

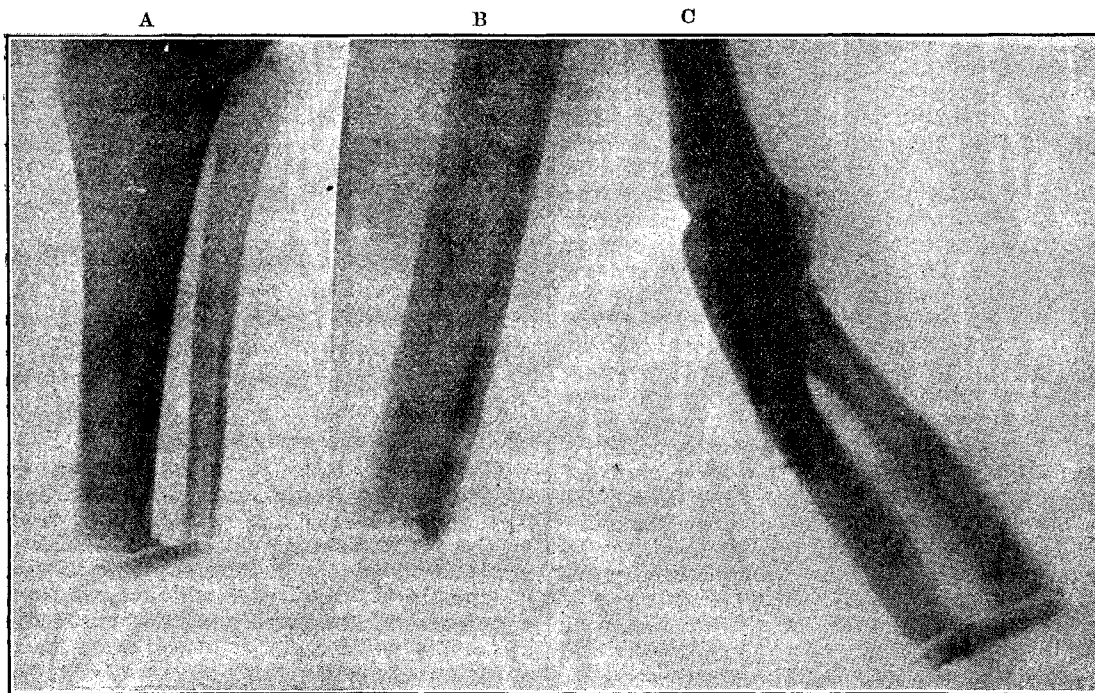
BIER'S OSTEOPLASTIC AMPUTATION.

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THE ideal stump after amputation is one which will enable the patient to bear pressure on it; this is in reality the only gauge of its utility. It is remarkable that until the advent of Professor Bier's proposal of a new method of amputation so little progress had really been made in improving the pressure-resisting power of stumps, although so much was done to improve their appearance and to obtain a better covering. Take the lower extremity as an example of what has been done, and it is more apt than the upper limb because of the importance of a good stump to a patient in the matter of locomotion. An amputation through the knee-joint, the stump of a Syme's or Carden's amputation, is each capable of bearing on its face the weight of the patient, and with a good support will permit progression in a manner altogether satisfactory; but these particular amputations probably form only a small proportion of all those which fall to be done in the lower limb, the great majority of which, I should say, require to be performed through the shafts of the leg bones or of the

skin will always in a short time thicken and hypertrophy and come to bear any weight. It has been supposed that it might be due to the difference in the width of the bone surface and that the sharp rim of the bone resulting from an amputation through a diaphysis directly damages the soft tissues covering it, but Bier disposes of this suggestion by stating that he has known cases of amputation through the ankle-joint without removal of the ends of the bones and yet the patients were able to walk on the extremities of the malleoli without hurt to the covering of the stump. Malgaigne's subastragaloid amputation, too, gives a good weight-bearing stump, in spite of the extremely uneven bony surface on which the patient has to walk. Bier suggests that the inability of a stump after amputation through the diaphysis of a long bone to withstand pressure is due to the scar in the medulla remaining tender and to get over this he covers the sawn surface with bone.

