Incidence of reamputation and death after gangrene
of the lower extremity

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Abstract

Since 1972 the Danish Amputation Register (DAR) has recorded major amputations in Denmark. The register is based on voluntary detailed reports from surgical and orthopaedic departments. The present investigation is based upon 2029 amputations for arteriosclerotic and diabetic gangrene with an observation period up to 4 years.

The incidence of ipsilateral reamputation is high in the immediate postoperative period with 10·4% after one month, 16·5% after three months and 18·8% after six months. Later the incidence is quite low, reaching a total of 23·1% after four years.

The risk of contralateral amputation is ever present with an incidence of 11·9% within one year, 17·8% after two years, 27·2% after three years, and finally 44·3% after four years.

The mortality after three months is 16·3% and then tapers off to a total of 22·5% after four years. As compared with the normal population a significant over-mortality is seen during the first three months, and an equally significant under-mortality from six months onward during the observation period.

Introduction

Over the years many studies have attempted to clarify the fate of the arteriosclerotic and diabetic amputee, with respect to later ipsi- or contralateral amputation (Silbert 1952; Goldner 1960; Baddeley & Fulford 1965; Mazet 1967; Sarmiento 1968; Whitehouse et al. 1968; Persson & Sundén 1971; Kolind-Sørensen 1974); and also mortality Smith 1956; Hansson 1964; Whitehouse et al. 1968; Ecker & Jacobs 1970; Persson & Sundén 1971; Kahn 1974; Kolind-Sørensen 1974).

A majority of the studies comprise rather few observations and the observation period is often rather short.

Method

The Danish Amputation Register was founded in 1972 for the purpose of continuous study of the amputation problem in the broadest sense. The register builds on voluntary reports from orthopaedic and surgical departments in Denmark and further reports from Danish prosthetic fitters.

Since 1973 the register has recorded data on *c.* 5,000 new amputations and an equal number of prostheses fitted. Data on amputee survival is brought up to date by a biannual comparison with the Danish Central Citizen Register (CPR). The present study was undertaken in order to establish survival of extremities and amputees and is based on detailed reports of 2,029 persons with amputations on the lower extremities, performed for arteriosclerotic or diabetic gangrene.

The input material was the date of birth, date of first lower extremity amputation and dates of any later ipsi- or contralateral lower extremity amputation performed during the observation period. In all instances of death the exact date is recorded.

The statistical analysis was performed in the department for medical statistics, Rigshospitalet, utilizing life table methods. All computations were carried out individually for the diabetic and non-diabetic groups, and as a compound as well. No significant differences were found between diabetics and non-diabetics.

Results

Ipsilateral reamputation

Ipsilateral reamputations are carried out on 10·4% of all amputees within one month of the initial amputation. The percentage after two months is 14·8 and after three months 16·5.

The percentage of reamputation after six months is 18·8, constituting the majority of all

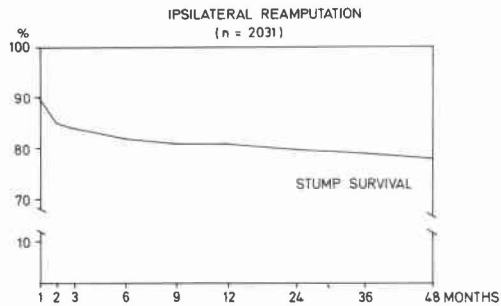ipsilateral reamputations during the observation period (Fig. 1).

Fig. 1. Ipsilateral reamputation was performed after one month in 10·4% of patients, after three months in 16·5% and after six months in 18·8%. Thereafter, until four years from the initial operation, a further 4·3% were reamputated.

In fact, from the 7th and 48th postoperative month only a further 4·3% of the amputee population is reamputated. It seems most probable that by far the majority of ipsilateral reamputations is due to postoperative complications which could not be controlled by conservative means.

Later breakdown of a stump which has healed after the initial amputation seems to be a rather rare occurence in the present material.

