Middle Articles

Amputations in Developing Countries

M. SWANN,* M.B., B.S., F.R.C.S.; GEOFFREY F. WALKER,* M.B., B.S., F.R.C.S.

Brit. med. J., 1966, **1**, 1041-1043

Many limbs have been sacrificed each year in developing countries. In this paper we discuss techniques which have been found to be of value in an area where the problems of amputation are different from those in the United Kingdom.

Pathology and Indications

Malignant changes in chronic tropical ulcers in the lower limb are a common indication for amputation (Fig. 1). Unfortunately these carcinomas disseminate, and, though the regional nodes are usually enlarged from infection, sometimes they are found to contain metastases. In either case amputation rids the patient of an evil foul-smelling sore and produces a remarkable general improvement.

FIG. 1.—Proliferative carcinoma arising in a tropical ulcer.

The immediate effects of severe trauma to the legs, or more often the late results of major open injuries in patients who have to be transported long distances, may necessitate amputation. Open fractures are rarely handled with a sterile technique in areas where medical attention is not readily available, and, while the resultant infection seldom kills, it may leave a stiff, deformed, painful, or discharging limb. Many of these chronically infected open fractures respond well to good surgical care, but occasionally a patient will ask to be rid of his unacceptable limb.

In the upper limb trauma rarely produces sufficient damage to necessitate immediate amputation. However, inadequate or misguided primary treatment of relatively simple injuries sometimes results in gangrene, or infection of such severity that amputation is the only possible procedure. Many closed fractures and joint injuries are treated by local untrained "doctors," who, while producing excellent reductions, do not appreciate the dangers of swelling and necrosis within any type of tight splint, and some of these mistreated arms have to be sacrificed for this man-made gangrene (Fig. 2).

Among other conditions necessitating amputation are occasional cases of severe chronic osteomyelitis with gross skin and soft-tissue loss, or of severe septic arthritis, that defy all attempts at control. Limbs infected with maduromycosis occasionally have to be amputated in spite of the introduction of chemotherapy. However, only rarely is it necessary or wise to perform a major amputation in leprosy.

FIG. 2.—Native splint with gangrenous hand.

Site of Amputation

As in more advanced countries, both the level and the method of amputation depend on the underlying disease and availability of suitable prostheses.

In the lower limb it is possible to provide an adequate prosthesis only for an end-bearing stump. This in practice means amputating at one of three sites.

When damage or disease is limited to the foot, a Syme's amputation is excellent, and the teaching of Harris (1956) should be closely followed. It is unwise to modify the classical procedure unless this is absolutely unavoidable. If necessary a simple elephant boot is provided, but many patients do better bare-stumped (Fig. 3).

If the leg has to be removed above the ankle then amputation 2 in. (5 cm.) distal to the knee leaves a flexed stump with normal weight-bearing skin, for which a Long-John-Silver peg is excellent (Fig. 4). These kneeling-peg amputees master their relatively heavy and clumsy prostheses very quickly indeed, and there is no need to spend a great deal of time and effort in preventing knee-flexion contractures. The prosthesis should be sturdily made, preferably carved from one piece of wood, and must be covered with leather (Fig. 5). This is not an aesthetic requirement; without protection the wood quickly splinters. A piece of motor-car tyre provides a good end to the peg and may easily be replaced locally.

Above this level disarticulation of the knee or, if healthy skin is scarce, division of the femur through the condyles, produces an end-bearing stump which can quite easily cope with a peg-leg. It is wise to excise the patella, as there is no element of vascular insufficiency in these patients, and its presence is not required to fit a stump socket. There is no advantage from the Stokes-Gritti technique, as a narrow-ended stump

* Orthopaedic Unit, Kano, Northern Nigeria. Present address: Royal National Orthopaedic Hospital, London.

results and the patella does not always fuse to the cut surface of the femur.

It is difficult even in advanced countries to fit mid-thigh amputees with satisfactory prostheses. Our patients were more mobile and comfortable with either a pair of crutches or a sturdy pole.

