Gritti–Stokes Amputation in Atherosclerosis: a Review of 237 Cases

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Operation

For the past 15 years we have used the Gritti–Stokes amputation extensively for threatened or established gangrene in atherosclerosis because the anatomy of the collateral circulation in limbs gangrenous from atherosclerosis makes primary healing usual. This is because the femoro-popliteal artery is nearly always obstructed, in which circumstance the distal part of the limb receives its blood supply through the collateral vessels which bypass this vessel. Collateral vessels normally pass in the intramuscular planes, but where there are no such planes they are forced into subcutaneous tissues (Fig. 1). So when the femoro-popliteal artery is blocked the collaterals are found in among the muscles where these surround the femur above or the tibia and fibula below; but in the region of the knee joint, where the bones are not so surrounded, they are forced into the subcutaneous tissues. Flaps fashioned from skin supplied by such enlarged collaterals can be expected to heal better than flaps not so nourished (Martin and Wickham, 1962). Mortality and morbidity have been low, and in addition a useful stump results. Others have advocated this operation (Jones, 1961; Middleton and Webster, 1962; Nayman, 1964; Lishman, 1965).

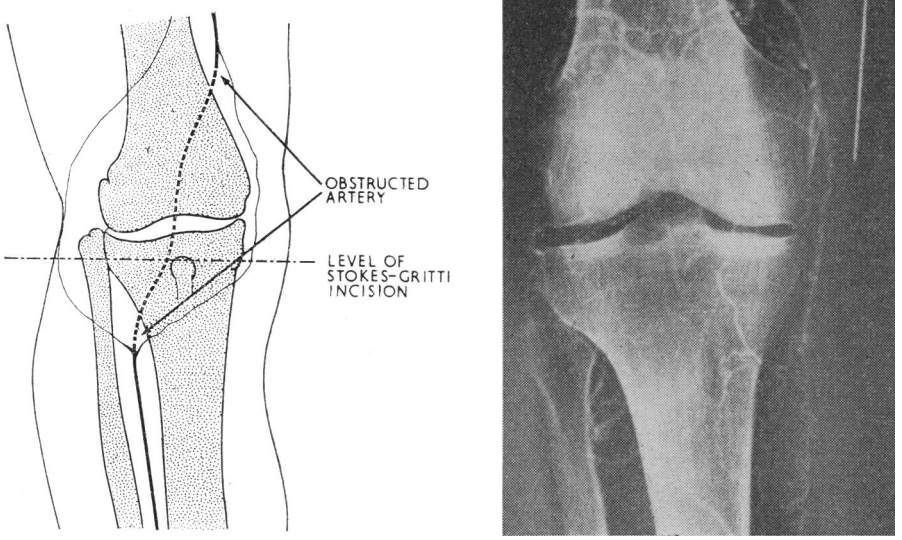

FIG. 1.

The U-shaped incision begins at the adductor tubercle, passes downwards, and then across the mid part of the tibial tubercle. It then ascends on the outer aspect of the lower end of the femur to a point corresponding to the adductor tubercle on the inner aspect. The incision goes down to bone. The two ends of this incision are joined behind the knee by an incision convex downwards, its lowest part about 1 in. (2.5 cm.) distal to its extremities. The knee joint is then acutely flexed and the lateral and cruciate ligaments of the joint are divided. The tibia dislocates forwards, the posterior capsule and the ligaments are divided, and then from in front the vessels and nerves in the popliteal fossa are also divided. The vein—but not the artery, which is already thrombosed—requires a ligature. The sciatic nerve may need a ligature. From the back the hamstring muscles are divided, and the amputation is completed.

The end of the femur is then sawn through at the level of the adductor tubercle. The articular surface of the patella is sawn off. With a bradawl, holes are bored through the lower end of the patella and the posterior lip of the femur so that the patella can be stitched with stout silk to keep it in place over the end of the femur, and to the popliteal ligament is sewn the hamstring tendons so that their extension function is preserved. The wound is sutured in one layer, and a suction-drain is inserted through one angle (Fig. 2).

The drain is removed, without disturbing the dressing, on the second day, and the dressings on the tenth day after operation. The patient is allowed up on the second day and to walk with crutches as soon as he can manage. Within two weeks he should be measured for his pylon. Little blood is lost, postoperative shock is slight, and for some reason phantom limb is not conspicuous.

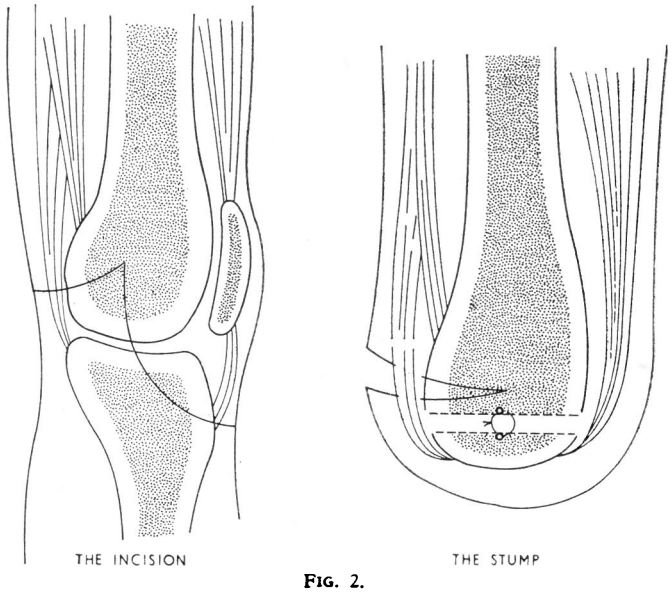

FIG. 2.

