon by Mr Tufnell [1] and Mr Erichsen—though I could feel the anastomosis of the long branch of the external circumflex with the superior external articular, and what I presumed to be the superior internal articular, communicating with the anastomotica

[1] "And here I may . . . refer to the uniformity with which these anastomosing vessels become enlarged. One of very considerable size runs down the centre of the tumour, apparently beneath the integument; a second on the inner side of the patella; and a third less constantly felt outwards over the head of the fibula. The artery which takes its course over the centre of the tumour is sometimes as large as the radial, and is apparently, from its direct position, the main medium of circulation after obliteration of the trunk. Judging from injected preparations, where the femoral artery has been tied in Scarpa's space, the principal supporter of the circulation would appear to be the branch that accompanies the sciatic nerve, which becomes tortuous and greatly enlarged; but this occurs in consequence of the transmission of blood, by the superficial femoral being suddenly stopped, and a corresponding increase thrown upon the internal iliac and profunda. Under treatment by pressure, on the contrary, the femoral artery remains pervious down to the very sac, and from careful dissections I am rather inclined to believe that the vessel which, in cases cured by compression, naturally at first assists the circulation, is one that, although constant, has not hitherto received a name, but which, arising from the posterior aspect of the femoral artery five inches above the head of the fibula and three above the head of the joint, gives a branch to the semi-membranosus, another to the biceps muscle, and then runs down the centre of the popliteal space, accompanying the external saphena vein. By close observation of the course of the arteries surrounding the joint, I am also led to conclude that the collateral branch, which generally is found to pulsate on the inside of the patella, is not the internal articular, but a branch of the popliteal given off at least an inch above it, which, instead of running under the tendon of the adductor magnus between it and the bone, passes superficial to the tendon immediately beneath the integuments, parallel to, and in company with, the tendon of the gracilis muscle. There is also a third arterial branch, which I look upon as being closely connected with the subject of compression. This is a vessel of considerable size, which, leaving the popliteal a little above the origin of the articular arteries, runs down immediately connected with, if not actually in the substance of, the communicans peronei nerve. It is this artery I consider that gives rise to the burning pain experienced at the period of cure; the sudden distention of the vessel, and its consequent pressure on the nerves, causing the painful sensation so generally complained of."—*Tufnell*, pp. 83–85.

magna; though I see Mr Tufnell is inclined to dispute that these are the vessels. Whatever they were, certain it is that, upon both the first and second consolidation of the sac, their activity was both palpable, and, to some extent, visible, while in the interval none of them could be recognised.

In Gorrie's case, with the exception of the pulsation of the superficial epigastric circumflex ilii and external pudic, nothing manifestly marked the change in the circulation effected by the obliteration of the profunda femoris.

The result in Mr G.'s case appears to me to open up an interesting question as to the comparative efficacy of compression and ligature. Perhaps at first sight one would be inclined to say that the recurrence of the aneurismal symptoms, after consolidation had become apparently complete, indicates that ligature would have afforded a more satisfactory result; but the freedom of the anastomosis in this case through the anastomotica magna leads me, on more mature consideration, to the opposite conclusion. Owing to this free anastomosis, cases are not wanting in the records of surgery where a popliteal aneurism, treated by ligature of the superficial femoral, has only ceased to pulsate until the collateral circulation became established; and in all these cases the directness of inosculation between the branches of the profunda and the anastomotica magna accounted for the free circulation from the common femoral into the superficial femoral above the aneurism. Such a case is represented in the Fasciculus of the Fort-Pitt Museum, illustrative of Arterial Disease, and another is given by Professor Porta of Pavia, in his great work upon the Effects of Ligature and Torsion.[1] In my own museum I have a preparation illustrative of the same result in a female, the subject of popliteal aneurism, in whom ligature of the superficial femoral had been performed by the late Dr Richard Mackenzie. The pulsation returned so soon as the collateral circulation was established, and continued till the period of her death, which was occasioned by the bursting of an aneurism of the aorta.

In all these cases the free and direct circulation into the superficial femoral above the aneurismal sac determined the persistence of the disease even after the upper portion of the superficial femoral had been obliterated by the successful application of a ligature in Scarpa's space.

