Original Article

Socio-economic outcome of paraplegia compared to lower limb amputation

A Cavigelli¹, R Fischer² and V Dietz^{*1}

¹ParaCare, Paraplegic Centre, University Hospital Balgrist, Zürich, Switzerland; ²Swiss Accident Insurance, (SUVA) Luzern, Switzerland

Study design: The socio-economic outcome was retrospectively compared between patients with traumatic lower limb amputation and those with paraplegia due to a spinal cord injury (SCI).

Objective: To evaluate the effect of specific rehabilitative procedures on the socio-economic outcome.

Setting: Paraplegic Centre at the University Hospital in Zurich, Switzerland.

Methods: Accidents occurring in a collective of 1.9 million persons in Switzerland over 3 years were included in the study. Fifty-six persons with unilateral amputation of lower limbs were compared with 54 persons with paraplegia. The follow-up was assessed over 5 years.

Results: The following data was obtained in patients with amputations compared to those with SCI (median values): (1) hospital stay: 150 *versus* 164 days; (2) the work was taken up after 689 *versus* 616 days; (3) the global average case costs amounted to SFr. 491.000 *versus* SFr. 606.000 during the first 5 years after injury; (4) the permanent degree of disability was determined to 40% *versus* 42%. Except for the global costs, all differences were not significant.

Conclusions: There are only a few differences between the socio-economic outcomes between patients with lower limb amputations and those with paraplegia. It remains unclear if the highly specialised rehabilitation services provided for patients with SCI accounts for the similarity since individuals with SCI have additional neurogenic dysfunction of the bladder and bowel. Alternatively, the data may suggest a need for greater rehabilitation services for amputees or may reflect a threshold effect in rehabilitation outcomes.

Spinal Cord (2002) **40**, 174–177. DOI: 10.1038/sj/sc/3101270

Keywords: unemployment; rehabilitation; vocational; spinal cord injury (SCI); lower limb amputation; Switzerland

Introduction

Highly specialised rehabilitation centres for spinal cord injury aim to optimise self-independence, reintegration into the workplace and pre-trauma social structures. This involves considerable expenditure. The socio-economic effect of rehabilitation, specifically the ability to regain an earning capacity and the right to receive a pension have yet to be reported in the literature. To investigate this issue the rehabilitation outcomes were compared between individuals with paraplegia and individuals with unilateral lower limb amputations.

Patients and methods

Inclusion criteria

One group of patients consisted of patients who suffered an accident which required unilateral limb amputation. The other group suffered a spinal cord injury. Before the trauma, all subjects included were healthy. Lower limb-amputation consisted of hip or knee exarticulation, amputation at the femur or the lower leg. Patients with clinically relevant additional injuries were excluded. For the group of patients with spinal cord injury (SCI): patients with both paraplegia and paraparesis were included. Cauda lesions ($n=57$) and cases with fatal outcome ($n=1$) within the 5 years follow up were excluded.

The inclusion criteria within the 3 years (1990, 1991 and 1992) were met by 56 patients with amputation

*Correspondence: V Dietz, ParaCare, Swiss Paraplegic Centre, University Hospital Balgrist, Forchstr. 340, CH-8008 Zurich, Switzerland

and 54 SCI patients. The proportion of males amounted to 97% (amputations) and 76% (SCI), respectively. The median age ($\pm$ SD) at the time of the accident was 41 ($\pm$ 12.8) years ranging from 18–65 years for amputations and 33 ($\pm$ 11.1) years ranging from 16–66 years for SCI patients. This difference was significant ($P=0.002$). The vocational qualifications were comparable between both groups. Most of the patients were manual workers.

Eighty-two per cent of patients with SCI had clinically relevant accompanying injuries. Most frequent were lung contusion (37%), costal trauma (36%), and mild to moderate brain trauma (45%). Injury of the abdomen (18%), fractures of femur (17%), of radius (17%), of pelvis (17%), of clavicle/scapula (17%) or of lower leg (12%) were also diagnosed.

Data analysis The unpaired Wilcoxon rank sum test was applied (probability $P=0.05$) using Systat, and the median value was calculated.

Swiss invalid pension

According to the Swiss accident insurance law (UVG), an invalid pension is calculated by the difference between the invalid salary (after reintegrating) and the valid salary (the theoretic salary without injury, in the respective profession). The difference results in the pension given to the patient. For example, a hard worker with a bad prospect for vocational reintegration receives a relative high pension. In contrast, in the case of an employment in an office with an income which is about equal to or even more after than before the accident, eventually no pension is obtained. All patients included in this study were fully employed and healthy pre-trauma.

