duration of their legs. We see rising numbers of amputations because of vessel disease or tumours. Many vascular surgeons try to maintain life and extremities by plastic surgery of the vessels, but if grafting fails the legs are amputated. However, we have to learn that these are not hopeless cases but that these patients can achieve function, mobility and independence by means of the best surgical treatment and modern immediate fitting of prostheses. Also in these cases the myoplastic stump-building procedure leads to better stump conditions than the simple flap-cutting technique.

I hope I have succeeded in showing you that stump correction by muscle plastic procedure is a method of operation by which physiological stump conditions will be produced. By this term we mean the tight closing of medullary cavity, and the establishing of functionally efficient muscle connections between antagonistic muscle groups, especially the tight connection of the adductors with the vastus lateralis and the ileo-tibial tract. By this method an active performance of the muscles is obtained, together with an actively increased circulation. The venous reflux from out of the distal muscle areas is secured and the ends of the vessels and nerves are transposed to such parts of the stump where they are protected against the influence of mechanical pressure and are placed within functionally efficient musculature. These stumps are free from pain, well supplied with arterial blood, and possess sufficient muscular power. The most efficient function of these stumps is achieved with the addition of the complete contact prosthesis. Immediate fitting has been an ingenious supplement in our perpetual striving for the development of the unit stump-prosthesis and its perfection.

The stump is the motor in the unit stump and prosthesis. It must be strong and painless so that it is able to move the modern as well as the old prosthesis. The best prosthesis for stumps so fashioned are the modern contact limbs which allow a tight attachment between stump and prosthesis. The pressure per square inch of the stump surface is minimized by the contact prosthesis. Immediate fitting has been an ingenious supplement to this chain of progress towards rehabilitation of the amputee.

" The small young girl called myoplastic remained ' Miss Fit ' for a long time, but now she has found a distinguished British-dressed partner named ' The immediate fitting '. The couple found complete contact, and we hope that they will now fit in an honourable place in the society of higher surgery."

IV. HINDQUARTER AND HIP AMPUTATION

by

G. Westbury

HINDQUARTER AND HIP amputations are performed almost exclusively for malignant disease. Very occasionally these major procedures are indicated for congenital malformations or chronic infections about the hip.

HINDQUARTER AMPUTATION

Hindquarter amputation was first carried out by Billroth (1891) for a soft tissue sarcoma; his patient died. The first recorded case with survival was that of Girard (1895). The operation was developed in this country principally by Sir Gordon Gordon-Taylor and the technique outlined below is based on his description (Gordon-Taylor and Monro, 1952).

Technique

Hypotensive anaesthesia and the use of diathermy to cut the muscles have contributed greatly to the speed and accuracy, and hence the safety of surgery. The measured operative blood loss may be as little as one pint. The bladder is emptied by a Foley's catheter which is left in place. The patient is positioned on his back with a long, narrow sandbag under the shoulder and buttock of the affected side. This gives good access to the major, anterior, extraperitoneal part of the dissection, and an assistant holding the leg can roll the patient towards the lateral position for the short time needed to cut the posterior flap and muscles.

Figure 1 shows the outline of the skinflaps (and the alternative lines of posterior bone section). An incision is made above and parallel to the inguinal ligament and deepened through the muscles. The peritoneum of the iliac fossa is stripped medially and the operability of the lesion confirmed. The deep epigastric vessels are divided and the rectus abdominis muscle cut across just above the pubis. We prefer to divide the symphysis at this stage, using a solid scalpel, perhaps helped by a few blows with the osteotome. The vertical ridge on the posterior aspect of the symphysis, known as Monro's tubercle, is an invaluable guide to the plane of the articular cartilage. After dividing the subpubic ligament, with due care of the underlying membranous urethra, the symphysis snaps open. A gauze pack controls any venous oozing from this region while attention is now turned to the crucial phase of the operation, division of the vascular pedicle of the limb. The peritoneum and ureter are swept medially to expose the iliac bifurcation (Fig. 2*a*). The common iliac artery is divided between ligatures. The next step is the division, with the diathermy point, of the psoas. The nerves, not shown, are cut cleanly with the knife. The ends of the psoas retract revealing the ilio-lumbar tributaries of the common iliac vein (Fig. 2*b*). These branches, between one and four in number, tether the main vein, and must be divided carefully between ligatures, to permit the safe mobilization of the major structure. If this preliminary step is omitted, the ilio-lumbar veins will tear out as the common iliac is lifted forward, with the possibility of disastrous haemorrhage. The divided vascular pedicle is gently pushed downwards to expose the under-surface of the sacro-sciatic notch.

