

The influence of prior stroke on the prosthetic rehabilitation of lower limb amputees

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Abstract

Concurrent stroke is believed to have an adverse influence on the process and outcome of prosthetic rehabilitation, but there is limited published evidence for this. The aim of this study was to establish a clearer picture in order to assist decision making for both patients and professionals.

Demographic and clinical data were collected from all lower limb amputees referred from North and West Yorkshire for prosthetic rehabilitation. Additional data were collected from all new lower limb amputees in three of the referring health districts, irrespective of prosthetic referral.

Patients with prior stroke were less likely to be referred for prosthetic rehabilitation. Improved mobility and independence were seen following prosthetic rehabilitation irrespective of prior stroke. The group with prior stroke compared well with the non-stroke group in terms of walking aid usage, but a smaller proportion of the stroke group were able to walk 30m without stopping and there were trends for smaller gains in independence in the stroke group.

Nevertheless, this study demonstrates that prosthetic rehabilitation can be successful in a selected amputee population with prior stroke. In those who continue prosthetic use for one year, outcome is similar to that in patients without stroke.

Introduction

There is a widely held belief that stroke adversely affects the outcome of prosthetic

rehabilitation; Varghese *et al.* (1978) and Altner *et al.* (1987) have reported that stroke, particularly if it occurs prior to amputation, results in more limited mobility with a prosthesis. Kerstein *et al.* (1974) also found that after neuropsychological and pulmonary symptoms, stroke was the factor most likely to influence placement in chronic care. In fact, Hoover (1964) commented that a hemiplegia renders ambulation unusually difficult frequently contraindicating prosthetic fitting. Is this view justified? To contribute to the understanding of this issue, the authors have examined their own experience in patients with stroke who subsequently underwent lower limb amputation.

The prosthetics department in Chapel Allerton Hospital, Leeds is one of the largest in Britain, providing prostheses to approximately 3,000 amputees from North and West Yorkshire (catchment population approximately 3 million). Between 200 and 250 new referrals are received each year. In October 1992, an electronic database was set up in order to facilitate audit of this service. As part of this audit, referrers in three of the 10 health districts which routinely sent patients to Chapel Allerton Hospital were asked to record demographic, clinical and disability details on all those who had amputations between October 1992 and October 1993, irrespective of whether prosthetic rehabilitation was felt appropriate. This provided an opportunity to examine whether the presence of a stroke influenced the decision to refer a patient for prosthetic rehabilitation following amputation.

By analysing the data from all those actually referred for prosthetic rehabilitation in the same time period, it was also the intention to re-

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examine whether a coexistent stroke adversely affects outcome of prosthetic rehabilitation, compared with amputees without stroke.

The main aim was to ensure that patients, their carers and those arranging referrals were as fully informed as possible about likely outcome of prosthetic rehabilitation at an early stage. It was known for example that patients often deferred decisions about moving house, and either remained in hospital or struggled on in difficult circumstances because they had received no clear guidance on how a prosthesis could be expected to influence their independence. However it was also hoped that it would be possible to identify features of stroke crucial to the success of prosthetic rehabilitation which might themselves be altered by targeted stroke rehabilitation.

It should be stressed that whilst there is a body of literature identifying characteristics which influence the outcome of rehabilitation in stroke *per se* (Wade and Hewer, 1987) findings are not necessarily applicable to the field of amputee rehabilitation. For example the clinical extent of stroke influences mortality. Age, sex, level of independence and the presence of a carer at home may influence place of discharge from hospital (Geddes, 1998). However one might predict that other factors such as the integrity of balance and proprioception would be crucial to the prosthetic rehabilitation process, and there is some evidence to support this view (Altner *et al.*, 1987). It is certainly possible to achieve successful prosthetic mobility, albeit with greater difficulty, in patients (without stroke) who are blind, or have cognitive or communication problems for other reasons. Such patients may remain dependent in other respects but achieving prosthetic mobility may nevertheless influence their care needs. On the other hand, functional independence and autonomy are feasible without ambulation. Thus it would be inappropriate to extrapolate from findings for stroke rehabilitation in patients who have not had amputations.

