

Wound healing complications following major amputations of the lower limb

J. STEEN JENSEN, T. MANDRUP-POULSEN and M. KRASNIK

Departments of Orthopaedic Surgery T-2 and T-3, Gentofte Hospital, Copenhagen.

Abstract

A series of 320 amputations was analyzed with regard to wound healing complications and re-amputation rates.

Among 111 AK amputations complications in wound healing were encountered in 14 per cent (15/111) of the cases, leading to re-amputation in 2 per cent (2/111).

TK amputations were followed by wound healing problems in 30 per cent (20/66) of the cases with re-amputation in 20 per cent (13/66) at AK level, as compared to 40 per cent (57/143) with wound healing complications and 20 per cent (28/143) re-amputations in BK-amputees.

As failure of BK amputation leads to re-amputation at AK level it is recommended that the TK level be selected in doubtful cases.

Introduction

Most amputation series reviewed in the literature consider above-knee and below-knee amputations. The re-amputation rate following below-knee amputations has been reported as 12-46 per cent (Baur et al. 1978; Chilvers et al. 1971; Christensen, 1976; Hierton & James, 1973; Lindholm, 1964; Robinson, 1976; Sarmiento et al. 1970; Warren & Kihn, 1968).

In this clinic major amputations of the lower limb are performed at the most distal level according to pre-operative measurements of the skin perfusion blood pressure (Holstein & Lassen 1973; Holstein et al. 1979 a, b, Holstein, 1980). The present study describes the results with respect to the re-amputation rates.

Patients and methods

A thorough description of the series has been given in a previous report (Mandrup-Poulsen and Jensen, 1982). Amputations of 320 limbs were performed because of gangrene on 310 patients with a mean age of 70 years (range 40-94). In 208 limbs (65 per cent) chronic arteriosclerosis was the cause of amputation, whereas acute arterial thrombosis accounted for 32 cases (10 per cent) and vascular disease combined with diabetes mellitus for the remaining 80 cases (25 per cent).

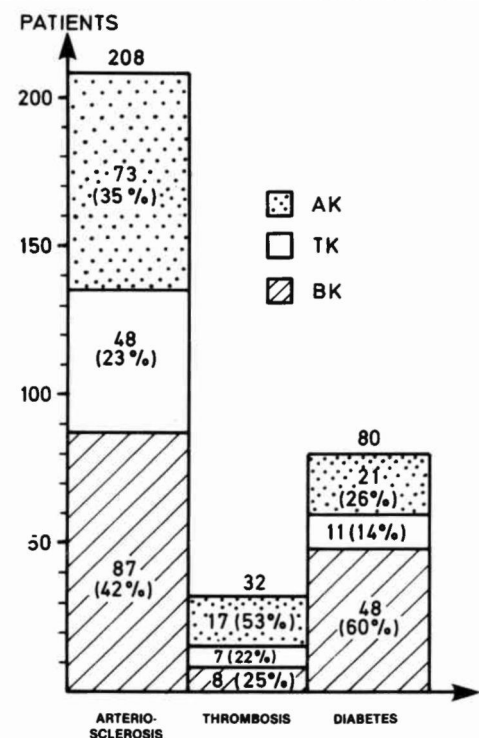
The level of amputation was grossly determined by measurement of the skin perfusion blood pressure. The pressure was recorded at ankle level and 10 cm above and below the knee joint. The sufficient blood pressure was considered to be at least 30-40 mm Hg, although a few amputations were performed at pressure levels of 20-30 mm Hg in order to gain length of the limb in patients with an ischaemic contralateral limb.

In the retrospective study the patient files were examined, recording the primary level of amputation, the number of wound healing complications and the final level of amputation.

Results

Above-knee (AK) amputations were primarily performed in 111 patients with a mean age of 74 years (42-94), through-knee (TK) in 66 patients with a mean age of 72 years (52-94) and below-knee (BK) in 143 patients with a mean age of 67 years (40-89). A multivariate contingency table analysis demonstrated the level of amputation to be related to the age ($P < 0.03$) and to the cause ($P < 0.007$). This means that the number of BK amputations decreases and AK amputations increases with age and that more BK amputations were performed in cases with diabetes mellitus, as shown in Figure 1.

All correspondence to be addressed to J. Steen Jensen, Dr. Med., Hestkøb Vaenge 63, DK-3460 Birkerød, Denmark.