Now, had these cases been treated by compression of the common femoral, so as to render the circulation of the extremity and in the sac still more indirect and circuitous, a successful result might have been at once attained, without resorting to a secondary

[1] Delle Alterazione patologiche delle Arterie per la Ligatura e la Torsione, Esperienze ed Osservazioni di Luigi Porta, Professor di Clinica Chirurgica nell'i, R. Universita di Pavia, 1845, p. 378, Tavola 12 and 13.

Cooper, British and Foreign Med. Review, vol. vi. p. 67.

Roux, Popliteal Aneurism, Bollettino etc., Bologna, An. xiii. serie ii. vol. ci. p. 185.

Monteath, Popliteal Aneurism. Treatise on Aneurism, etc., by Ant. Scarpa. Translated by J. Henry Wishart. 2d edition, Edinburgh, 1819. Appendix, p. 540.

operation, whether ligature of the vessel just above the sac or of the external iliac artery. I incline to believe, therefore, that in this case of Mr G.'s, had deligation of the superficial femoral been employed, it would have been another instance added to the list of failures after ligature. For in it the great facility for a reproduction of the circulation in the sac was manifested in connexion with the patent condition of the anastomotica magna, which continued even after consolidation did become permanent, the pulsation of this vessel almost up to its origin being manifest both immediately and after the lapse of several months.

It must be obvious that compression accurately applied to the common femoral must command the arterial circulation of the limb far more completely than compression or ligature of the superficial femoral. In compression also the power of altering the situation of the vascular obstruction must afford a facility in regulating the degree of interruption of the free flow of blood through the sac proportioned to the activity of the collateral circulation, which cannot be claimed for the ligature; for the ligature, once applied, is not susceptible of any modification to suit the requirements of each case according to the effects it is found to induce.

I have no wish to argue against the employment of the ligature in the treatment of popliteal aneurism as fraught with great danger to life and limb, because, speaking from personal experience, I should incline to believe the contrary, and to regard evil results when they occur as largely due to a want of care in applying the ligature, or rather, I should say, in clearing the artery for that purpose. But it appears only a reasonable conclusion, if compression affords a higher certainty of success in curing the aneurism than ligature of the superficial femoral, that it should throw an enormous weight into the balance in favour of an operation which has the great advantage of no wound to add to its risks, nor operative procedure to increase its horrors in the mind of the patient.

It is a curious subject for observation, as yet unsettled in the history of compression in the cure of aneurism, to determine the nature of the occluding substance in the sac. The old view was, that it consisted of concentric fibrinous layers adherent to the sac and to each other, which formed a solid mass, and occluded the sac and its afferent and efferent vessels. In cases of compression, this view was adopted apparently without investigation, from the analogy of the process of consolidation of aneurism when it occurs spontaneously or after ligature. Anything else, in fact, than the formation of an adherent fibrinous laminated clot was believed to be fraught with danger to the patient in the form of either gangrene of the limb or suppuration of the sac. In so very modern a work as the fifth edition of Mr Erichsen's admirable work on Surgery,[1] we find him saying, "If it (the current) be suddenly arrested, coagulation of the blood

[1] Science and Art of Surgery, being a Treatise on Surgical Injuries, Diseases, and Operations, by John Eric Erichsen, etc., vol. ii. p. 24.

which happens to be in the sac may then take place, filling it with a large, dark, soft clot; the sudden formation of which is indeed, like a foreign body, apt to induce suppuration and sloughing of the sac and neighbouring tissues, and hence is rather prejudicial than otherwise." Recent writers and observers seem to doubt whether or not this slow deposit of concentric fibrinous layers is the mode by which consolidation is effected, at least in those cases where it takes place rapidly, and sometimes almost suddenly. In Mr G.'s case, we certainly could hardly suppose that it was the breaking-up or solution of such fibrinous layers "hard as a cricket-ball" which permitted the reproduction of the symptoms of aneurism. It appears more probable, therefore, to suppose that the coagulation of the fluid blood in the form of an ordinary clot is the means by which the obstruction through the sac is in the first instance effected. This view tallies with that of Dr Wm. Murray, the accomplished lecturer on Physiology in the College of Medicine, Newcastle on Tyne, in whose hands a case of abdominal aneurism was consolidated under pressure in five hours. Nor could any other mode of occlusion of the sac serve to account for the results obtained by Mr Heath of Newcastle on Tyne, in his famous case of Aneurism of the External Iliac, where the compression effected consolidation in *one* hour. The same also may be said of the case occurring in the practice of Dr E. D. Mapother,[1] of St Vincent's Hospital, Dublin, where absolute compression was continued for only four and a half hours, when consolidation suddenly became perfect.