Patients and methods

In order to examine whether the presence of a stroke influenced the decision to refer a patient for prosthetic rehabilitation following amputation, referrers in three of the 10 health districts (Leeds, Airedale, Huddersfield) which routinely referred patients to the prosthetics

department at Chapel Allerton Hospital collected data on all new lower limb amputees between October 1992 and October 1993, irrespective of whether referral was planned. The following data were recorded:

1. name, date of birth, occupational status, type of accommodation;
2. reason for non-referral (Table 1);
3. amputation site and reason for amputation (underlying diagnosis);
3. other relevant diagnoses (ischaemic heart disease, stroke, chronic bronchitis, arthritis);
5. dependence in personal care (Barthel scores) following and (estimated) three months prior to amputation;
6. whether an early walking aid (PPAMaid) had been tried.

In order to examine whether a prior stroke influences the outcome of prosthetic rehabilitation, additional data were recorded on all new lower limb amputees referred for prostheses and first seen in the Prosthetics Department over the same 12 month period. Patients were reviewed three, six and twelve months after the supply of the first prosthesis. Data recorded included:

1. whether the patient was still wearing a prosthesis and, if not, why not;
2. if the prosthesis was used for longer than half the day;
3. distances walked without stopping (<10m, 11-30m, >30m) and use of walking aids;
4. Barthel scores;
5. Frenchay activity index (first and last visit only);
6. patient satisfaction with the appearance and function of the prosthesis.

The Medical records of patients with strokes

Table 1. Reasons for non-referral for prosthetic rehabilitation.

Does not wish to wear a limb
Cardiac/respiratory problems limiting stamina
Claudication in remaining limb
Arthritis
Joint contractures
Stroke
Mental state
Death
Other medical problems ... (specified)
Other reasons ... (specified)

were subsequently reviewed to establish, where possible, the side of the body affected and additional clinical features such as the presence of sensory or visual inattention.

Data were analysed using Statistical Package for the Social Sciences.

Results

Comparison of referrals and non-referrals in three health districts

During the study period, 103 patients from Leeds, Airedale and Huddersfield Districts were referred for prosthetic rehabilitation following lower limb amputation. During the same time period, a further 65 patients in these three districts had lower limb amputations but were not referred for prosthetic rehabilitation.

Stroke was present in 16 (19.3%) of non-referrals, was cited as a reason for non-referral in 15 (23.1%) of these and was the only reason given in 2 (4.6%). Other reasons given included post-operative death in 14 (21.5%), cardio-respiratory problems in 4 (6.2%), cognitive dysfunction in 3 (4.6%), patient's wish in 2 (3.1%), arthritis in 1 (1.5%), or a combination of these reasons. By comparison, stroke was only present in 7 (6.8%) of amputees referred for prosthetic rehabilitation. Stroke was present in a greater proportion of non-referrals (Chi-square, $p = 0.012$).

Comparison of all referrals with and without stroke

Overall 227 patients were referred from all ten health districts during the study period. Referrals with and without prior stroke were not

significantly different in terms of age, sex distribution or amputation level and as expected, bearing in mind the shared risk factors, peripheral vascular disease and/or diabetes were the predominant underlying pathologies in both groups.

Prosthetic rehabilitation

Once referred, four (19%) patients with stroke and 14 (7.9%) patients without stroke were never measured for a functional prosthesis. This difference is not significant.

Of the 209 patients who were prescribed functional prostheses, data were available for analysis on 194 patients, 19 (9.8%) of whom had previously suffered strokes. Walking aid usage and walking distance are summarised in Table 2. The group with prior stroke compared well with the non-stroke group in terms of walking aid usage, but by one year, a smaller proportion of patients with stroke had gained the ability to walk more than 30m (stroke group – 50%, non-stroke group – 78.7%). This difference is significant (Chi-square, $p < 0.05$).

Functional independence

Patients with stroke were more dependent at the initial visit to the prosthetics department (median Barthel scores – no stroke = 17, stroke = 15.5, Pearson $p = 0.046$) and had led more restricted lifestyles in the three months prior to amputation (Frenchay Activity Index, no stroke median = 14.5, stroke median = 11, not significant $p = 0.08$) than patients without stroke. Although Frenchay Activity Index scores improved in both groups (no stroke = 19, stroke

Table 2. Mobility using a prosthesis.

