The bone, in re-amputation, is dealt with by the Bunge method. The bone canal is tamponed with a section of muscle, bleeding vessels are carefully tied, the nerve is cut at a fairly high level with a razor blade, and drainage tubes are inserted for one day. The use of the osteoplastic operations of Pirogov, Bier, Gritti-Stokes, and Kirschner is widely recommended.

Preparation of Stump for Prosthesis

From the very beginning of treatment very careful attention is given to the preparation of the stump for prosthesis. In the first stage of stump treatment binding scars, contractures, and limitation of motion must be prevented. In the second stage, after the wound has healed, physiotherapeutic methods of treatment are used; these include massage of the extremities—omitting the stump itself—contrast baths, and electric stimulation. Stump exercises and gymnastics for the amputee, stump-wrapping, and training to accustom the stump to withstand pressure are started early, and therapeutic prostheses are extensively used. Stump preparation continues for two to three months.

Organization of Prosthesis Supply

In the Soviet Union a network of special hospitals have been established for the purpose of supplying prostheses. Each hospital includes a department of orthopaedics where the stump is treated, a department of physiotherapy where it is prepared for prosthesis, and a prosthesis department where the artificial limbs are completed and fitted. Our prostheses are made of wood, leather, or emolyten, and in the main our system of supply is divided into two sections—the manufacture of parts and the assembly of the finished limb. Several factories exist for the manufacture of unassembled metal and wooden limbs. Assembly of the prostheses is done by regional workshops distributed throughout the Soviet Union.

Special attention is given to supplying prostheses for wounded men with bilateral arm amputations. Either a Krukenberg operation or phalangization is performed, and the amputee is provided with an active artificial hand.

A healed amputation stump and a suitable prosthesis are essential for re-establishing the patient's working capacity and providing him with employment. Up to 90% of our amputees, after being treated and supplied with artificial limbs, return to the factories, plants, and other establishments where they were employed prior to the war. Only work can complete their rehabilitation; only work can heal their severe psychic wounds and restore their shaken nerves.

OSTEOPLASTIC RE-AMPUTATION OF THE THIGH

BY

Dr. ALEXANDER KOTOV

Many surgeons in the U.S.S.R. and in other countries consider end-weight-bearing stumps preferable to other types from the prosthetic point of view. These permit an artificial limb to be lighter in weight and simple in construction, and in addition they guarantee stability in walking, due to the fact that the amputee in a way "feels the earth under his feet." Non-end-weight-bearing stumps in many cases involve permanent pressure on the tuber ischiadicum, which is difficult to support and which hampers walking.

The objections raised by critics of end-weight-bearing stumps lie not in their disagreement with what has just been stated but basically in that in course of time the supporting capacity of the stump lessens and even completely disappears. It seems to us, however, that this does not justify depriving the amputee of the possibility of using an end-weight-bearing stump, even if only for a limited period.

End-weight-bearing Stumps

We consider that below-knee amputations provide the best means of obtaining end-weight-bearing stumps by operative procedure. According to our observations in the Soviet Union, the Pirogov, Syme, Bier, and Kirschner operations all give

excellent results. Because of this they are widely used in our hospitals in cases requiring below-knee re-amputations. It was possible, by use of the methods mentioned, to provide the majority of patients with prostheses that reached no higher than the level of the knee-joint.

In re-amputation of the thigh there is less possibility of securing end-weight-bearing stumps. The Gritti-Stokes osteoplastic amputation, in the opinion of various authorities and according to our own observations, gives a good end-weight-bearing stump in the region of the lower third of the thigh. Some writers claim that they get a stable end-weight-bearing stump in the middle third of the thigh by that method. Conditions of war, however, especially in amputation centres, limit the use of this operation, both for thigh and for below-knee amputations. It is first of all excluded when thigh stumps do not include the patella; and, secondly, its use is seldom indicated on stumps of the upper third of the lower leg. Thus, in thigh re-amputations we do not regard the osteoplastic operation as an accepted method of securing an end-weight-bearing stump.

On the basis of data gathered from all hospitals under the control of the People's Commissariat of Health of the U.S.S.R., the number of thigh amputations following war trauma is approximately equal to the number of below-knee amputations. They constitute, however, a far more difficult group with respect to restoration of lost function.

Owing to the absence of two groups of major joints a thigh case finds walking much more difficult than a case with amputation of the lower leg. In addition, the surface that can be utilized to fasten the socket of the prosthesis is only one-half or one-third of that available in below-knee amputations. Finally, in non-end-weight-bearing stumps of the thigh the only anatomical point of pressure in walking with the prosthesis is the tuber ischiadicum. We are in agreement with those who, having observed the prostheses of patients with thigh amputations, point out that their adjustment to weight-bearing on the tuber ischii is often a lengthy and unpleasant procedure.