The posterior flap is rapidly developed, preserving a variable portion of the gluteus maximus according to the site of the lesion. Both sides of

the greater sciatic notch are now exposed and a large artery forceps is passed underneath this to grasp the end of a Gigli saw. The site of posterior pelvic section depends on the location and nature of the pathology. Division of the posterior part of the ilium is easy and bloodless; the projecting remnant can be trimmed when the specimen is off. Where necessary, section can be made through the ala of the sacrum; I have done this on two occasions, in preference to sacro-iliac disarticulation practised by some surgeons (see Fig. 1).

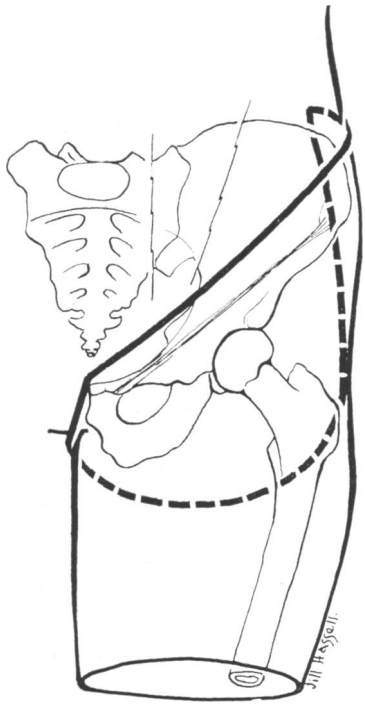


Fig. 1. Incision for hindquarter amputation. Alternative sites of posterior pelvic section are indicated by the jagged lines.

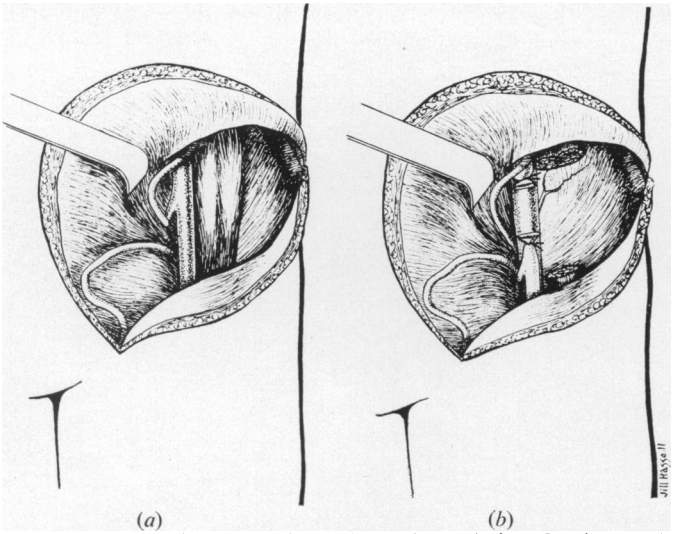
The hindquarter is now pulled away from the trunk and the remaining soft structures divided; visceral branches of the internal iliac vessels, levator ani, sacro-tuberous and sacro-spinous ligaments, pyriformis, etc.

Bleeding from the veins of the prostatic plexus and the cavernous tissue may be troublesome and is best controlled by catgut stitches. The wound is closed with skin sutures only and suction drainage applied for five or six days. The bladder catheter is removed on the fifth postoperative morning.

Indications

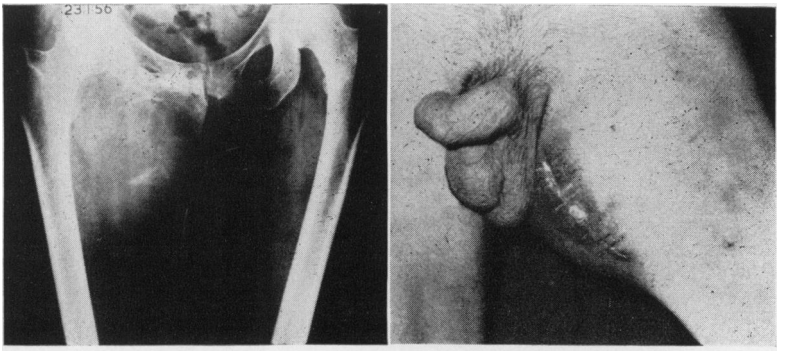
The conditions for which we have performed hindquarter amputations are:

1. Primary malignant bone tumours of the pelvis or proximal femur.



(*a*) (*b*)

Fig. 2. (*a*) Exposure of common iliac bifurcation. (After Gordon-Taylor and Monro.) (*b*) Common iliac artery and psoas divided; ilio-lumbar vein exposed. (After Gordon-Taylor and Monro.)



