

## RECENT ADVANCES IN TENDON TRANS- PLANTATION AND BONE GRAFTING

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THE title of the paper naturally implies that these advances have been made or proven through the exigency of the results of war. This last overshadowed all ordinary production and prevented the regular trend of research and experimental work. The time of those qualified for such work, who were obliged to remain at home, was so occupied by over-taxed daily routine that further work was an impossibility. The demands from the military side on the medical service, however, did emphasize certain principles in practice before the war. The word demands occurs to me as appropriate; as the army demanded first, the categorizing of men for active service and then that before a man was discharged from the army his rating as an effective should be as high as possible, and finally that his charge on the country, or pensionable disability should be reduced to a minimum. Prophylaxis wiped out typhoid and tetanus, but what about surgical prophylaxis?

The beginning of the campaign found the service prepared for casualties to a certain percentage of the troops engaged. But the lesson of attending to and segregating the hundreds of thousands of casualties could not be learned in a short time. In our own Corps there was probably an average of 15,000 casualties in each major field operation in which it was engaged. In addition it must be noted that the organized activity of the medical services saved many more lives proportionately than in previous wars and this fact demanded great expansion in the number of beds in the various home bases. It is very true the statement of Sir Robert Jones, "That one of the greatest tragedies of the war was the results in the early fractures, particularly of the femur." The various links in the chain of prophylaxis were rapidly forged and preventive orthopædic practice was adopted. The segregation and treatment of femur cases was a triumph and there was a constant

and remarkable improvement in the treatment of fractures, with corresponding diminution in the occurrence of malunion and nonunion. There was also a marked decrease in the number of cases of splint and ischæmic disabilities.

At the Granville Special Hospital, Buxton, and the Orthopædic Division of the St. Anne Military Hospital, large numbers of these post-war disabilities came into the writer's services. There were many war nerve lesions, ununited and malunited fractures. Of the former musculo-spiral, median and ulnar nerve conditions of the arm and the sciatic trunk, or the two divisions of the same, were frequent. The musculo-spiral lesion does not cause serious disability from sensation, but the muscular disability from this lesion is very great: wrist drop, the peculiar extension by the lumbricales and the adducted thumb. The great disability of this last may be overlooked until one considers how useless is the hand in which the fingers close on the thumb. The results of early nerve suture have been fairly satisfactory, but this procedure has been carried out in a relatively small percentage of cases owing to the presence of sepsis and infected fractures as complications. Permanent nerve disability has been of frequent occurrence. What is the remedy? A satisfactory procedure has evolved from our ante war experience of tendon transplantation and the results have been excellent. The first disability was to meet or counteract *the wrist drop*, i.e., to restore power to the long and short wrist extensors. On the flexor side the muscle which could be best spared and also having the most satisfactory anatomical position was the pronator radii teres. The tendon of this muscle when properly transferred to the wrist extensors will correct the wrist drop. The problem of the hand: you will remember that the extensor function is relatively gross. It exists as an opponent, to allow the fine work of the front of the hand to be accomplished. How can we compensate for this disability: abduction and extension of the thumb and extension of the fingers? On the flexor side the palmaris, flexor carpi radialis and flexor carpi ulnaris muscles can be spared without causing much disability. Insert the palmaris, if strong, into the thumb extensors, or the radialis into the thumb and index extensors, and the ulnaris into the tendons of the three outer extensors. There is no power of hand grip without wrist extension. A long J incision curved over the radial flexor side gives a very good exposure. I found a strange condition resulting in one of my cases. The primary results were good: wrist, thumb and fingers, but a few weeks later the wrist drop recurred. I again exposed the site

the pronator teres tendon. In the previous operation the two wrist extensors were transfixed, the tendon passed through and sutured with catgut. The latter was completely absorbed and the tendon, though a little scarred, was so firmly attached to its normal site on the radius that an elevator was necessary to detach it.

In cases of several thumb extensors, when the ends cannot be sutured, the supinator longus, extensor radialis longior or the radial flexor may be utilized to improve the disability.

*The Median Nerve.* Sensation is very important, in fact the fine co-ordinate movements of the thumb and index are absolutely dependent on the same. In our winter the percentage of disability is much increased, so much so that the individual has to estimate his activities by what the hand will allow him to do. So far no operative procedure can relieve a permanent sensory lesion. The motor disability can be improved by transplanting the tendon of the extensor carpi radialis longior to the flexor longus pollicis tendon by lateral implantation as recommended by McMurray. The result is a useful thumb.

*Deltoid Paralysis.* Before the war it was proven that tendon transplantation did not give satisfactory results and that arthrodesis is the real treatment.