These factors forced us to seek a means of alleviating the condition of this group long before the outbreak of the present war. At the clinic of the Ukrainian Institute of Orthopaedics and Traumatology in Kharkov physiotherapeutic methods of accustoming the thigh to pressure after re-amputation were employed. Our observations showed that to secure an end-weight-bearing thigh stump by means of this method long and unwearying persistence was required, but the results completely justified the effort.

As a result of his training the patient with an end-weight-bearing thigh stump showed incomparably greater stability and ease in walking than when he had a non-weight-bearing stump. In addition the majority of amputees, after therapeutic treatment, began to walk with a mobile artificial knee-joint and refused to wear a lock, which they had previously insisted upon in order to prevent mobility. In some cases the end-weight-bearing stump enabled patients to abandon completely the use of the ischium for support.

During the war, which has made wide use of operative procedures for treatment of the stump possible, the idea arose of employing the osteoplastic method to increase the ability of the thigh stump to bear pressure. Our use of the Kirschner method for re-amputations of the lower leg in the amputee hospital at Seipolatinsk, Khazakstan, gave good results, and we decided to utilize the principle of this operation to obtain a pressure-bearing thigh stump. During ten months of work we performed 15 osteoplastic re-amputations of the thigh stump in the middle third. The post-operative wound healed very quickly in all these cases. We began educating the stump to weight-bearing on the twelfth to the fourteenth day after operation, exercising it a few times daily. At the beginning of the second month after operation the amputee was supplied with special crutches fitted with a platform for supporting the stump. The walking time was increased daily. Later this group of amputees were supplied with end-weight-bearing prostheses having free mobility of the knee-joint.

Technique

The technique we use in osteoplastic re-amputation is very simple. A flap of skin sufficient to cover the lower surface

of the stump is cut out on the anterior aspect of the thigh. The skin on the posterior surface is divided almost perpendicularly to the bone of the extremity. After this the muscle layers are divided conoidally and the bones of the thigh are sawn through. We saw off a ring-shaped bone transplant, 0.5 to 0.75 cm. thick, from the proximal end of the amputated bone and divide it into several sections. After appropriate modification the transplant is introduced into the bone-marrow canal, closing it. The muscles are then stitched in layers and the skin sutured. In some cases the diameter of the bone transplant enables us to fit it into the bone-marrow canal without division into sections, thus facilitating the operative technique.

Our observations relate to only a small number of cases and are too recent for definite conclusions to be drawn. Nevertheless the results have been so satisfactory that we feel justified in giving them wider publicity.

TRAUMATIC URAEMIA

BY

CLIFFORD G. PARSONS, M.D., M.R.C.P.

(From an E.M.S. Base Hospital)

Just as the original draft of this paper was completed there appeared an article by Darmady and his colleagues (1944), writing from the R.A.F. casualty clearing station which feeds this E.M.S. base hospital. They described 8 patients who developed uraemia a few days after being wounded by high-explosive missiles. Oliguria and vomiting were constant features in these cases, and six of the patients died. Reference was made to similar cases described during both the present and the last war, but no mention was made of a paper on the subject by Duval and Grigaut (1918).

In the hope that further light may be shed on the mechanism responsible for the azotaemia two further cases are here reported. Both these patients were healthy young soldiers whose wounds caused such extensive muscle and vascular damage as to necessitate amputation; shock was severe and was treated by transfusion of blood and plasma; infection was well controlled by early surgery and the administration of penicillin and sulphanilamide. Uraemia developed rapidly and was undoubtedly responsible for the death of one of the patients, whose wounds were not sufficient in themselves to cause a fatal outcome. Looking back through our case records, it seems probable that other unrecognized examples of the condition may have passed through our hands.