(*a*) (*b*)

Fig. 3. (*a*) Osteogenic sarcoma of right ischium arising in a previously irradiated osteoclastoma. (*b*) Fibrosarcoma of adductor region of left thigh.

2. Soft tissue sarcoma of the pelvis or proximal thigh.
3. Locally advanced malignant melanoma, especially with fixed groin nodes.

Where the mass of the tumour makes life intolerable this major mutilation is of palliative value even in the presence of known metastases.

I have omitted from the list other rare indications which we have not met, but which have been described: massive congenital malformations or benign tumours; chronic inflammatory disease around the hip; " extended hemipelvectomy " in continuity with adherent pelvic visceral cancer (Brunschwig, 1962); " solitary " metastasis in the innominate bone. A few cases of traumatic hindquarter amputation are on record (McLean, 1962).

Figures 3 (*a*) and 3 (*b*) illustrate respectively examples of a primary bone tumour and of a soft tissue sarcoma requiring hindquarter amputation.

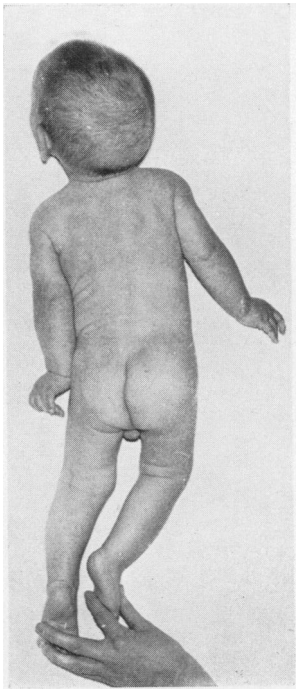


Fig. 4. Fibrosarcoma of right gluteal region in a six-month-old infant.

Figure 4 is the youngest patient in this series, an infant aged six months with a fibrosarcoma of the buttock; the oldest patient was a 70-year-old woman.

In two patients hindquarter amputation was undertaken as an emergency for secondary haemorrhage from an ulcerating tumour mass eroding the femoral vessels. The first, a 64-year-old woman with inguinal metastases from a malignant melanoma remains well more than eight years following operation. The second, a young man with a fungating fibrosarcoma in Hunter's triangle, died six months later from widespread secondary deposits, but free from local recurrence.

Figure 5 shows the appearances of a patient after hindquarter amputation, and wearing his tilting table prosthesis.

HIP AMPUTATION

The posterior flap incision of Fitzmaurice Kelly gives an ideal stump (Fig. 6). The alternative racquet with an anterior handle is less satisfactory, but consideration of the site of disease and position of radiation fields may call for modifications in design of flaps in this as in any other amputation for malignant disease.

Once again hypotensive anaesthesia and diathermy serve to simplify the operation. The patient's position is similar to that for the hindquarter