Results

In Switzerland every accident-damaged patient (independently of its financial situation), obtains unique financial support in the form of an integrity remuneration according to the severity of anatomical-functional damage (severity of disability). The median integrity remuneration in SCI patients amounted to ($\pm$ SD) 50% ($\pm$ 27.3) and in those with amputations of lower limbs to 40% ($\pm$ 18.4). This difference was not significant ($P=0.1$).

The median duration of the hospitalisation in traumatic SCI patients amounted to ($\pm$ SD) 164 days ($\pm$ 129; range 8–750) and in those with amputations to 150 days ($\pm$ 113; range 7–453). This difference was not significant ($P=0.52$).

The median duration of the inability to work after trauma in SCI patients amounted to ($\pm$ SD) 616 days ($\pm$ 269; range 175–1523), and in those with traumatic amputation to 689 days ($\pm$ 411; range 13–1.549). This difference was not significant ($P=0.31$) (Figure 1).

The median global case costs (hospital, loss of earnings, integrity remuneration) over 5 years in

patients with traumatic SCI amounted to ($\pm$ SD) SFr. 606.000 ($\pm$ 360.500; range 82.500–1.476.500) and in those with amputations to SFr. 491.000. ($\pm$ 255.000; range 75.000–1.038.000.) This difference was significant ($P=0.04$). (Figure 2).

The median hospital and rehabilitation costs (without the costs of the vocational reintegrating) amounted to ($\pm$ SD) SFr. 151.000 ($\pm$ 101.500; range 23.000–405.000), and 95.000–($\pm$ 84.000; range 8000–435.000) in patients with SCI and amputation, respectively. This difference was significant ($P=0.005$).

The median degree of invalidity pension amounted to ($\pm$ SD) 42% ($\pm$ 31.3) in patients with SCI and to 40% ($\pm$ 28) in those with amputation. This difference was not significant ($P=0.89$). (1 SFr. corresponds to about 0.7 Euro, 0.6 US Dollars or 0.4 Pounds).

Discussion

The main observation made in this study is that although patients with SCI are much more impaired by their functional deficits (both legs are paralysed, impairment of bladder, bowel and sexual function) than patients with a unilateral leg amputation, the degree of invalidation is about the same in both patient groups. It is suggested that the higher costs for the rehabilitation of patients with SCI are justified.

The target of rehabilitation procedures within a rehabilitation centre for patients is to become

Figure 1 Duration of hospitalisation and temporal disablement (inability to work) in patients with paraplegia and those with leg amputation

Figure 2 Costs of hospitalisation and global costs of patients with paraplegia and those with leg amputation

independent from external assistance connected with a good quality of life. The quality of life does not necessarily correlate with the level of the spinal cord lesion; the main quality factor is return to the pre-trauma living and work environment.¹ The possibility to return to the early socio-economic network is achieved by a global rehabilitation, which promotes the self-independence and vocational re-education during the hospitalisation. By a global rehabilitation a significant improvement of self-independence (according to the modified Bartel-index) could be achieved in 711 patients, who suffered a traumatic SCI.² In paraplegic patients by such an approach the time of hospitalisation could be shortened, rehabilitation sessions were less frequently required, and the survival rate became improved.³

In patients with amputations only a few reports exist in the field of socio-economic outcome. A similar functional outcome was found in patients with amputations above and below the knee.⁴ Discussions were mainly focused on the question about the indication for an amputation and whether an amputation has to be performed. The answers to these questions are well documented and concrete appropriate guidelines exist.⁵⁻⁸ The selection of patients who require an amputation can be made according to various score-systems such as the Mangled Extremity Syndrome Index (MESI), the Mangled Extremity Syndrome Score (MESS), the Reductive Salvage Index (PSI) or the Limb Salvage Index (LSI). By none of these scores can the socio-economic outcome be predicted.

The average duration for the resumption of meaningful employment amounted to about 2 years without significant difference between the two groups of patients. In the amputation group it has to be noted that these patients have occasionally to be re-operated. In most cases, the post-hospitalisation time was used for intensive ambulatory rehabilitation.

The costs per case during the first 5 years amounted to around half a million Swiss Francs (higher in SCI patient). The difference between the two groups of patients was just significant. For comparison, the costs for traumatic SCI patients during the first 5 years were calculated by Berkowitz to an amount of 356.000 US \$.⁹ The case costs are influenced in SCI patients by the complications. These consist most frequently of bladder dysfunction, pulmonary complications (even in paraplegic patients the lung function can be impaired), bowel malfunction, pathological bone fractures, pressure skin ulcers and deep vein thrombosis.¹⁰

In our study, the invalidity pension for both groups of patients amounted to around 40%, without significant difference. Functional re-integrating programmes can improve significantly the rapid resumption of work.¹¹ Such programmes have to be executed during the rehabilitation phase at the hospital, otherwise the connections to the past work environment might become lost. Appropriate support by

vocational guidance, psychological tests, test workstations and ergotherapy is necessary.