Contralateral amputation

The prognosis for "survival" of the other leg is less optimistic. Whereas the risk of ipsilateral amputation was almost eliminated 6 months after the primary amputation, the "other leg" is at risk as long as the tables are able to predict, with contralateral amputation hitting 11·9% within the first year, 17·8% within two years,
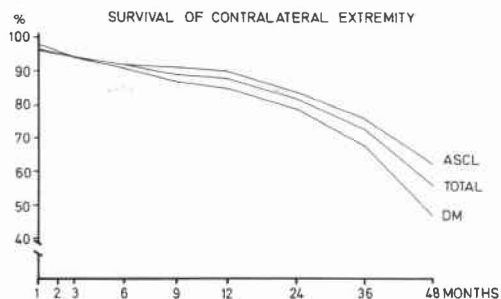

Fig. 2. One year after primary amputation, contralateral amputation in the compound group had been performed in 11·9% of patients, after two years in 17·8%, after three years in 27·2% and after four years in 44·3%. The incidence in diabetic amputees (DM) after four years was 52·6%, whereas in the non-diabetic group (ASCL) it was 38%.

27·2% within three years and 44·3% less than four years after the initial amputation (Fig. 2).

A certain difference is seen between the rate of contralateral amputation in arteriosclerotic patients (38%) and diabetic patients 52·6%.
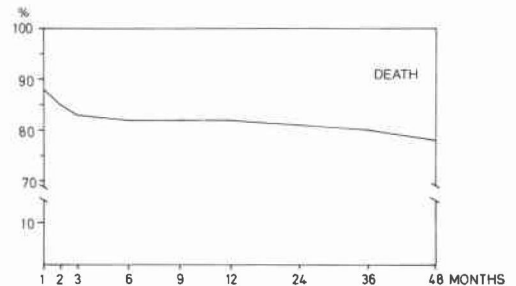

Fig. 3. Compound survival of diabetic and non-diabetic amputees.

Mortality

The rate of survival was stipulated for the arteriosclerotic and diabetic groups individually and no significant differences were encountered.

The compound survival curve (Fig. 3) demonstrates an initial "dip" but afterwards a rather linear and not very steep slope. By far the greatest risk of death is encountered within three months following amputation (16·6%), whereas the figures after 1 through 4 years are 18·4, 19·2, 20·3 and 22·5%. However further statistical study demonstrates an astounding difference in mortality, as compared to the "normal" population (Fig. 4). Within the first 3–6 months a markedly increased mortality is noted in the amputee group—the difference being significant ($p < 0.001$). At six months postoperatively the chance of survival is roughly the same as in the
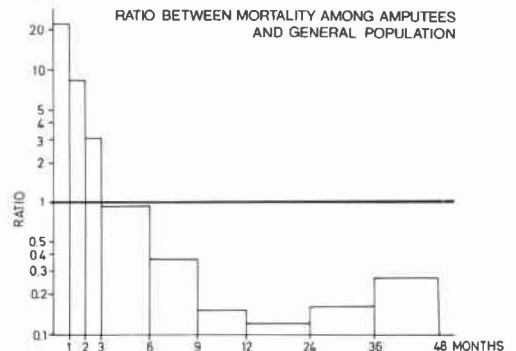

Fig. 4. A significantly increased mortality among amputees compared with a "normal" population is shown during the first three postoperative months. During the next three months the mortality is the same and after six months a significantly decreased mortality in the amputee group is demonstrated.

normal population, but at any later stage the chances of survival are significantly ($p < 0.001$) greater in the amputee group. The reasons for this unexpected observation are not known at present, but it is tempting to postulate that the frail and infirm are eliminated through the operative stress, leaving alive the fittest.

The compound fate of patients following the first lower extremity amputation is demonstrated in Fig. 5. After four years 36·6% of the patients are still alive without further ablative surgery. A further 40·9% have been subjected to ipsilateral reamputation (9·5%) or contralateral amputation (31·4%). After four years 22·5% are dead.
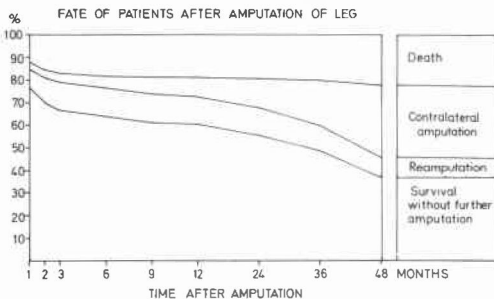

Fig. 5. Four years after the initial amputation three out of four patients were still alive. Almost half of these had no further amputation. The remainder had been ipsi- or contralaterally amputated at a later stage within the observation period.