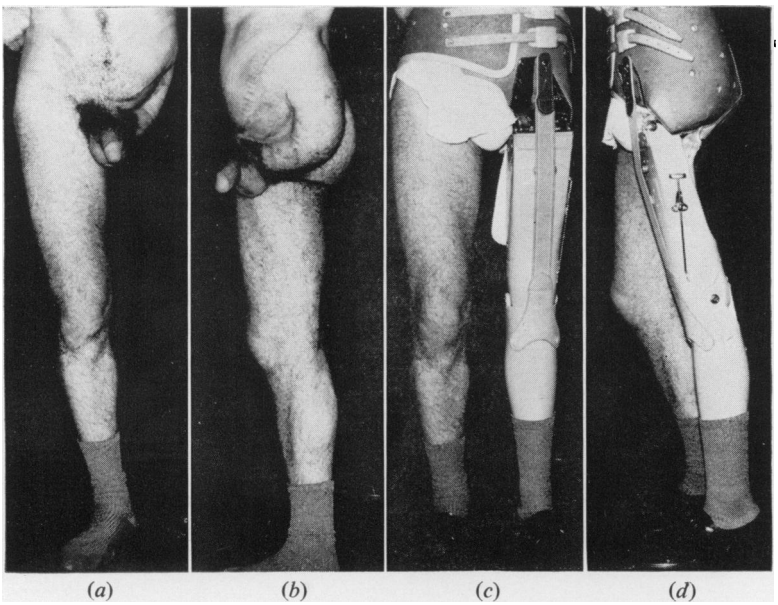
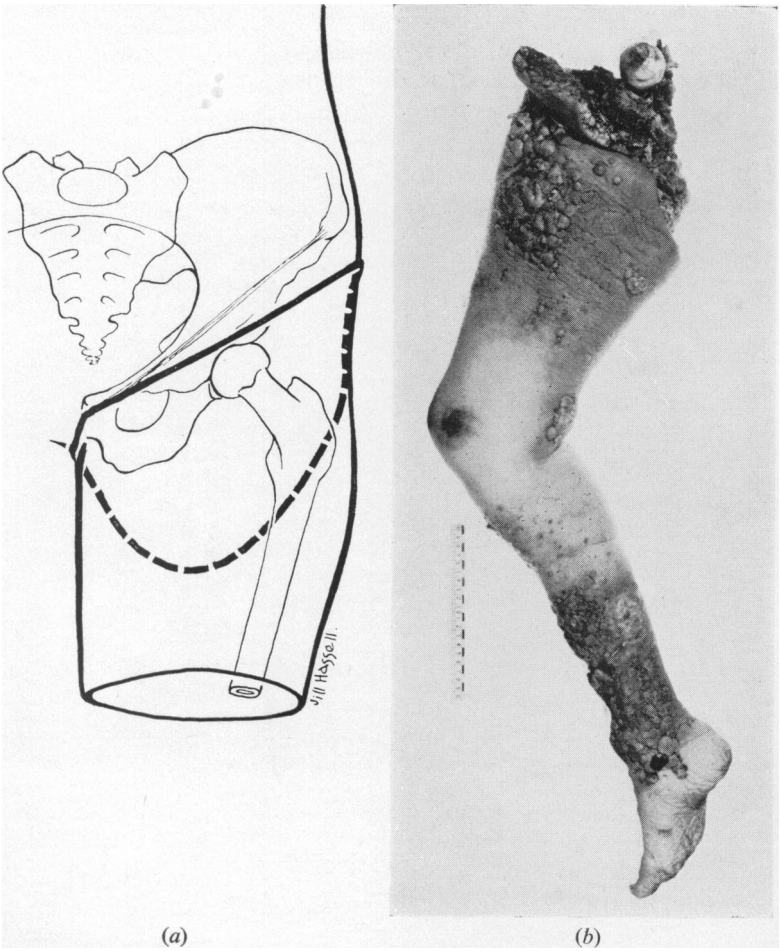


Fig. 5. (*a*) Hindquarter amputee: front view. (*b*) Hindquarter amputee: side view. (*c*) Hindquarter amputee with prosthesis: front view. (*d*) Hindquarter amputee with prosthesis: side view.

amputation and the greater part of the procedure is carried out from the front.

The femoral vessels are divided immediately below Poupart's ligament. Then the anterior, lateral and medial muscle groups are cut, the latter flush with the bone. The capsule of the hip joint is incised sufficiently to allow the head of the femur to slip out of the acetabulum as the assistant externally rotates the limb. Division of the ligamentum teres frees the head and the posterior part of the capsule now divided. The sciatic nerve is divided from in front with a knife (as are the femoral and obturator nerves a little earlier). The accompanying artery is carefully clipped

and ligated, avoiding damage to the nerve. The hamstrings are cut close to their origins and the posterior flap fashioned retaining as much of the gluteus maximus as the location of the tumour permits. The skin is sutured and suction drainage applied for five days.



(*a*) (*b*)

Fig. 6. (*a*) Incision for hip disarticulation. (*b*) Specimen of palliative hip disarticulation for malignant melanoma.

The indications for hip disarticulation are similar to those described for hemipelvectomy, provided that the disease process is situated sufficiently distally in the thigh. It must be stressed, for example, that nothing less than disarticulation will suffice for primary malignant tumours of the femur, even of the lower end. Mid-thigh amputation in such cases may well be followed by local recurrence in the stump, a risk clearly demon-