Level of amputation significantly related to cause ($P < 0.007$)

Fig. 1. Level of amputation related to cause of amputation.

As seen from Table 1, the number of wound healing complications were significantly related to the level of amputation ($P < 0.0005$), as the majority of complications encountered arose after BK and TK amputations. There was no significant correlation to the cause of amputation, as 31 per cent (74/240) of complications were encountered in vascular cases and 23 per cent (18/80) in diabetics. All stump complications recorded in the present series were local infections or secondary skin necrosis.

Conservative treatment of the stump complications was followed by healing of the stump in 13 per cent (42/320) of cases, whereas local operations were successful in only 2 per

Table 1. Wound healing complications in relation to level of amputation.

AK	15/111	(14%)
TK	20/66	(30%)
BK	57/143	(40%)
Total	92/320	(29%)

cent (7/320) of cases (Table 2). Re-amputation at a higher level was necessary in 20 per cent (41/209) of TK and BK amputations. The number of re-amputations was significantly correlated to the cause of amputation ($P < 0.025$, Chi-square test), as vascular cases accounted for 16 per cent (39/240), as compared to 5 per cent (4/80) of diabetics.

The final level of amputation is shown in Table 3. It is seen that failure of TK amputations was followed by amputation at AK level. It is also noticed that failure of BK amputations led to re-amputation at AK level in the majority of cases, as only 3 out of 7 re-amputations at TK level resulted in successful healing of the stump.

Mortality following re-amputation was 7 per cent (6/92) in patients with wound healing complications, as compared to 2 per cent (4/167) in totally uncomplicated cases.

Table 2. Treatment of wound healing complications in relation to level of amputation.

	Conservative treatment	Operative revision	Re-amputation
AK	12/111 (11%)	1/111 (1%)	2/111 (2%)
TK	7/66 (11%)	—	13/66 (20%)
BK	23/143 (16%)	6/143 (4%)	28/143 (20%)
Total	42/320 (13%)	7/320 (2%)	43/320 (13%)

Table 3. Correlation between primary and final level of amputation.

BK to TK	3/143	(2%)
BK to AK	25/143	(18%)
TK to AK	13/66	(20%)

Discussion

In the fifties and sixties amputation for arteriosclerotic gangrene of the lower limb was synonymous with amputation at AK level. It must, however, be realized that successful prosthetic fitting following AK amputations was achieved in less than two thirds of geriatric patients in the best series (Chapman et al. 1959) and less than every quarter in others (Hierton & James 1973; Warren & Kihn, 1968).

It is true that AK amputations rarely necessitate further operations (Baur et al, 1978; Warren & Kihn 1968), but the risk of death was not proven to increase appreciably with the appearance of wound healing complications in the present series.

The goal of prosthetic treatment must be to return the geriatric patient home with preserved gait function. This means that the most distal level of amputation should be selected. It is, however, unacceptable always to choose the BK level, if the re-amputation rate is 46 per cent, as reported by Sarmiento et al, (1970). The level of amputation was determined by the skin perfusion blood pressure in the present series (Holstein et al, 1979 a, b; Holstein, 1980), although a few amputations were performed in spite of unacceptably low pressures in bilaterally threatened limbs and a number of amputations performed as life saving procedures without further investigations. The re-amputation rate following TK or BK amputations was fairly consistent with recent reports (Christensen 1976, Hopkins & Harris 1965, Howard et al. 1969, Newcombe & Marcuson 1972, Warren & Kihn 1968), but somewhat lower than others (Chilvers et al, 1971, Hierton & James 1973, Lindholm 1964). It is, however, most interesting to experience that failure after BK amputations in the majority of cases leads to re-amputation at AK level. The TK level is thus lost, which is decisive considering the high success rate of prosthetic fitting following TK amputations (Chilvers et al, 1971; Hopkins & Harris, 1965; Howard et al, 1969; Newcombe & Marcuson 1972).

In our opinion the limb should be carefully evaluated prior to selection of the level of amputation, including measurement of the skin perfusion blood pressure. In cases with borderline skin perfusion blood pressure or doubtful clinical condition of the skin or muscles, we advocate selection of the TK amputation level, as this level of amputation is followed by as successful a prosthetic fitting as after BK amputations.

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