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Summary

Rehabilitation for the lower limb amputee is a central concern for the patient and health care professionals. Rehabilitation is vital to enable the amputee live life to his/her optimal ability. Age and the stump length/level of amputation emerge as two dominant factors that affect rehabilitation outcome. A variety of outcome measures are available to assess patients' rehabilitative potential. However, one particular measurement tool, the 'timed up and go' measure displays clinical usefulness by its usability in the assessment of physical mobility. The potential of a nursing role in rehabilitation of the amputee is immense and is evident in both hospital and community.

Key words: amputation, amputee, rehabilitation, outcome measures.

Introduction

This literature review was undertaken to examine the evidence in relation to rehabilitation for lower limb amputees. The topic is one of key interest to nurses. It is reported that 5000 new lower limb amputees are referred to United Kingdom limb fitting centres in 2005-2006 (National Amputee Statistical Database 2007), and amputees account for a significant proportion of patients within all sectors of the health care system. Patients with a lower limb

amputation report unsatisfactory quality of life (De Godoy *et al* 2002). Amputation leads to a three fold loss in terms of function, sensation and body image (Breakey 1997, Racy 2004). Furthermore, the high prevalence of reduced balance confidence among persons with a lower limb amputation (Miller *et al* 2002), can result in avoidance of certain activities and loss of confidence (Miller *et al* 2001), which ultimately affects the individual's quality of life.

An amputee is a person who has lost a limb due to malignancy, trauma, diabetes, congenital deficiency or peripheral vascular disease. 80% of amputees are aged over 60, and 80-90% of amputations are caused by peripheral vascular disease (Schoppen *et al* 1999). The term 'Lower- Limb amputation' refers to a variety of amputation situations (Table 1), and lower limb amputees account for 91% of new referrals 2005-2006 (National Amputee Statistical Database 2007).

Rehabilitation for an amputee is the restoration of function and the regaining of an acceptable level of functioning and participation (van Velsen et al 2006). It involves retraining and re-education of those who have become partially or wholly incapacitated (Blackwell 2004). The goals of rehabilitation are contextual, and for those with a lower limb amputation, they are to improve on the individual's functional mobility and successfully re-integrate the patient into the community (Hagbert *et al* 2004). Moreover, a major advantage for the amputee of rehabilitation is decreased phantom and residual limb pain and mastering prosthetic ambulation (Munin *et al* 2001). However, conflict between caring ('doing for') and rehabilitation ('standing back' and coaching) is an issue evident in nursing practice (Long *et al* 2002a).

A review of the literature reveals that many factors contribute to success of, and suitability to rehabilitation, including age, gender, cause of amputation, level of amputation, presence of co-morbidities, length of hospital/ rehabilitation stay, pain, body image and appropriate use of outcome and mobility measures. However, this review concentrates on three issues that dominate discussions on rehabilitation among amputees, these being, age, stump length/level of amputation, and outcome measures of rehabilitation. In addition, a discussion on the role of the nurse in the rehabilitation process for amputees is addressed (Traballesi *et al* 1998, Legro *et al* 1999, Schoppen *et al* 1999, Munin *et al* 2001, Nasser *et al* 2001, Sjodahl *et al* 2001, Golding and Mitchell 2002, Long *et al* 2002a, Long *et al* 2002b, Larner *et al* 2003, Whyte and Niven 2004).

Age and stump length/level of amputation

Age is identified as one of the most important issues that affect rehabilitation in many of the studies reviewed. Age and level of amputation were the most significant predictors of functional outcome in a prospective study by Traballesi *et al* (1998). The mean age of the sample (n=144) was 68.7years, and outcome measures utilised by the researchers indicated that age was the most powerful factor influencing effectiveness expressed as mobility. Less than age 65 was reported to have a greater probability of achieving good autonomy in mobility than older patients

Another study with age as a determining factor, utilised a retrospective study design to study the effect of age and weight on frequency of prosthetic repairs (Nasser *et al* 2001). The sample (n=116) ranged from 16-96 years (mean 58.7 years). Frequency of prostheses repair was

measured over a six month period. The number of repairs correlated significantly with body weight ($p<0.001$) with a confidence interval of 95%. Age was correlated inversely to the number of repairs ($p= 0.003$), suggesting that young overweight amputees account for more repairs. No correlation was found between repairs and gender, cause of amputation or level of amputation. The results provide evidence of age and weight as determining factors in rehabilitation. However, it is important to note the study only lasted six months and if the study sample were followed up at yearly intervals the results may have been different.