Another feature of these aneurisms, in which a simple clot forms in great measure the occluding medium, is the rapid subsidence of the sac, and speedy disappearance of the tumour—features observed in both the cases I have narrated.

If further evidence were needed in proof that an ordinary coagulum may play an important part in the consolidation of an aneurism, we see it in the collateral fact, that where an aneurismal sac has given way externally, or upon a mucous surface, such as the trachea, the coagulum which plugs the opening not only temporarily occludes the aperture, but permanently arrests the hæmorrhage; and, as I have more than once observed, in the case of a large sacculated thoracic aneurism, this process is followed by partial consolidation of the sac, shrinking of the tumour, and healing of the opening. It was a change of this kind in one portion of the sac which led to the pro-

[1] Med. Press, March 29, 1865, part i. pp. 298–300. This view, although not usually entertained by modern surgeons, was undoubtedly enunciated by the late Professor Porter of Dublin, who at page 110 of his work on Aneurism, published some years before the treatment of aneurism by compression was employed, says: "The great object to be accomplished is the removal of the impulse of the heart from the blood contained within the sac for a sufficient time to allow of this reservoir becoming slowly and gradually filled with blood, and for that blood to become firm and coagulated. . . . If there could be any other means devised for removing the impulse of the heart during the required period, a ligature need never be applied for the cure of aneurism."

longation of Mr Liston's life after the aneurism had opened into the trachea. If it be once admitted that the cure of an aneurism is due to the mere coagulation of its contents, and extension of this process into the vessel upon the proximal and distal side of the sac, it encourages us to expect a larger amount of success in the treatment of aneurism by the employment of compression upon the distal in addition to that on the proximal side of the sac. In such circumstances, the almost complete severance of the blood in the sac from the general circulating fluid would favour coagulation not only by repose, but also by diminishing the vital repulsion of the blood for the parts with which it is in contact to such a degree as to probably determine a rapid consolidation. The consequences observed where a ligature has been applied to the continuity of an artery in two situations, at a moderate distance from each other, and where no coagulation has taken place in the fluid generally, or in fact at all, except where the deligation has cut through the inner coats at the point of application, must not be regarded as at all invalidating this view of the matter; for although the blood has little tendency to coagulate so long as it is in contact with the internal coat of a living artery, the interior of an aneurism cannot be regarded as possessing the same vital repulsion for blood which is presented by the internal tunic of a healthy vessel.

The proposal to employ simultaneously distal as well as proximal compression in the treatment of aneurism was first suggested to me by my kind friend Mr Edward Ledwich, of Mercer's Hospital, Dublin. "A case," he says, "occurred in our Hospital a short time ago where pressure was employed for some time without success. It was a fusiform aneurism in the popliteal space. I was called by one of my fellow-surgeons to look at it. I advised him to apply pressure to the vessel below as well as above the tumour. He did as I suggested, and in the course of a few hours it became perfectly consolidated." I observe also that Dr Mapother expresses himself strongly in favour of this procedure: "The pressure on the cardiac side should be preceded and accompanied by pressure on the artery leading from the sac. This step was suggested to me by my distinguished colleague Dr O'Ferral."[1]

In both the cases of aneurism I employed the Iodide of potassium in large doses, on the recommendation of Dr Geo. W. Balfour. In Mr G.'s case, while small doses of 10 grains, which were given for the first three or four days, threatened to induce coryza, the large dose at once checked this, and was unattended by any symptoms of iodism throughout the whole period of its administration. In the second case, large doses produced within twenty-four hours severe

[1] Med. Press, March 29, 1865, p. 300.
Treatment of Aneurism: Advantages of completely arresting the Current through the Sac, by E. D. Mapother, M.D.
Notes on the Rapid Pressure Treatment of Aneurism, by W. Murray, M.D. —British Med. Journal, Oct. 5, 1867.