*Sciatic Nerve.* A very troublesome motor disability of the trunk or external popliteal branch of this nerve is foot drop. There has been a good percentage of recovery after suture. The disability from a permanent lesion means that the individual is harnessed to a drop foot brace or the deformity becomes aggravated and more fixed. Strength for weight-bearing is the important essential. The usual muscles utilized for transplantation are the tibialis anticus and one of the peronei. The best of all tendon fixations in the leg result from the use of the tibialis anticus and peroneus brevis. The anticus tendon is exposed, and the tibia. Raise the periosteum and drill a hole through the tibia from either side two to three inches above the ankle joint. Cut off the tendon about two inches above the hole, pass the tendon through, turn it back on itself and suture it. A loop of tendon through the bone results.

*Peroneus Brevis.* Cut this tendon four inches above the lower end of the fibula, and then pull it through a small incision below, in order to transplant it in front of the malleolus under the annular ligament and then fix it either through the already prepared hole in the tibia, or through a new hole below, passing the tendon in the reverse direction.

By this means a strong sling is made which counteracts the troublesome drop foot and allows the brace to be discarded.

*Free Transplantation of Tendons.* Considerable experimental work has been done but the only surgeon I know who definitely reports success is Sencert of the Val de Grace, Paris. I saw one case of his where there had been a large defect on front of the wrist and he had sutured lengths of sterilized dog tendons 2 to 5 centimetres long in several of the flexor tendons. Superficially he had repaired the defect with a flap. Six weeks later when I saw the case, very good function was noted and practically no scar infiltration. Other reports are very discouraging *re* scar infiltration.

*Bone Graft.* The great number of ununited fractures and bone defect cases have developed a procedure best calculated to give good results. The sites from which the graft is chiefly taken are the ilium, ribs and tibia. The jaw surgeons have found that grafts from the first are most satisfactory in jaw repair work. For the long bones the rib and tibia have been most satisfactory. The non-touch technique is naturally essential. The medullary insert has not been used so much. The essentials for a good result are: a good groove in each fragment and a well modelled graft to give enough and the best contact and fixation. There is always a marked osteosclerosis at the ends of the fragments and the contact must be carried well up into the normal bone. The best insert is that of the mosaic type which brings each region of graft and host in natural apposition. Chutro, however, has used a thin graft with very good results. When the rib is used it is modelled at each end to have a good insert in each fragment. The graft from the tibia may have the square end insert, but we have had a number of cases, especially in forearm cases, where we have employed the so-called butterfly graft—thick in the centre and tapering to a fine edge. This graft can be very accurately fitted and in many cases does not require to be tied in place. The ends can be fashioned so as to get a good hold in the medulla. The contact is excellent and almost ideal for the revascularization of the graft. In cases that have been plated without success the graft must be carried well beyond the screw holes. In one such case of which I show the slide there was a plaque of sclerosed bone across the radius. This was so hard that the saw had to be employed instead of the fine chisel. This graft is successful in the troublesome lower one-third fractures of the radius when the lower fragment at times almost touches the ulna. A good dorsal insert has enough splinting to hold the fragments.

In one case I had to divide the wrist extensors to accomplish this. These, of course, were easily sutured after the graft was in position.

In every case of bone grafting it is essential to have as much tissue as possible sutured over the graft. We have usually been able to have the graft site covered by three layers. Very careful splinting or plaster of paris fixation is necessary to ensure the results. On two occasions I used boiled bone with good result. Heitz Boyer of Paris reports twenty-five cases of using dead graft transplanted with satisfactory result, and this is confirmed by numerous other observers, though where possible the autogenous graft is preferred. Albee, Hey Groves, Gallie, and Robertson and others have written extensively on the subject. In conclusion, as a stimulus to work may I recommend the last publication of Professor Keith of the Royal College of Surgeons: "Menders of the Maimed." Lantern slides illustrating the above work and the results were shown.

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IN terms of the bequest made to the Royal College of Physicians of Edinburgh by the late Dr. John Parkin, Fellow of the College, a prize is offered for the best essay on certain subjects connected with medicine.

The subject of the essay for the present period is, in terms of the deed,—

"On the curative effects of carbonic acid gas or other forms of carbon in cholera, for different forms of fever and other diseases."

The prize is of the value of one hundred pounds sterling, and is open to competitors of all nations.

*Essays intended for competition, which must be written in the English language, to be received by the secretary not later than 31st December 1920.* Each essay must bear a motto, and be accompanied by a sealed envelope bearing the same motto outside, and the author's name inside.

The successful candidate must publish his essay at his own expense, and present a printed copy of it to the college within the space of three months after the adjudication of the prize.