The evolution of the osteoplastic amputation of Bier, which is quite a different procedure from that of Pirogoff and Gritti, has been a gradual one. His first proposal was to form an artificial foot for the purpose of taking the weight. Having amputated the limb he took out a wedge higher up, involving the whole thickness of the bone, and turned up the distal segment of bone which was then fixed at right angles to the remainder and projected forwards beyond it so as to form a support something like a miniature foot. Latterly he shortened the piece of bone which was to be turned up



Skiagrams of stumps after Bier's amputation, from plates by Dr. James R. Riddell. A, Amputation through the leg. B, Amputation through the thigh. C, Amputation through the forearm.

femur and there is not one of these stumps which is capable of bearing the patient's weight on its face. The artificial limb is made to take its bearings on some natural bony prominence higher up and the result is that atrophy of the tissues of the stump is excessive. Yet the more completely a stump allows a patient to put weight on it the more natural will be the movements of the limb and atrophy of tissues ought to be reduced to a minimum. Pirogoff in 1852 modified Syme's operation by carrying out the first of the osteoplastic methods and it gives a stump which is most admirable but the method is not necessary here in this region of the limb; the patient can walk upon the Syme stump every bit as well as he can on the Pirogoff stump and so it is with the osteoplastic amputations at the lower end of the femur—e.g., Gritti's or SabanJeff's; they are unnecessary complications, for the patient can always bear his full weight on the sawn surface of the femur in a Carden's amputation, which is moreover a simpler and easier operation to perform.

What is it that renders a stump after an amputation through the central canal of a long bone unable to bear pressure on the sawn surface of the bone, whereas in an amputation through cancellous tissue or through an articulation the bone can bear weight? It is not due to want of skin accustomed to bear pressure, for if properly treated

so that it merely covered the end of the proximal segment without forming any projection at all. Neither of these suggestions appealed to me on account of the complexity of the manipulations that were necessary and I never attempted to carry them out. When, however, I read a report five years ago of Bier's modified operation (which had been published in 1897) it seemed to offer such a vast improvement on existing methods that I tried it at once and have continued to use it ever since in every case where it was practicable. The idea of the method is to cover the transverse saw-cut surface of the bone with a small and thin bone flap cut from that portion of the limb which is to be removed.

As the method has not yet to my knowledge been published in any of the British text-books of surgery I may give a brief description of it, taking as an example an amputation through the middle of the leg. A flap of skin and subcutaneous tissue is cut, preferably, as Bier suggests, from the antero-internal aspect of the limb and reflected with care that there is no damage to the periosteum covering the shin surface of the tibia. Next, three sides of a rectangular flap of periosteum are cut on the shin surface of the tibia, the two lateral incisions being made just beyond the margins of this surface of the bone, and the transverse incision about one and a half inches down from the base of the skin flap. With an elevator the periosteum is raised for about one-third

of an inch upwards from the transverse incision and then a fine saw is applied and a thin flap of bone, still adherent to the periosteum, is cut from the compact bone of the shin surface. If it consists of the whole thickness of the compact layer of bone it is no matter. Its length must be equal to the transverse diameter of the tibia but it may be made long enough to cover the transverse surfaces of the tibia and fibula as well. (I have found it better to divide the fibula higher than the tibia and to make the bone flap for the tibia alone.) When the bone flap is cut sufficiently long its base is snapped through but the periosteal bridge connecting it to the bone of the stump is to be most carefully preserved. The bone flap being held up out of the way a short posterior flap is cut; the bones of the leg are cleared and sawn transversely. The prominence of the sharp shin border of the tibia should be removed as well as any irregularities that may be present at the margins of the bone flap. After the vessels are tied the bone flap is sutured by the margin of its periosteal covering to the edge of the periosteum of the bone of the stump and to the muscles of the stump also, so that it flaps down close over the sawn end of the tibia. The results are illustrated by the accompanying illustration.

As soon as the wound is healed the patient is encouraged to walk on the face of the stump. At the end of four weeks as a rule I fix a wooden pin leg to the stump by plaster-of-Paris bandages and get the patient up.

The results of the operation are, in my opinion, admirable. A patient with an amputation through the leg or femur can put his whole weight on the face of the stump just as well as another patient can bear his weight on a Syme's stump.

I have now performed this operation 24 times altogether—15 times through the leg, six times through the femur, twice through the humerus, and once through the forearm. All those with amputation through the lower limb except two have been able to put their full weight on the stump. As to the two who could not, they were small children who were among the first to be operated on and at a time before I had a saw which was narrow enough to turn easily; during the process of cutting it the bone flap became almost completely separated from its periosteum, but though the wounds healed well in the course of time the bone flap necrosed and had to be removed. In the upper limb the advantages of this method of operation are that a working man will be able to bear pressure against his stump, as in the effort of pushing objects, which in many occupations may be of importance to him. In the single case which I have done through the forearm bones the movements of pronation and supination at the elbow-joint have been quite arrested but rotation takes place so freely at the shoulder that the patient tells me he has no inconvenience.

