Prosthetics and Orthotics International, 1983, 7, 116–118

Failures in through-knee amputation

R. BAUMGARTNER

Balgrist Orthopaedic Hospital, University of Zurich

Abstract

Long-term results over a period of more than 10 years give evidence of the superiority of the through-knee compared to the above-knee stump. However, failures in through-knee stumps before, during and after operation and pitfalls in prosthetic fitting are still too frequent. They are mostly due to errors because the peculiarities of the stump and the prosthetic management are not recognised. This paper emphasizes frequent causes of failure in the selection of the level of amputation, the operative technique, post-operative treatment and prosthetic rehabilitation in order to reduce the complication rate.

Introduction

In comparing knee disarticulation versus above-knee amputation in detail, the author tried to encourage surgeons and prosthetists to give priority to through-knee (TK) and not to above-knee (AK) amputation whenever possible (Baumgartner, 1979). The message was understood by many colleagues who, in turn, are recommending the procedure (Vaucher and Blanc, 1982; Stirnemann and Althaus, 1983). Other colleagues gave up this procedure because they had too many complications and failures and therefore again give preference to AK amputation with less wound healing problems regardless of the further results of overall rehabilitation. In fact, complications in TK amputations are still too frequent and are reported to be as high as 25% (Stirnemann and Althaus, 1983). The purpose of this paper is to analyse these pitfalls in order to reduce the complication rate and to improve the possibilities of rehabilitation.

All correspondence to be addressed to Prof. R. Baumgartner, Balgrist Orthopaedic Hospital, Forchstr. 340, CH-8008, Zurich, Switzerland.

1 Level of amputation

It is understood that even a short below-knee (BK) stump is better than any method of TK amputation as long as the BK stump is free from pain, permits a total surface contact with the prosthetic socket and the function of the knee joint is not impaired by trauma or by severe osteoarthritis. As in any level of amputation, the feasibility of a TK amputation mainly depends upon the quality of the tissues which in turn is given by a sufficient blood supply. A loss of sensation or a femoral fracture are no contraindications.

The assessment of a sufficient tissue blood flow therefore represents the main problem. Despite the many laboratory tests to investigate local blood circulation, anamnestic and clinical findings before and particularly during surgery are still of primary importance. As for the main arteries, an obliteration of the popliteal artery might still permit a short BK stump to be obtained. Also, the obliteration of the superficial femoral artery does not represent a contraindication for a TK level as long as it was not due to a sudden occlusion by embolism or trauma. An occlusion of the iliac artery, however, requires an AK amputation at the level of, at least, the middle third of the femur.

The observation of local blood circulation is most important in the assessment of tissue viability. In some cases, primary wound healing may still be obtained without a single artery having to be clamped. Attention must be given not only to the arteries, but also to the veins. Venous thromboses are bad signs and justify a higher level of amputation.

The skin must cover the entire surface of the stump without the slightest tension. The skin flaps must be large enough in order to compensate for the remarkable skin retraction during the operation.

Severe contractures of the hip joint which persist under anaesthesia also suggest an AK rather than a TK level.

2 Operative technique

The patient lies in the supine position with the pelvis slightly elevated by a cushion. The hip and knee joints are allowed free motion to permit easy access to the posterior part of the femur.

In order to obtain primary wound healing especially in vascular patients, the surgeon must minimize tissue damage by using atraumatic techniques and by reducing to a minimum the amount of suture material in the wound. In vascular patients, the tourniquet should not be used. With this philosophy in mind, every deep suture and ligature are avoided and arterial grafts are also removed by making first an incision at the inguinal ligament to disconnect the graft and to pull it downwards. The edges of the femur must be carefully rounded with a rongeur or the file. In transcondylar amputations, the patella has to be removed through the same incision.

Wound drainage is of utmost importance. There is no space for a haematoma which will damage the soft tissues and may lead to necrosis and infection. Whatever type of drainage is used, it has to be safe for 48–72 hours.

3 Postoperative management

In the postoperative management of the stump, again every effort must be made to obtain primary wound healing. Whether a soft, semi-rigid or rigid dressing is applied, its purpose is to reduce the postoperative oedema, to protect the stump from infection and to prevent pressure sores.

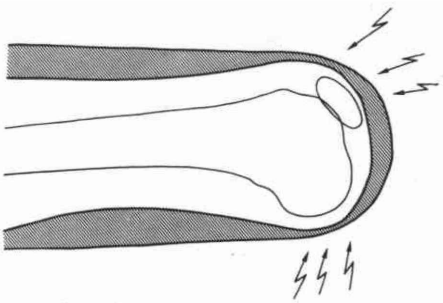

Fig. 1. Pressure sensitive areas of the through-knee stump.

The peculiar anatomy of the TK stump needs special precautions in wound dressing. The dorsal sides of the condyles and the patella are extremely sensitive to external pressure (Fig. 1). In the neutral position, the stump always goes into slight external rotation. This means that even with a patient lying in bed, the lateral condyle is at the lowest level and therefore particularly in danger. It must be relieved by a thick pad applied dorsally in the supracondylar area. The situation is very much the same as in the heel and the Achilles tendon. The dorsal part of the condyles is particularly sensitive to pressure sores if the operative scar is placed transversely and not sagitally (Fig. 2). If there is still evidence of skin necrosis, stitches should be removed immediately. If underlying bone becomes visible through the wound, surgical stump revision should not be postponed.