A successful rehabilitation is connected with an optimal re-integration into the surrounding vocational field. Cognitive behaviour training can increase the success rate to find appropriate work.¹² Re-education is quite rewarding because life expectancy of SCI patients has continuously increased since the second world war.¹³ An increasing number of patients with SCI is capable of resuming work.¹⁴ A stimulus for the resumption of work obviously represents the socio-economic status of the patient. In a study, which included 10 000 households of patients it could be shown that a low socio-economic status has a negative influence on the re-integration process after trauma.¹⁵ Furthermore, injured patients with no financial concerns achieve a better quality of life.¹⁶ In Switzerland patients who are employed have a higher income compared to patients with an invalid pension.

In conclusion, this study indicates that the degree of disability differs little between paraplegic patients and patients with amputation of one leg. This is surprising in respect of the fact that the SCI does not only involve both legs but also an impairment of bladder, sexual and bowel function. It seems unlikely that the difference in age of about 8 years did considerably influence this result. This observation might rather be due to the fact that paraplegic patients undergo a global rehabilitation in specialised centres. Alternatively, the observation may also reflect an underachievement of the rehabilitation system for amputees or a threshold effect for rehabilitation for people with lower limb dysfunction. It would be worth considering that the conditions could also be improved in patients with traumatic leg amputation by a similarly consistent and global rehabilitation.

Acknowledgement

This work was supported by the B and D Koetser Foundation.

References

- 1 Cushman LA, Hassett J. Spinal cord injury: 10 and 15 years after. *Paraplegia* 1992; **30**: 690-696.
- 2 Yarkony GM *et al.* Benefits of rehabilitation for traumatic spinal cord injury. Multivariate analysis in 711 patients. *Arch Neurol* 1987; **44**: 93-96.
- 3 Heinemann AW *et al.* Functional outcome following spinal cord injury. A comparison of specialized spinal cord injury center vs general hospital short-term care. *Arch Neurol* 1989; **46**: 1098-1102.
- 4 Walker CR, Ingram RR, Hullin MG, McCreath SW. Lower limb amputation following injury: a survey of long-term functional outcome. *Injury* 1994; **25**: 387-392.
- 5 Robertson PA. Prediction of amputation after severe lower limb trauma. *J Bone Joint Surg [Br]* 1991; **73**: 816-818.

- 6 Johansen K *et al.* Objective criteria accurately predict amputation following lower extremity trauma. *J Trauma* 1990; **30**: 568–572.
- 7 Gregory RT *et al.* The mangled extremity syndrome (M.E.S.): a severity grading system for multisystem injury of the extremity. *J Trauma* 1985; **25**: 1147–1150.
- 8 Bonanni F, Rhodes M, Lucke JF. The futility of predictive scoring of mangled lower extremities. *J Trauma* 1993; **34**: 99–104.
- 9 Berkowitz M. Assessing the socioeconomic impact of improved treatment of head and spinal cord injuries. *J Emerg Med* 1993; **11**: 63–67.
- 10 Bergman SB, Yarkony GM, Stiens SA. Spinal cord injury rehabilitation. 2. Medical complications. *Arch Phys Med Rehabil* 1997; **78**: 535–538.
- 11 Burke SA, Harms-Constas CK, Aden PS. Return to work/work retention outcomes of a functional restoration program. A multi-center, prospective study with a comparison group. *Spine* 1994; **19**: 1180–1185.
- 12 Proudfoot J *et al.* Effect of cognitive-behavioural training on job-finding among long-term unemployed people [see comments]. *Lancet* 1997; **350**: 96–100.
- 13 DeVivo MJ *et al.* Seven-year survival following spinal cord injury. *Arch Neurol* 1987; **44**: 872–875.
- 14 DeVivo MJ, Richards JS. Community reintegration and quality of life following spinal cord injury. *Paraplegia* 1992; **30**: 108–112.
- 15 Bartley M, Owen C. Relation between socioeconomic status, employment, and health during economic change, 1973-93 [see comments]. *BMJ* 1996; **313**: 445–449.
- 16 Pentland W, McColl MA, Rosenthal C. The effect of aging and duration of disability on long term health outcomes following spinal cord injury. *Paraplegia* 1995; **33**: 367–373.