iodism, which lasted for nearly a fortnight, though the medicine was given up as soon as the consolidation of the sac was recognised to have occurred. It is a little difficult to see in what way the iodine conduces to the good result and affords such marked relief as recent experience of its employment has shown it to possess in thoracic aneurisms. I have sometimes been tempted to believe that iodine only benefits those cases of aneurism where mercurio-syphilis (*i.e.*, syphilis treated with mercury) has been the predisposing cause of the aneurismal condition; and just as iodine and its compounds benefit syphilitic phthisis (pulmonary gummata), that so iodine relieves syphilitic aneurismal disease.[1] At the same time, as there can be no doubt that in some anæmic cases the employment of iodine increases the proportion of globules to the other elements of the blood,[2] it may act in them by affording substance for the formation of a more bulky red clot out of the same quantity of fluid blood. Whatever effect the iodine may possess upon the aneurismal changes, certainly in the first case no obvious influence was traceable to its administration, unless, indeed, we were to presume that the ultimate coagulation occurred just when the condition of blood most favourable for the formation of a clot had been reached. In the second case, the irritant influences of the iodine were very manifest; but we have still to learn that such physiological effects bear any proportion to its curative influences in aneurism. Furthermore, it is, I think, an interesting subject for observation and experiment how far the large doses of iodide of potassium are influential, like those of bromide of potassium, in stupifying the cerebral structures, and how much may be expected from the employment of either remedy as an adjuvant to compression in making the patient tolerant of the compressing agency.

In treating the first case, I employed the flexion method of Mr E. Hart, without, however, the preliminary and systematic bandaging of the limb which he deems essential to its success. I did not employ the bandage because I feared, in the condition of the circulation of the limb, lest the use of the bandage should have induced gangrene when flexion of the knee was superadded to the compression of the tumour in the groin. I have always considered this flexion method of treatment advocated by Mr Hart the perfection of simplicity, and in lecturing upon the subject have taken occasion to impress upon my pupils the facility in application it affords and the good results which theoretically it has appeared to promise. The apparatus I employed consisted of a waist-belt and shoulder-straps, to which a slipper was attached by means of a strap and buckle. I

[1] Is the frequency of aneurismal disease in soldiers due to the tightness of their tunics and stocks, and the badly-adjusted knapsacks they wear; is it not rather due to the frequency of syphilis among them, and the almost constant employment of mercury for its cure?

[2] Leçons sur le Chancre, professées par le Docteur Ricord, p. 143 et seq. Maunder's translation of the same, p. 102 et seq.

found that no degree of flexion which I could enforce upon the patient had any perceptible influence upon the circulation in the sac as gauged by the pulsation and bruit. I should not, however, have readily relinquished further efforts to enforce its employment had it not been that the patient insisted that, come what might, he neither could nor would tolerate the flexion any longer.

The employment of the shot-bags was only a temporary measure until I could have the Carte compression apparatus modified to carry ovoid weights. If, however, they exercised no real beneficial influence on the progress of the aneurism, they certainly seemed to accustom Mr G. to the pressure of weight in the groin, and thus to render the cutaneous tissues there more amenable to the use of the 8 and 12 lb. weights afterwards.

The employment of weights in the treatment of aneurism by compression has, I am aware, nothing novel in it. They were early employed in the history of compression by the surgeons of Dublin, and in imitation of their methods I had several weights made in 1853, for the use of the late Professor Miller. They, like the leaden weights then usually employed, were simply applied over the line of the artery, and retained in position by means of straps surrounding the limb, without in any degree girthing it.

More elaborate weight-compressors had also been invented both by Carte and Reade.[1]

The instrument which I employed, and now show you,[2] is simply the Carte's circular compressor for the thigh with the metal arch

[1] *Mr Carte's apparatus for applying the weight.*—"This apparatus consists of three parts—viz., a belt of peculiar shape, a receiver in connexion with it, and metal weights of different sizes. The belt, which is made of leather lined with chamois, is shaped so as to fit accurately the hip, buttock, and upper part of the thigh; it almost surrounds the limb, and is secured on the outside by straps and buckles, one strap passing round the pelvis. Immediately over the artery a circular hole is left in the belt, about an inch or a little more in diameter. The receiver (which is termed a 'hopper' from its resemblance to this part in some machines) is made of very strong leather, and has the shape of an inverted cone, the small end being attached to the edge of the circular hole in the belt. The weights, which are of lead and of different sizes, have a conical shape, so as to fit easily into the receiver, and are so shaped that the smaller end will pass through the opening in the belt, and rest upon a compress or pad laid upon the artery underneath."