Discussion

The incidence of ipsilateral reamputation has been described as ranging from 7·5% to 48% (Sarmiento 1968) and from 12·5% to 30% (Persson & Sundén 1971).

During the 48-months' observation period a total of 23·1% of our patients were reamputated.

In our series approximately half the total number of reamputations (10·4%) were performed within 1 month of the primary operation, three quarters (16·5%) after 3 months and almost all (18·8%) within 6 months following the initial amputation. From the 7th through the 48th month only a further 4·4% of the amputee population was reamputated.

No previous study details the exact time of ipsilateral reamputation over a prolonged period of time.

These findings suggest that the majority of ipsilateral reamputations were sequels to an unrealistic primary choice of amputation level and/or postoperative complications such as infection. If the amputation stump survives the initial 6 postoperative months it stands a very good chance of permanency.

In a series of unilateral diabetic amputees Baddeley & Fulford (1965) recorded 20% contralateral amputations within three years. The corresponding findings of Silbert (1952) were 30% after three years and 51% after five years. Mazet (1967) in a group of unilateral diabetic amputees computed the risk of contralateral amputation at 10, 20 and 40% after 1, 2 and 5 years. Goldner (1960) followed 71 diabetic patients with amputation on one side of whom 66% eventually developed contralateral lesions; among these two thirds (68%) were amputated. The advent of the contralateral lesion was recorded within the 1st—4th years in 23, 61, 72 and 89% of all. With the stated amputation rate of 68% this would mean contralateral amputation in 15·6, 41·5, 49 and 60·5% of the originally unilateral amputees within the 1st through 4th years.

The above mentioned figures correspond fairly well to those of our series, in particular the general trend is identical, towards a relentlessly increasing risk of contralateral amputation. It should be stressed that whereas the studies referred to were all concerned with diabetic amputees, we found the same tendency in non-diabetics as well.

Many authors operate with the concept "in-hospital mortality" or "postoperative mortality" without clearly defining the average duration of the hospitalization.

In contemporary work it has become conventional to substitute "3-month mortality" i.e. the rate of death within 3 months following initial surgery. For this reason it is not possible to compare exactly the mortality in different series.

The in-hospital mortality ranges from 9% (Kahn 1974) over 11·9% (Persson & Sundén 1971) and 12% (Smith 1956), through 25% (Kolind-Sørensen 1974). In a nationwide survey of lower extremity amputations in Denmark during 1977 Ebskov (1979) found an average in-hospital mortality of 14%—varying between 8% and 21% in different parts of the country. The total number of amputees was 1725 and the average duration of hospitalization was 47 days. In the present series of 2,029 amputees 16·6% were dead within three months following surgery.

As will be seen there is no principal difference in this respect. This compatibility changes when

the mortality is followed over a longer span of time.

Hansson (1964) showed 45%, 58%, 71% and 76% mortality 1, 2, 3 and 4 years postoperatively.

Ecker & Jacobs (1970) found a 39% mortality after 3 years, Kolind-Sørensen (1974) demonstrated 50% after 5 years, Smith (1956) 60% after 5 years and Whitehouse et al. (1968) c. 80% after 7 years.

In our series the percentages after 1 through 4 years are 18·4, 19·2, 20·3 and 22·5. As far as can be judged there are no major differences in aetiology and age distribution, the sole difference in fact being the much more comprehensive material in our series.

Hanson (1964) flatly stated that the mortality in a group of 254 patient was four times that of a comparable "normal" population. This is in strong contrast to our findings that after 6 months the amputee group demonstrates a highly significant under-mortality as compared with the "normal" population. There is no known explanation for this discrepancy.

Whitehouse et al. (1968) stated that "a diabetic amputee will probably lose his life before he loses his second leg". This dictum is widely cited, but it is certainly not in correspondence with the findings in the present series, where very significant numbers of diabetics and non-diabetics live long enough to lose additional parts of the primarily amputated leg and in particular to lose in ever increasing numbers "the second leg".

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