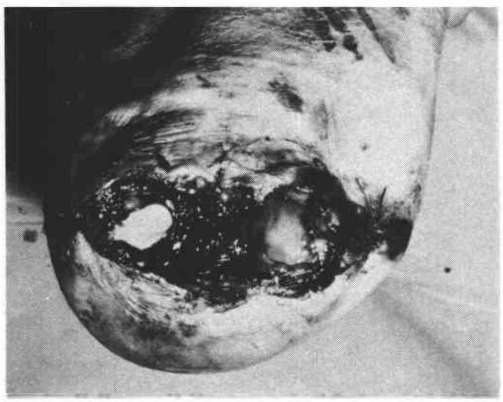

Fig. 2. Breakdown of an incision placed in transverse direction.

4 Prosthetic management and rehabilitation

Every TK stump is very sensitive to external pressure in the first weeks. Stump bandaging directly on the skin is unable to provide uniform external pressure and might cause pressure sores (Fig. 1). The patella and the condyles need careful padding before any type of dressing is applied. Total end-bearing can only be obtained gradually within the first 4–6 weeks after surgery. To avoid pressure sores, the best results are obtained by starting gait training with the inflatable plastic bag prosthesis. It permits partial weight-bearing and applies homogenous

external pressure and accelerates stump shrinking. Only 3–6 weeks after surgery, the final prosthesis is prescribed (Botta and Baumgartner, 1983). In order to permit easy adaptation of the socket and of the alignment, this prosthesis is not completed for 1–2 months. After 6–12 months, the socket often has to be replaced completely.

As with every amputation stump, the TK stump undergoes significant shrinkage within the first weeks and months. Since the limits between too little and too much pressure are very small in the condylar area, the prosthesis requires frequent adaptations of the soft socket. Even in the area of the condyles the stump will finally shrink in diameter by 10–15 mm within the first 6–12 months. (Fig. 3). This will permit a prosthetic fitting with little or no extra width and length, but requires a particularly well adapted socket in all the three dimensions. At any time, the entire distal surface of the femur must be involved in end-bearing. On the other hand, the patella needs to be completely relieved of external pressure. The patients appreciate being able to move the patella a few millimetres up and down while wearing their prosthesis.

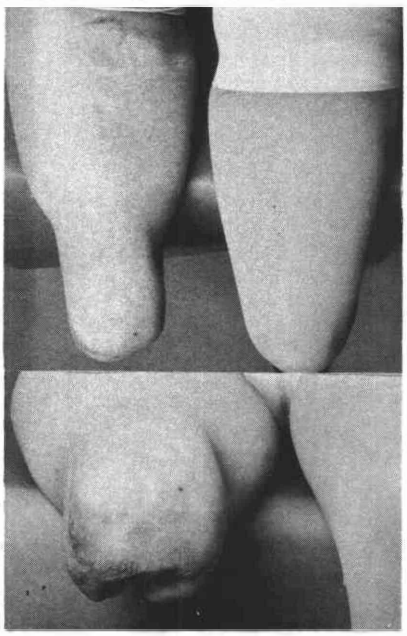

Fig. 3. Shrinking of the mature stump permits prosthetic fitting with little or no extra width and length.

The thigh part of the socket must not be circular, but oval according to the anatomical shape of the thigh even if the outer socket is made from flexible material. If it is too hard, discomfort and pressure sores might occur at the prosthetic rim.

With this enumeration of frequent errors in TK amputation and prosthetics, it is hoped that the number of complications will be reduced. As in every amputation level, however, it will not be possible to eliminate them completely.

REFERENCES AND BIBLIOGRAPHY

BAUMGARTNER R. (1973). Beinamputation und Prothesenversorgung bei arteriellen Durchblutungsstörungen. Enke, Stuttgart, 56–64.

BAUMGARTNER, R. (1979). Knee disarticulation versus above-knee amputation. *Prosthet. Orthot. Int.* **3,** 15–19.

BOTTA, P. (1981). Langzeitergebnisse mit der Prothesenversorgung von Knie-exartikulationen. *Orthop. Tech.* **32,** 20–23.

BOTTA, P., BAUMGARTNER, R. (1983). Socket design and manufacturing technique for through-knee stumps. *Prosthet. Orthot. Int.* **7,** 100–103.

NEFF, G. (1981). Die Amputation in Kniegelenk-chirurgische und prothetische Gesichtspunkte. *Orthop. Tech.* **32,** 24–29.

STEEN-JENSEN, J., MANDRUP-POULSEN, T., KRASNIK M. (1982). Wound healing complications following major amputations of the lower limb. *Prosthet. Orthot. Int.* **6,** 105–107.

STIRNEMANN P., ALTHAUS, U. (1983). Die transgenikuläre Amputation: eine Alternative zur Oberschenkelamputation? *Chirurg,* **54,** 170–174.

VAUCHER J., BLANC Y. (1982). La désarticulation du genou: technique opératoire—appareillage. *Rev. Chir. Orthop.* **68,** 395–406.