Also retrospective in design is a study by Munin *et al* (2001), which examined factors for successful early prosthetic ambulation. The sample (n=75) were admitted directly into a rehabilitation facility. Statistical analysis was used with a clinically relevant model to determine possible trends. It included factors that were addressed in previous research such as age, phantom pain, wound drainage on admission, amputation level, diabetes and residual limb contracture. 68% of the sample attained successful ambulation, and the study revealed that successful outcome was predicted by being of younger age, staying longer in rehabilitation and having a home nurse on discharge.

While age is an important factor to consider in predicting rehabilitation potential, the stump length/level of amputation also emerges as a dominant factor for consideration in rehabilitation outcome. Transtibial amputees account for more than half of new referrals in UK (National Amputee Statistical Database 2007). The most distal level of amputation still compatible with wound healing is the ideal. The level that successfully removes diseased or damaged tissue provides the best environment for rapid return of mobility and function.

Furthermore, Smith (2004) suggests that the surgical procedure should be coordinated with rehabilitation plans to minimise breakdown of the stump wound.

Larner *et al* (2003) studied predictive power of psychological variables and site of amputation to predict outcome, and reported that the site of amputation was significant (p= 0.016). Unique to this study and perhaps worthwhile to take into account for all of the other studies reviewed, is the small sample size (n=43), as representative of a typical inpatient rehabilitation facility.

What emerges strongly from the literature is the importance of evaluating the effectiveness of clinical practice through rehabilitation outcome measures. Rehabilitation outcome measures either predict suitability, or forecast expected progress. However, because each amputee has a unique circumstance and response to rehabilitation, there is no 'gold standard' in use.

Outcome measures

Due to the variety of outcome measures available for rehabilitation, it is difficult for health care professionals to choose which one is best to use. Nevertheless, it is evident that if patients who would benefit from immediate rehabilitation with the potential to do extremely well, were identified early, the positive outcome for the amputee would be maximised. This is particularly relevant in view of in-hospital rehabilitation being considered the "most critical phase", presenting the greatest challenge to the patient, the family and the rehabilitation team (Racy 2004, p. 731) Furthermore, nurse initiated transfer, based on a suitable assessment, would ensure rehabilitation is being planned while hospital and surgical care is still taking place.

The role of successful rehabilitation cannot be underestimated. In a review of the literature, Horgan and MacLachlan (2004) report that depression and anxiety are relatively high up to two years post amputation, and depression is associated with activity restriction and vulnerability. Therefore, it is argued that the use of a prosthesis could be an important tool and mediator between disability and emotional wellbeing (Horgan and MacLachlan 2004).

Functional outcome measures are essentially assessment tools. They can be subjective (a self-reported assessment) or objective (based on measured performance). Ideally, both should be performed, and results should correlate well to give an accurate picture of the patient's level of functioning, providing a basis for identification of attainable goals.

There are many valid and reliable outcome measurement tools available. Among the most frequently used assessment tools is the SF-36 (Short form 36) (Ware and Sherbourne 1992), which examines physical, psychological and social concerns approaching the concept of health as recommended by the WHO in a holistic manner, and is considered a suitable assessment tool for rehabilitation and quality of life (Legro *et al* 1999). Also popular is the 'Prosthesis Evaluation Questionnaire' (PEQ) (Legro *et al* 1998), a 16 item self report instrument specifically developed for amputees with the intent of measuring small differences in prosthetic function and major life domains related to prosthetic function. Response is recorded along a linear analogue scale with four headings: prosthetic function, mobility, psychological experience and wellbeing. It consists of paired questions and open ended questions which obtain rich qualitative data. Moreover, it has established reliability with a reported Cronbach's alpha ranging from .73-.89 (Legro *et al* 1999). Legro *et al* (1999) in a study to identify issues of importance to amputees incorporated the SF36 and the PEQ. The PEQ

revealed the most important function of prosthesis was enabling walking, and the most important characteristic was the way it fit.

Another tool available is 'The Barthel Index', which is reported widely as a useful and popular measure of activities of living of amputees (Gailey & Clarke 2004). However, this tool is more commonly used in the assessment of rehabilitation among neurological patients (Liu *et al* 2004, Houlden *et al* 2006). The index values on this tool are used to assess changes between admission and discharge. Low scores indicate difficulties in using stairs, walking, self bathing, getting on and off a toilet and bowel and bladder control. However, the tool does not detect subtle deficits in those functioning at a high level and is therefore more suited to more impaired amputees (Traballesi *et al* 1998).