Messrs Reade's apparatus for applying the weight.—"This apparatus consists of a cradle composed of two light flat metal hoops or rings, joined together by a connecting flat piece of iron, into which the upper part of the thigh fits; and the hoops are so constructed that their size can be increased or diminished as occasion may require. A ball and ring similar to that of the 'aneurism compress' comes off from the upper hoop; but, instead of the screw, a smooth cylindrical rod moves in the ball, and is connected with a pad below. The apparatus is intended for the compression of the artery in the groin, which is effected by passing flat leaden weights having a hole in the centre down the rod connected with the pad; and their number may be increased until the necessary degree of pressure is made."—*Observations on Aneurism and its Treatment by Compression*, by O'B. Bellingham, M.D., pp. 92, 93.

[2] See plate facing title-page.

heightened, the pad removed, and the elastic element withdrawn. There still remains the rod, no longer, however, acting as a screw, but sliding through the ball-and-socket joint beneath so as to admit of the easy introduction of the weight. The weight is ovoid in form, and has a channel through its central long axis large enough to let the rod play easily without catching. The extremity of the weight by which the pressure is applied has the form of the larger end of an egg cut out of metal, $3\frac{1}{2}$ inches in diameter. The inclination given to the rod by the universal ball-and-socket joint determines exactly the amount of weight and the situation at which the pressure is to be applied. A very slight variation in the inclination of the weight from the perpendicular materially modifies the actual amount of weight borne by the limb at the point of compression, so that the minimum amount of pressure sufficient to control the circulation through the artery can be arranged to a nicety, with the same mass of metal. The pressure is rendered accurate by the ball-and-socket joint, which is made immovable by a pinch-screw, or it is directed by the hand of an assistant, sitting at the bedside, steadying the weight or gliding it from side to side as his other hand, resting on the aneurism, may indicate. This apparatus has certainly the virtue of simplicity, as there is nothing connected with it which could not easily be constructed by a blacksmith or brassfounder. So far as I am aware, it has not been previously employed. In editing the last edition of the "System of Surgery" by the late Professor Miller, I briefly mentioned this apparatus: "The weight is perforated, and allowed to slide loosely upon the rod of the Carte's apparatus, its ordinary compressing-pad having been removed."[1]

The only notice I have been able to find of at all an analogous plan of employing weight-pressure in the treatment of aneurism is in the Report of the Proceedings of the Surgical Society of Ireland,[2] where Mr Samuel A. Cusack is reported as saying—"The pressure throughout was made by means of the weights now on the table, which are kept upright and in position by means of a stiff iron wire fixed in a ring in the cradle which is placed over the patient's body —a mode of applying them which I have found more convenient than any other contrivance in which the patient or an assistant is obliged to keep the weight in an upright position."

The weight employed as a compressing agency has a great advantage over the screw-compressor, whether with the improved elastic element of Carte or not, in so far that it yields with every impulse of the artery, without, however, allowing any blood to pass it. The weight will accordingly be seen to move slightly but quite perceptibly whenever the pressure is accurately applied, and completely arrests the circulation. This slight yielding makes the pressure far more tolerable than any method which affords no allowance for a certain degree of "giving." Further, there is no squeezing of

[1] A System of Surgery, by James Miller, F.R.S.E., etc., p. 421.
[2] Dublin Med. Press, February 29, 1860, p. 179.

the limb against the splint behind, as there must be in the screw-pressure; the counter support in the case of the weight is afforded by the whole limb, and diffused over every point of it which comes in contact with pillow or mattress.

Digital compression by the thumbs of professional assistants is considered by some as the *ne plus ultra* of excellence in compression. To this view I cannot accede. Digital compression is painful, usually unequally maintained, apt to be excessive, requires relays of skilled assistants, whose frequent shifts annoy the patient and prevent sleep, while, except in an hospital patient, they are practically unsuitable. The weight, on the contrary, once correctly set, needs no meddling, exhausts no strength, is unvarying in its degree of force, and requires only so much regulation and watching as can be afforded by a non-professional assistant, who, without fatigue, can easily maintain a constant and efficient superintendence for several hours at a time without occasioning the slightest disturbance of the patient's repose.

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