Case I

Soldier aged 19. Penetrating wounds of both knees and left arm on Aug. 15, 1944; right popliteal artery severed. No note of tourniquet. Wound toilet and amputation through right knee 17½ hours after injury; B.P. 130/65, "not shocked"; A.T.S. 3,000 units; A.G.G.S. 10 c.cm. intravenously; 2 pints blood and 5 pints

Blood Counts of Case I

Date	R.B.C. (mill.)	Hb % (Sahli)	W.B.C.	Differential Count (%)						
				Neut. Poly. Seg.	Non-Seg.	Metamyelocytes	Eosinophils	Basophils	Lymphocytes	Monocytes
Aug. 18	2.45	54								
" 25	2.15	45	18,200							
" 29	2.39	48	20,000							
Sept. 5	2.04	35	1,000							
" 6	1.50	26	500	50			2		18	30
" 7	3.36	64	1,620							
" 8	3.16	57	1,450	18		36			32	14
" 9	3.46	61	3,600	12		38	2		24	24
" 10	3.52	74	5,500	24	36	10			16	14
" 12	2.68	54	9,800	59	20		1		12	8
" 18	2.76	55	10,000	78					16	6
" 27	3.14	52	14,200	71			1		22	6
Oct. 12	2.66	38	15,000	79					12	9
" 25	3.65	68	8,100	70					24	6
Nov. 13	4.40	78	8,200	68					22	10
Dec. 19	5.24	94	10,000	61			2	1	32	4

plasma. 660,000 units penicillin intramuscularly by Aug. 22; sulphanilamide 2.5 g., and sulphathiazole administered in unknown quantity.

Aug. 18.—Mental condition disturbed; R.B.C. 2,450,000, Hb 54%. Severe mental confusion continued; psychiatric examination advised.

Aug. 25.—Admitted to this hospital (Mr. A. B. Watson). Still in similar state; completely disorientated, uncooperative and unable to understand questions; general condition poor; large sacral bed-sore. Wounds dressed under anaesthesia—clean. Unable to pass urine before going to theatre; 30 oz. of normal urine withdrawn by catheter. Hb 45% (record of blood counts in accompanying Table); 2½ pints blood given. Particulars of fluid balance summarized in Chart; the figures for the first 5 days are inaccurate, as he was incontinent, some specimens being lost.

Chart showing details of fluid balance in Case 1.

* Average of previous five-days period.

Aug. 28.—Taking fluids well. Still drowsy, irrational, and incontinent. Respirations deep and slow; dry skin, fishy odour, and uraemic tongue. No oedema. Urine: Sp. G. 1013, alkaline, no albumin, no sugar, sulphanilamide crystals present. Blood urea over 600 mg. per 100 c.cm. (value approximate only at this level; subsequent determinations on Chart). It was discovered at this point that since admission the bed-sore had been dusted daily with sulphanilamide, and that sodium citrate 30 gr. t.d.s. had been given without instruction; both discontinued.

Aug. 31.—Rational and continent. B.P. 140/70. A few small haemorrhages and one white plaque seen in retinae; arteries of fundi a little prominent.

Sept. 1.—Urine: albumin and a few red cells; urea concentration normal. Running slight pyrexia due to low-grade infection of left knee-joint; amputation stump healthy.

Sept. 5.—Further course of penicillin started (650,000 units). Agranulocytosis noted; van den Bergh negative. Pentnucleotide 10 c.cm. 3-hourly and blood 4 pints, followed by rapid improvement in blood picture. The leucopenia was undoubtedly due to sulphanilamide absorbed from the bed-sore, for the blood sulphanilamide on Sept. 9 was 4 mg. per 100 c.cm.

Sept. 20.—Ocular fundi normal; B.P. 140/90; slight oedema of left leg, which subsided within 2 weeks.

Oct. 4.—Van Slyke's urea-clearance test, 94 and 108% of normal function; urea concentration normal.

Oct. 10.—Re-amputation of right femur and removal of foreign bodies from left knee. Considerably shocked; 2 pints blood given. Blood urea after transfusion, 27 mg. per 100 c.cm. Recovery rapid. Nocturia persisted until mid-October, but urine normal from Sept. 27. Subsequent course of illness uneventful.

Nov. 11.—Simple water dilution test revealed inadequate dilution and imperfect elimination of fluid. (50 oz. fluid given at 8 a.m. Total fluid passed between 9 a.m. and noon, 24 oz.; lowest Sp. G., 1010. Normal should exceed 50 oz., with dilution to 1002 or less.)

Nov. 13 and Dec. 5.—Simple water concentration tests showed defect. (Fluids restricted to 1 pint for 24 hours. Total output in the two tests, 12 oz. and 21½ oz.; highest Sp. G., 1024 and 1025. Normal less than 30 oz. and more than 1027.)

Nov. 15.—Excretion pyelography normal.

Case II

Soldier aged 25. On Nov. 4, 1944, sustained dirty wound of right arm, with extensive muscle damage, disorganization of elbow, and division of ulnar vessels and ulnar and median nerves. Tourniquet applied until arm was amputated at fracture site 5 hours later. Pulse 92; blood pressure unobtainable before operation. A.T.S. and