In the upper limb it is wise to save as much length as possible, provided the stump is covered with healthy skin of normal sensibility. The only prostheses available for upper-limb amputees are a very simple leather socket and hook. Most patients appear to become one-handed very rapidly and hide their deficiency in the voluminous folds of long robes.

Technique of Amputation

Primary closure of amputation wounds is rarely wise and often hazardous in developing countries. If there is any sepsis in the limb attempts at primary suture invite catastrophe or even death. Delayed primary suture at two to three days, or occasionally secondary suture at seven to fourteen days, as described by Jack and Charnley (1943), will usually result in excellent healing, provided the patient's general condition is satisfactory and the haemoglobin is maintained above 30% (4.4 g./100 ml). Delayed closure is applicable to all amputation wounds, but when used with Syme's operation care must be exercised at the time of definitive closure to keep weight-bearing skin over the tibial stump by means of strapping (Harris, 1956), which may occasionally require reinforcement from a pin driven upwards through the heel flap into the cut surface of the tibia.

The technique of amputation is important, and if possible an exsanguinating tourniquet should be used. Incisions are made distal to the elective site of bone section, so that the wound may be closed without tension. The incisions are also planned so that healthy weight-bearing skin will cover the weight-bearing bone surface with the scar well clear of this area.

Skin flaps incorporating deep fascia are raised, and the muscles and tendons are divided at the same level as the skin incision. The bone is divided at a right-angle to the axis of the limb. Main nerves are pulled down into the wound, divided, and then allowed to retract. Main vessels are ligated and the tourniquet is removed. After careful haemostasis the wounded is dusted with penicillin and a sulphonamide powder. The muscle and skin flaps are approximated without tension over a large gauze pack at least 1 in. (2.5 cm.) in diameter by means of three sutures which bite deeply into the muscles

and skin. The ends of the pack are left protruding to permit drainage, and this loose closure will also prevent the flaps retracting (Fig. 6).

FIG. 5.—Long-John-Silver peg.

Definitive closure is performed after two or three days unless there is persistent active infection in the stump, when it is delayed for seven or more. The gauze pack is removed by dividing the retaining sutures and the wound cleaned with hydrogen peroxide. If, as is usual, clean granulations have appeared, the stump is closed in layers over a simple rubber drain, which is removed after 24 hours. If infection is still present a fresh pack is inserted and the wound is again loosely sutured, further inspection being made at seven days.

FIG. 3.—Syme's stump and simple prosthesis.

FIG. 4.—Kneeling stump.

FIG. 6.—Amputation flaps sewn loosely over a large pack.

Amputations in leprosy present a problem, because the skin does not have normal sensibility. Sacrifice of the limb must therefore be considered only when there is no possibility whatever of leaving it *in situ*. D. S. McKenzie (personal communication, 1964), working at the Limb Fitting Centre, Roehampton, has had some success with total-contact sockets for anaesthetic stumps in spina bifida, and, if available, this type of prosthesis might be suitable for lepers, particularly for above-knee amputees. Its value is enhanced by a large bulky stump which is produced by the use of myoplastic flaps.

The guillotine operation is mentioned only to be condemned. It produces very poor scars and stumps, and further amputation is often required (Gillis, 1954).

Summary and Conclusions

Techniques of proved value for amputations in developing countries are described.

In the lower limb the sites of election are Syme's, below-knee (kneeling-peg), and through the knee, either disarticulation or transcondylar.

In the upper limb as much length as possible should be saved, provided the stump is covered with healthy skin.

Closure of amputation wounds should be either by delayed primary or secondary suture. Immediate closure is often dangerous.

There are virtually no indications for guillotine amputations.

A Long-John-Silver peg-leg prosthesis if sturdily constructed is of great value.

We are grateful to Mr. A. F. Bryson for advice and to Mr. H. Jackson Burrows for reading the manuscript.

REFERENCES

- Gillis, L. (1954). *Amputations*, p. 19. Heinemann, London.
Harris, R. I. (1956). *J. Bone Jt Surg.*, 38B, 614.
Jack, E. A., and Charnley, J. (1943). *Brit. med. J.*, 2, 131.