	With stroke		Without stroke	
	6 months	12 months	6 months	12 months
% able to walk ... >30m	50	50	67.8	71.2
... 11-30m	8.3	25	16.1	11
... <10m	33.3	25	9.3	8.5
missing data	8.4		8.6	9.3
% using ... no sticks	8.3	25	9.3	11.9
... 1 stick	25	58.3	27.1	34.7
... 2 sticks/crutches	41.7	8.3	45.8	32.2
... frame	16.7	8.4	11	11.9
missing data	8.3		6.8	9.3

= 11.5) those without stroke were faring significantly better 12 months after being supplied with a prosthesis (Wilcoxon, $p < 0.05$). The non-stroke group also manifested a reduction in dependency (median Barthel at 12 months = 20). Missing data precluded adequate between group analysis of Barthel outcomes.

Patients' perceptions

There were no striking differences between patient groups with regard to comfort and satisfaction with the overall performance of the prostheses as shown in Table 3.

Completion of one year's prosthetic rehabilitation

63.2% of patients with stroke and 67.4% of those without were still using their prosthesis one year later. Similar numbers of patients in each group died (stroke – 10.5%, no stroke – 10.3%). Second amputations were performed in 10.5% of the stroke group and 6.3% of the non-stroke group. 10.5% of patients with stroke and 8% without stroke stopped prosthetic use for other reasons.

Stroke characteristics

The small sample size and incomplete data precluded useful analysis of the influence of stroke characteristics on outcome. In particular the authors were unable to draw any conclusions about the relationship between laterality of the stroke and outcome.

Discussion

One of the most striking findings in this survey was that patients with concurrent stroke are less

likely to be referred for prosthetic rehabilitation following lower limb amputation than those without strokes. This almost certainly reflects the view that such patients are less likely to derive benefit from a prosthesis. A separate survey of referring teams in the authors' area confirmed that stroke was one of the main factors likely to prevent referral (Neumann *et al.*, 1995).

Once referred, 81% of patients with stroke and 92.1% without stroke were prescribed a prosthesis at Chapel Allerton Hospital. This implies that referrers have already screened out those with more severe strokes. There is some indication that this is the case (Neumann *et al.*, 1995), but such a relationship between referral pattern and severity of stroke cannot be assumed.

There is also a widely held belief that outlook for prosthetic rehabilitation is worse if the stroke affects the intact limb. Published evidence for this however is based on studies with sample sizes too small to yield significant data (Varghese *et al.*, 1978; Altner *et al.*, 1987; O'Connell and Gnatz, 1989).

It is possible that this belief also influenced referral.

Small sample size in the stroke group and incomplete data in both sets adversely influenced the statistical power of this study. However, the study provides evidence to support the view that patients with stroke fare worse than their counterparts without stroke in prosthetic rehabilitation. Although the majority of patients in both groups were still using their prostheses one year after prescription, during this time the patients with stroke failed to match in some respects the level of mobility and independence

Table 3. Patients' perceptions of comfort and function using their prosthesis.

	With stroke		Without stroke	
	6 months	12 months	6 months	12 months
"Does prosthesis hurt?" ... no	41.7	33.3	36.4	48.3
... a little	41.7	58.3	37.3	23.7
... moderate	8.3	8.3	16.9	11
... a lot	0	0	5.1	5.9
Function ... good	33.3	50	44.1	50
... moderate	50	33.3	28	28.8
... not satisfactory	8.3	8.3	20.3	9.3
... missing data	8.3	8.3	7.6	11.8

achieved by those without stroke. Nevertheless as a group the population with stroke were able to make some gains in terms of independence and lifestyle and the importance of such gains, for self respect as well as their relevance to future care costs should not be overlooked.

This retrospective study has not yielded sufficient information to draw conclusions about stroke characteristics which may influence the outcome of prosthetic rehabilitation and which might be addressed by specific therapies. It would be valuable to establish how and why stroke influences outcome in order to select appropriate strategies.

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