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Patients

Gritti-Stokes amputations have been done on 237 occasions between 1957 and 1966 at the Hammersmith and Chelmsford and Essex Hospitals. During this period 20 primary mid-thigh amputations and 21 below-knee amputations were performed for all varieties of vascular disease. Mid-thigh amputations were done when there was infection, sometimes by gas-forming organisms, and when non-infected gangrene of the limb extended to the level of the upper third of the tibia. Below-knee amputations were rarely done for arteriosclerotic gangrene. Bilateral amputations were done on 20 patients.

The average age of patients was 67 years, with a range from 41 to 89 years. Ten per cent. of the patients had had a previous cerebrovascular episode, and 87% had evidence of ischaemic heart disease. Forty-four (20%) suffered from diabetes. The ratio of male to female patients was 5 to 1.

Indications.—The operations were performed for gangrene, rest pain, or indolent ischaemic ulceration.

Results

There were 14 deaths in the first two weeks after amputation, a mortality rate of 5.9%. Primary healing occurred in 176 patients (78.8%). In 27 healing was delayed by minor skin sepsis but was eventually complete, giving a total healing rate of 91%.

In 17 patients (7.7%) sepsis or failure to heal led to a higher amputation, and we have one patient with an unhealed ulcer who will probably come to higher amputation. Two patients have wound sinuses with radiological evidence of osteomyelitis, but they use their prostheses without discomfort. One patient has a mobile patella, probably due to incomplete removal of the cartilage from the joint surface of this bone.

These results are summarized in the Table.

Results in 223 Amputations in which Patient Survived 14 Days or Longer

Complete healing	Primary healing	176	(78·8%)
	Delayed healing	27	(12·2%)
Incomplete healing	Stump sinus	2	(1·3%)
	Persistent ulcer	1	
	Failure needing re-amputation	17	(7·7%)

Subsequent Use of the Stump.—During the past 12 months we have fitted seven patients with an immediate prosthesis in association with the Limb Fitting Centre at Roehampton. All these patients were using their stumps for walking within 14 days of amputation. They will form part of a later communication from Roehampton.

Of the remaining 230 patients 123 (55%) were fitted with a prosthesis which they use. At least 29 (12.5%) were recorded as having returned to gainful employment.

Discussion

The operative mortality in this series was 5.9%, which is in close agreement with that reported by others of between 6 and 8% (Middleton and Webster, 1962 ; Lishman, 1965). This low mortality rate is probably due to the fact that the operation is easily and rapidly performed, that there is minimal loss of blood, and that there is no injury to muscle substance. The mortality for mid-thigh amputations is much higher, as Lishman (1965) showed, varying from 18 to 42% (Gilchrist, 1961 ; Ham *et al.*, 1964 ; Otteman and Stahlgren, 1965 ; Lishman, 1965).

The healing rate was 91%—78% by first intention. Others have reported primary healing rates for this operation varying between 76 and 90% (Middleton and Webster, 1962 ; Nayman, 1964 ; Lishman, 1965). The reported healing rates for mid-thigh amputation vary from 53 to 72% (Dale and Jacobs, 1962 ; Ham *et al.*, 1964).

Reamputation at a higher level was necessary in 7.7% of patients. This contrasts markedly with a reamputation rate of between 29 and 38% for below-knee amputations (Tolstedt and Bell, 1961 ; Dale and Jacobs, 1962 ; Lishman, 1965).

As regards disarticulation through the knee, we have been disappointed because primary healing failed to occur in the few of which we have had experience. This may be due to the fact that the skin incision traverses skin which does not enjoy the liberal blood supply found with a Gritti-Stokes incision. Furthermore, the only account of a series of disarticulations that we have seen recorded only 15 patients with primary healing out of 27 patients undergoing operation (Taylor, 1967). In addition, we have evidence that some of the successful cases would in fact have been better if part of the condyles of the femur had been removed to avoid pressure on the skin covering them. If the technique of disarticulation is going to be altered so that the condyles do in fact have to be removed to some extent, then this operation will approximate very closely to the Gritti-Stokes amputation here described. We await with interest reports of amputation by disarticulation.

It is also interesting to note that in the interim report from Roehampton of the results of immediate fitting of prostheses the only type of amputation which was successful in every case was the Gritti-Stokes, though certainly the numbers were small.

Thus the Gritti-Stokes amputation has a low mortality, a high healing rate, and a low reamputation rate. The stump, too, is a useful one.

Rehabilitation is facilitated by the availability of a light-weight articulated prosthesis. This is partially ischial and partially end-bearing, the latter factor ensuring proprioception. The knee joint can be arranged so that flexion is at the same level as that of the opposite side.

If bilateral amputation becomes necessary the Gritti-Stokes amputee can get about in the house on his knees or with rockers and can turn over in bed, which a bilateral mid-thigh amputee cannot do.

Summary

The results of 237 Gritti-Stokes amputations for atherosclerotic gangrene are presented. Primary healing occurred in 78.8%, with a total healing rate of 91%. A mortality of 5.9% and a reamputation rate of 7.7% compare more than favourably with similar series of below-knee or mid-thigh amputations. The immediate fitting of a prosthesis on the operating-table should promote earlier mobility and lower the mortality rate still further.

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