CONFERENCES AND MEETINGS

Recent Research on Burkitt's Tumour : Conference at Kampala, Uganda

[FROM A SPECIAL CORRESPONDENT]

A conference on research into Burkitt's tumour was held at Kampala, Uganda, on 7 January 1966. The conference was sponsored by the Chemotherapy Panel of the International Union Against Cancer. The co-chairmen were Dr. J. H. BURCHENAL (New York) and Mr. DENIS P. BURKITT (Kampala). Delegates attended from Uganda, Kenya, Nigeria, the United States of America, France, Western Germany, Switzerland, Sweden, Australia, and Great Britain. The first session was devoted to a review of the natural history of the disease, and the second to the epidemiology and speculations on the possible aetiology of the disease in relation to its treatment. Chemotherapy was dealt with on the second day; on the third day the question of possible host defences was discussed, and the conference ended with a panel discussion.

Unique Histological Appearances

Dr. D. H. WRIGHT (Kampala) emphasized the distinctive morphological characteristics of Burkitt's lymphoma as seen in histological and more particularly in cytological preparations of the tumour. Some still doubted the specific character of this tumour, but he had now studied over 500 cases in Uganda and elsewhere and was impressed by the highly uniform morphological characteristics, which he considered diagnostic. Cytological preparations were made by fixing air-dried tumour imprints in methanol, and staining with May-Grünwald-Giemsa. Burkitt tumour cells also differed from the cells of other forms of lymphosarcoma in their easy growth in short-term tissue culture. Apart from the characteristic cytology the distribution of lesions also differed from that found

in other malignant lymphomata, and leukaemic transformation was extremely rare. Professor R. J. V. PULVERTAFT (Ibadan) described the distinctive growth characteristics of Burkitt tumour cells in short-term cultures, which differed greatly from those of many hundreds of malignant lymphomata he had studied in London.

Geographical Distribution

Professor M. S. R. HUTT (Kampala) pointed out that the Burkitt lymphoma was the commonest tumour of childhood in Uganda, comprising 50% of all malignant conditions in endemic areas. In areas where Burkitt lymphoma was especially common the other forms of lymphoma were not necessarily less prevalent. Burkitt lymphoma was therefore an addition to the other forms of lymphoma and did not replace them. The distribution of the common forms of lymphoma in Uganda was simply related to the density of the population, but Burkitt lymphoma had a distinctive distribution in Uganda. Mr. BURKITT said that the disease, though commonest in Africa, had also been described in New Guinea, England, the United States of America, and South Africa. It was, however, common only in the trans-equatorial belt of Africa with a prolongation southwards along the east coast. It appeared to be common in the moist warm lowland areas of New Guinea, but rare in the dry mountainous districts. There was some evidence that it was also common in parts of Brazil. A detailed survey in Uganda showed that in lowland areas along the Nile the tumour was 20 times as common as in the mountainous regions. In the mountains the average age of onset was 16.2 years, whereas in endemic

areas it was 8.1 years. The tumour was extremely rare below the age of 2.

Site of Tumour

At the age of 3 all the cases presented with jaw tumours. From 9 to 14 years girls commonly presented with massive bilateral ovarian tumours, and 75% of all girls coming to necropsy were found to have ovarian tumours. After the age of 15 years jaw presentations were rare. The tumour was not uncommon in immigrants to Uganda who had come from the mountainous districts of Rwanda and Burundi, where the disease was almost unknown.

Possible Virus Aetiology

Dr. M. C. WILLIAMS (Entebbe) discussed the hypothesis that the tumour might be virus-induced, and that its prevalence in endemic areas could be accounted for by transmission by an insect vector. The hypothesis had arisen from the similarity of the distribution of Burkitt lymphoma with that of the distribution of yellow-fever antibodies in Africa.

Dr. A. J. HADDOW, formerly director of the Virus Research Institute at Entebbe, had reasoned that if the hypothesis of a virus aetiology was correct the distribution would indicate a very high rate of infection early in life. The great majority of persons infected would develop immunity, and only a small minority would develop malignant tumours. The rarity of the disease above the age of 15 years in endemic areas except in presumably non-immune immigrants would fit in with the hypothesis. The cumulative age incidence of Burkitt lymphoma in Uganda paralleled the changes in yellow-