Walking speed is an inexpensive functional measure that also offers an objective method of monitoring gait rehabilitation. Sjodahl *et al* (2001) report gait improvement in a sample of 9 amputees where a combined approach of psychological and physiotherapeutic treatment was studied. The "Timed up and go" test (TUGT) was modified by Podsiadlo and Richardson (1991) following its initial development as the "Get up and go" test (Mathias et al 1986). The TUGT is reported to correlate well with the Barthel index (Podsiadlo and Richardson 1991). However, the study population described by Podsiadlo and Richardson (1991) did not include patients with a lower limb amputation. Nevertheless, the TUGT has proven to be a quick and easy measure of physical mobility for lower limb amputees in a sample of over sixty years (n=32), with Peripheral vascular disease (PVD) (Schoppen *et al* 1999). The test involved measuring the time to get off the chair, walk a distance and walk back to starting point. Standardised equipment was used and observers were trained and pilot tested it on five

amputees. The study clients performed for two observers at different times of the day, and inter-rater reliability showed good correlation. Moreover, the tool was shown to correlate moderately well with other tools (Schoppen *et al* 1999). The TUGT measure displays clinical usefulness, due mainly to its ease of administration. However, Siggeirsdottir *et al* (2002) caution that test performance is dependent on the chair type and recommend that chairs with armrests and a seating height of 44-47cm should be used. Moreover, Deathe and Miller (2005) report "a ceiling effect" (p.627) with the TUGT, particularly with elderly people who are fit and younger people with amputations. Nevertheless, the TUGT does provide crucial information regarding the patient's ambulation with prosthetic devices during the rehabilitation process (McGuire 2004, Deathe and Miller 2005). Moreover, its usefulness has further potential when utilised with the 'Rehabilitation activities profile' (RAP), a practice framework for all members of the multidisciplinary team, as reported by Beckman *et al* (2004).

Nurses' Role

It is argued that nurses play a vital role in the care of lower limb amputees by alleviating and preventing factors that contribute to limb fitting delay such as general ill health, weakness, pressure sores, pain, depression and high incidence of infection, delayed healing and contracture deformity (Crowther 1982). Moreover, Donohue (1997) asserts that the nurse assumes a central role in liaising with other members of the multidisciplinary team in order to ensure that the person undergoing the amputation is prepared for their discharge home. However, according to Nolan and Nolan (1997), the literature predominantly views the nurse's role in rehabilitation as a secondary one, or else is virtually absent. Long *et al* (2002b) report

on their postal questionnaire (240 semi-structured questionnaires distributed with a 137 return rate of 57%). 64% of respondents reported their pre-registration education was only a basic introduction to rehabilitation and had not provided them with the skills and knowledge they needed. Post registration courses were viewed highly with respect to the skills and knowledge promoted; however, many respondents reported difficulty accessing relevant courses. Long *et al* (2000b) also conducted 45 unstructured interviews with nurses in the context of over 330 hours of observation. Nurses expressed the view that students on placement on rehabilitation units were already socialised into 'doing for', and had difficulties with adapting to the philosophy underpinning rehabilitation (Long *et al* 2002a, p. 139). In view of the study findings, Long *et al* (2002b) suggest that an accredited post- registration qualification in rehabilitation is essential and also dedicated student placements in rehabilitation facilities are needed to prepare nurses for their role in rehabilitation.

Long *et al* (2002a) also undertook an ethnographic study of sets of contrasting case studies involving interviews to outline the role of the nurse in rehabilitation. The sample (n=49 clients), was drawn from patients with fractured neck of femur, with rheumatoid arthritis and stroke. A second phase of the study involved expert workshops with users and carers (n=10), nurses (n=21), multi-professional team members (23), and educationalists (n=20). Long *et al* (2002a) report that the nurse's contribution to the multi-professional rehabilitation team was centred on six interlinked roles with the role of assessment as central to the client's rehabilitation (Table 2). Moreover, the potential for the role of a surgical liaison nurse is evident in post-surgical care, where the role would involve coordination of the patient's care between the surgeon and prosthetics, while simultaneously maintaining intense assessment of the patient which would facilitate prompt recognition of stump wound breakdown.

The role of nurse initiated transfer is also important to the rehabilitation of amputees. This transfer involves a nurse to nurse referral providing a more efficient service for both patient and nurse allowing timely transfer, efficient use of resources, individual discharge planning and improved communication with patients, relatives and other healthcare workers (Golding and Mitchell 2002). Nurses also can play a key role in referring patients to suitable services, where appropriate. Professional practice in prosthetics and orthotics may not require in depth knowledge of associated psychological disorders but an awareness of the issues patients' face and a facilitation role in making appropriate referrals (Desmond and MacLachan 2002).