I am specially interested in watching how these amputations through the leg in the case of young children will ultimately succeed. This, of course, is one of the sites where a conical stump is most likely to occur, probably due to the continued growth of the bone and a defectively commensurate development of the soft parts over it from want of proper use. In these Bier's amputations in children, although muscles not in use will certainly atrophy as in the old form of amputation, those muscles employed in movements which are preserved to the limb will not; the growth of the parts ought, therefore, to approximate more closely to that of the normal state and possibly this troublesome condition of conical stump may be avoided in consequence—if so the method will prove a still further benefit. The stump which results from Bier's method is often small in appearance as compared with the broad, fat stump seen after amputation by the ordinary methods but in these latter there is practically complete atrophy of every tissue and the size of the stump is really due to the development of fat, whereas in a Bier's stump which is being used the bone and its functional muscles certainly do not atrophy though the other tissues may, and the development of fat is not so great. The operation by this method requires a few more minutes for its completion than in the case of the ordinary flap operation but the results of the two methods as far as utility is concerned are not comparable. Bier states that the bone flap does not always unite to the stump bone but that even so the stump will still be capable of bearing full weight. In all my cases, except those of the two children mentioned already, there has been solid bony union between the bone flap and the bone of the stump. That an amputation stump of the lower extremity capable of bearing the weight of the patient is a rarity has been thoroughly impressed on me by the reluctance of various makers of

artificial limbs to make a support which would bear directly on the face of the stump for some of the patients.

A year ago I showed at a meeting of the Glasgow Medico-Chirurgical Society three of the patients who had been operated upon by this method, two of whom were men with amputation through the femur, the one wearing an instrument maker's appliance, and the other wearing a support thoroughly efficient which he had made for himself; the third being a child with amputation through the leg, wearing the rather crude pin leg of the type that has been supplied to many of the cases at the hospital. They were all able to walk with perfect freedom and ease.

In my opinion this ought to be the operation of choice in all cases in which there is a reasonable chance of avoiding a virulent suppuration in the wound. Bier advises that the method should not be employed in diabetes and senile gangrene, but states that he has found a moderate suppuration does not endanger the vitality of the bone flap. Even though the bone flap should necrose from any cause the patient would be no worse off than if the amputation had been carried out on the ordinary lines.

Bibliography.—Bier: *Archiv für Klinische Chirurgie*, vols. xlv. and l.; *Centralblatt für Chirurgie*, 1897. Bunge: *Deutsche Medicinische Wochenschrift*, 1899.

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A CASE OF VESICO-VAGINAL FISTULA FOLLOWED BY HÆMATOMETRA AND PYONEPHROSIS.

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THE following case has been recorded for three reasons: first, because of the comparative rarity at the present time of vesico-vaginal fistulæ resulting from a prolonged labour; secondly, because of the peculiarities of the local conditions for which the plastic operation was performed; and thirdly, the unusual complications of hæmatometra and pyonephrosis which arose some years later.

The patient, aged 29 years, married, was delivered of a still-born child in February, 1896. It appears that she was four days in labour and delivery was finally effected either by the forceps or cephalotripsy. Within two days of the termination of the labour she had a swollen and tender abdomen and high fever which continued for three weeks subsequently. On the seventh day post partum she found her urine was continually dribbling away and this complication persisted up to the time she first came under treatment—namely, April 29th. She was then troubled with a horribly offensive urinous smell which disgusted both herself and her friends; in addition there were soreness about the vulva and difficulty in sitting down. There had been amenorrhœa since the labour.

On examination the patient was found to be 4 feet 10 inches high and walked with a somewhat waddling gait. The external pelvic measurements, however, were only slightly below normal and there were no signs of rickets. Per vaginam the posterior portion of the vulva was excoriated and very red, tender, and swollen; the vagina was sore, making examination difficult. About one and a half inches up the vagina the examining finger passed anteriorly into a somewhat transverse oval orifice, easily admitting two fingers, but with very tense edges. This led directly into the bladder. The flap above the fistula and forming the posterior portion of the bladder was reflected backwards and lost on the recto-vaginal wall. No sign of a cervix could be detected, the vault of the vagina being therefore represented by a cul-de-sac. What appeared to be one of the ureteral orifices was seen opening on this surface. Through the speculum the anterior vaginal wall over the lower flap of the fistula was covered by a patch of villous-looking tissue about one and a half inches broad and one inch long, which bled on being handled and looked somewhat like bladder epithelium. Bimanual examination showed a lump, fixed and of rounded shape, lying above the vaginal cul-de-sac but not presenting the usual features of a cervix and uterus. The urine was offensive and alkaline and was nearly entirely