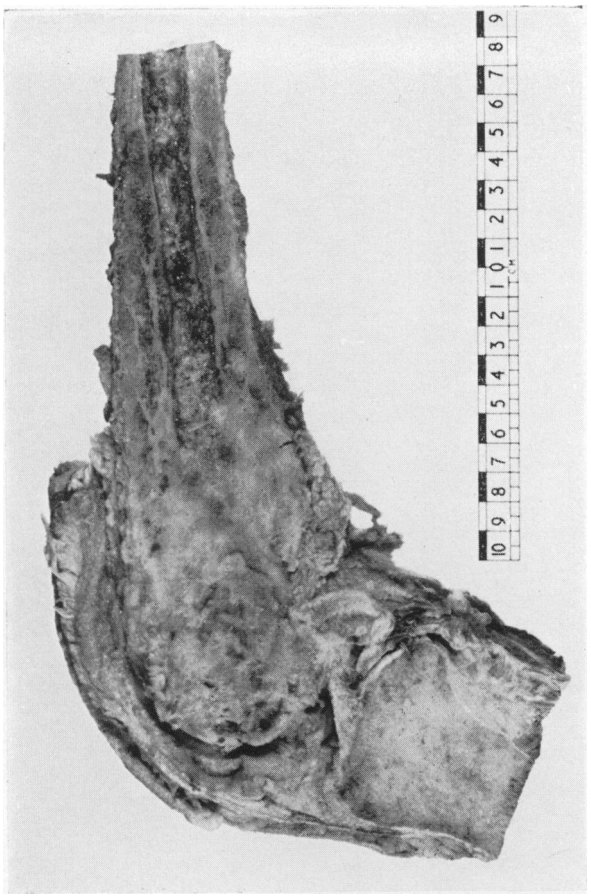
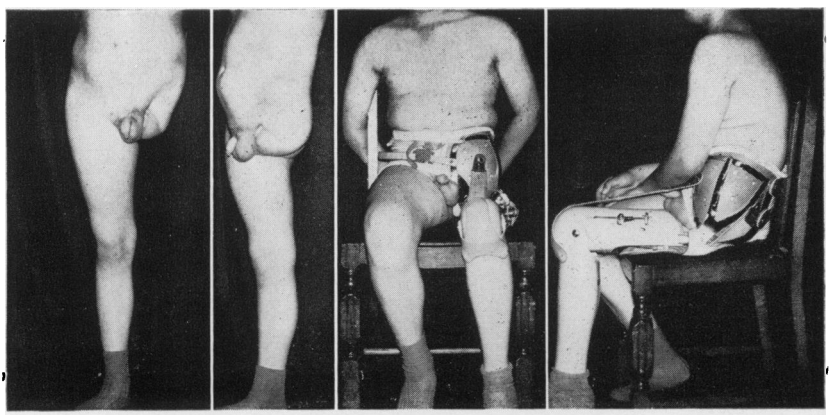


Fig. 7. Primary fibrosarcoma of lower end of femur treated by hip disarticulation. Note that tumour extends proximally within the medullary cavity to the point where the pathologist has cut the bone. Surgical amputation at that level would have been followed by stump recurrence.



(*a*) (*b*) (*c*) (*d*)

Fig. 8. (*a*) Hip amputee: front view. (*b*) Hip amputee: side view. (*c*) Hip amputee sitting with prosthesis: front view. (*d*) Hip amputee sitting with prosthesis: side view.

strated by study of Figure 7. Figure 6 (*b*) illustrates a limb removed at the hip joint for palliation of confluent deposits of otherwise uncontrollable malignant melanoma; in continuity iliac node dissection may be added in suitable cases by raising the anterior skin flap above the inguinal ligament and splitting the oblique and transverse muscles.

Figure 8 shows a patient after hip amputation and sitting down wearing a Canadian type prosthesis.

Results (Table I)

A total of 100 cases of hindquarter amputation and hip disarticulation are available for study from 1952 to date from the records of Westminster Hospital Radiotherapy Department. Seventy-two operations were performed at Westminster Hospital; the remaining 28 by referring surgeons. There were 27 hindquarter and 73 hip amputations, with one operative death attributed to " shock " following hip disarticulation at another hospital.

TABLE I

HINDQUARTER AND HIP AMPUTATION, 1952–1966

Hindquarter 27	Bone	9	Hip 73	Bone	56
	Soft tissue ..	14		Soft tissue ..	16
	Melanoma ..	4		Melanoma ..	1

Total 100 *cases*

Operative deaths	1
Alive at 5 years	27/68
Alive at 10 years	11/30

The numbers of cases in the individual pathological groups are small, but the combined survival figures are worthy of note. Of 68 patients available for follow-up at five years, 27 are alive and well; at 10 years 11 out of 30 are alive and well. A recent account of the end-results of a large series of hindquarter amputations has been given by Pack and Miller (1964).

CONCLUSIONS

The indications for and techniques of these major ablations are now well established. The operative mortality is negligible and both the palliative and curative value impressive. The combination of modern limb-fitting technique and human courage can return such patients to the community as active and happy individuals.

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