However, with major change over the past decade in the philosophy of amputee rehabilitation service, it is essential to address the shift towards out-patient rehabilitation, which now dominates the service. This out-patient amputee service is offered at centres providing ATLAS (Artificial Limb & Appliance Service Centre). An ATLAS service includes, assessment, casting and fitting of prosthetics, the repair and maintenance of prosthetics, a consultant service to advise allied health professionals and carers on matters relating to amputees and prosthetics, and education and training on the use of care of prosthetics for health professionals. As part of the multidisciplinary team at the ATLAS, the nurse is placed in an ideal position to offer holistic care to patients. Nurses address post amputation problems in a holistic manner, taking account of the multidimensional nature of the experience (Whyte and Niven 2004). The holistic nature of nursing allows the ideal assessment incorporate all these issues and not just the mechanical and physical aspects of the prosthesis. The importance of a holistic assessment is vital as the visit to the prosthetic clinic/ALAS is often the only point of

contact for patients in the community. It is also important because it allows actual or potential problems hindering the success of rehabilitation to be pinpointed and prevented. The role of the community nurse in meeting the primary care needs of patients is also evident. This can be achieved by the additional support and information that nurses working in the community can give to amputees. This potential is particularly evident among elderly lower limb amputees where co-morbidity, particularly cardiopulmonary disease, influences functional outcome (Levin 2004). This view is emphasised by Whyte and Niven (2004) who argue that nurses, along with other allied professionals to medicine "have a clearer understanding of the issues involved in post-amputation care" (p. 898), and they suggest the role of the practice team in meeting the care needs of amputees.

Conclusion

The literature reveals that the two most significant variables concerning the functional outcome of the amputee are age and level of amputation. In assessing the amputee's suitability to a rehabilitation programme, being of older age and having a poorly healed distal stump are immediately disadvantaging to the successful rehabilitation process. The most efficient way of assessing a patient in order to determine their potential is by use of an outcome measure tool. Moreover, due to the economic pressures placed on health care facilities it is important to identify the patients that would benefit most from immediate rehabilitation in in-patient settings (Golding & Mitchell 2002).

A comprehensive assessment would include both subjective and objective measures, such as use of the "timed up a go" test (TUGT) in conjunction with the SF-36 (Short-form – 36), which should correlate to give a true picture in order to plan rehabilitation. Nurses, if appropriately educated, can competently assess rehabilitation potential in a rehabilitation facility or as a rehabilitation coordinator in the acute setting. It would appear that the TUGT offers much clinical usefulness, and if used the SF-36, would provide a comprehensive picture of the patient's rehabilitative progress.

In conclusion, the potential of a nursing role in rehabilitation of the amputee requires more attention. This potential is evident from the surgical nurse caring for the amputee post-operatively, to nurses working in ATLAS, to the community nurse caring for the amputee post discharge. The liaison role of the nurse is most evident when one considers the array of professionals involved in the rehabilitation of the patient following amputation. Rehabilitation is vital to enable the amputee live life to their optimal ability, and the nurse's role in that process needs to be acknowledged and developed further.

Implications for practice

Rehabilitation needs to be recognised as a specialist area of nursing practice.

Suitably educated nurses have the potential to co-ordinate rehabilitation for the patient with an amputation, and ensure appropriate use of resources.

The "timed up and go" test, used in conjunction with a subjective measure, such as the SF-36, would provide comprehensive assessment of rehabilitative progress.

Nurses in ATLAS play a key role in providing an holistic rehabilitation service to amputees.

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Table 1: Amputation Locations

Position	Surgical term
Above knee	Trans-femoral
Through knee	Knee disarticulation
Below Knee	Trans-tibial
Symes	Ankle disarticulation
Forefoot	Trans-metatarsal
Toe	

Table 2 Nursing roles in rehabilitation (Long et al 2002a)

Rank	Role	Description
1	Assessment	Identifying and addressing actual and potential problems, referrals to other team members, ongoing assessment provides up-to-date information for all team members.
2	Co-ordination and Communication	Gathering, synthesising and disseminating information. Providing feedback to team members. Discharge planning referral and negotiation.
3	Technical and physical care	Nutritional support, medication administration, wound dressing and infection screening. Help clients meet personal hygiene needs and maintain comfort.
4	Therapy integration and therapy carry on	Carrying out prescribed therapy exercises. Minimising physical, social or emotional barriers to rehabilitation and integrating the work of new ability into activities of living i.e. using new transfer method.
5	Emotional support	Reassuring, explaining and encouraging and creating a supportive environment.
6	Involving the family	Providing information, emotional care and communicating any fears or questions.