

SHORT COMMUNICATION

OUTCOME OF PHYSIOTHERAPY AS PART OF A MULTIDISCIPLINARY REHABILITATION IN AN UNSELECTED POLIO POPULATION WITH ONE-YEAR FOLLOW-UP: AN UNCONTROLLED STUDY

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Objective: The aim of this study was to evaluate the outcome of physiotherapy as part of a multidisciplinary rehabilitation.

Design: Prospective uncontrolled intervention study.

Subjects: Fifty patients with late effects of polio, first time referred to physiotherapy at the Danish Society of Polio and Accident Victims (PTU) Rehabilitation Centre.

Methods: The intervention was physiotherapy as an essential part of an individually planned multidisciplinary rehabilitation. The outcome measures Six-Minute Walk Test and Timed-Stands Test were used to assess the functional capacity. Quality of life was evaluated by Medical Outcome Survey Short Form (SF-36) and fatigue by Multidimensional Fatigue Inventory (MFI-20). Patients were tested at baseline; 3 months after the start of rehabilitation and at one-year follow-up.

Results: The patients showed significantly better functional capacity on all measurements 3 months after start of intervention and at one-year follow-up. The patients showed significant improvement in 3 of the SF-36 dimensions regarding quality of life, but only the improvement in "general health" remained after one year.

Conclusion: This study shows that patients with late effects of polio, who experience new problems related to polio, can benefit from an individually planned multidisciplinary intervention with emphasis on physiotherapy, and the improvement in physical capacity and general health can remain at one-year follow-up.

Key words: late effects of polio, functional capacity, quality of life, fatigue, multidisciplinary rehabilitation, physiotherapy.

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INTRODUCTION

Many patients with polio experience new or increased muscle weakness, fatigue, pain and a decline in functioning decades after acute poliomyelitis, also called late effects of polio or post-polio syndrome (PPS) (1, 2). The prevalence of PPS has been reported as 15–80% of all patients with polio, depending on the criteria applied (3). Approximately 6000–7000 persons in Denmark still have late effects of polio, and approximately 100 patients per year seek help at the Rehabilitation Centre of the Danish Society of Polio and Accident Victims (PTU) for

the first time. The physiotherapy offered to patients with polio is based on knowledge about best practice (3), but the results of our intervention have not yet been documented. There are only a few studies of the effect of physiotherapy on patients with polio, and thus Farbu et al. (3) concluded in the EFNS guidelines (European Federation of Neurological Societies) that further studies of therapeutic intervention are needed.

The aim of this study is to evaluate outcome of an individually planned physiotherapy programme as a part of a multidisciplinary rehabilitation to attempt to answer the questions: Do the newly referred patients improve by intervention and, if so, does this improvement remain after one year?

MATERIAL AND METHODS

Design

A prospective, uncontrolled intervention study with data collection from November 2002 to January 2005.

Subjects

Fifty patients (30 women and 20 men, mean age 58 years, age range 24–82 years) with polio sequelae referred to physiotherapy for the first time at PTU were included in the study. It was, on average, 52 years since their acute polio (range 23–74 years). Forty of the patients had their acute poliomyelitis in Denmark, 23 patients were still full- or part-time employed. The majority suffered from paresis in their legs and many used walking aids, only one was a permanently wheelchair user. For further details see Table II, where baseline data are compared with reference values (4).

The patients were included consecutively, as they were referred to physiotherapy. The patients were not diagnosed as to whether they had PPS, but all the patients had experienced new problems related to their polio diagnosis; 74% experienced a decline in muscle strength. Four patients dropped out due to concurrent illness.

Intervention

The physiotherapy was an individually planned programme based on the patient's problems. The programme consisted of many different kinds of treatments, but non-fatiguing exercises, stretching and massage were frequently used (Table I). The duration of the treatment was, on average, 1 h twice a week for 3 months (range 3–39 weeks). The range is wide, as some patients only required a little advice concerning training methods, while others required a regular treatment, i.e. reduction of pain, exercises, gait training and energy management. To maintain acquired performance the patients were offered self-training after the end of the individual physiotherapy, i.e. group gymnastics, aquatic exercise in warm water or self-training at the PTU fitness centre. Forty-two of the 46 patients trained in our fitness centre after the first 3 months, and 38 of them continued training for the whole data collection period. The patients and their relatives were offered a patient education programme including the diagnosis, training principles and energy conservation

strategies. Based on the individual needs, the patients were referred to other members of the multidisciplinary team; social workers (15 patients), psychologist (3 patients), therapists specialized in assistive devices (20 patients), and orthopaedic technicians (25 patients). Twelve patients started to use assistive devices for walking, i.e. a cane or a brace. Fourteen patients were treated with physiotherapy only.

The science ethics committee in Copenhagen, Denmark, found that this study did not need the approval of the committee. Informed consent was obtained from all patients for their participation in the study.

Outcome measures

Patients were tested at baseline, 3 months after baseline and at one-year follow-up (15 months after baseline). The outcome measures consisted of 2 tests of physical performance: 6-Minute Walk Test (6MWT – distance walked at 6 min) (5), and Timed-Stands Test (TST – duration 10 times from sit to stand) (6). The 6MWT is a measure of walking capacity and is used as outcome measure in other polio studies by Strumse et al. (7) and Gonzales et al. (8). TST was chosen as a measure of activity of daily living, but also as a measure of strength and endurance in the lower extremities.

Because other studies find that quality of life is affected in patients with polio, as shown by Nollet et al. (2) and Schanke et al. (9), we wanted to explore this in our population. The Medical Outcome Survey Short Form 36 (SF-36) was used in a Danish validated version by Bjørner et al. (10). SF-36 represents the following dimensions: Physical Functioning (PF), Role limitations due to Physical problems (RP), Bodily Pain (BP), General Health perceptions (GH), Vitality (VT), Social Functioning (SF), Role limitations due to Emotional problems (RE) and Mental Health (MH). The SF-36 is used in studies of patients with polio by, among others, Gonzales et al. (8) and Schanke et al. (9). To evaluate fatigue, which is a common problem in patients with polio (1), the Multidimensional Fatigue Inventory 20 (MFI-20) was chosen, as also used by Gonzalez et al. (8). It is a 20-item self-report instrument designed to measure fatigue introduced by Smets et al. (11) and translated in to Danish by Grønvold et al. (12). It represents the following dimensions: General Fatigue (GF), Physical Fatigue (PF), Reduced Activity (RA), Reduced Motivation (RM) and Mental Fatigue (MF). The baseline data were compared with reference values for the Danish population (Table II).

Statistical analysis

Data from SF-36 and MFI-20 were transformed into scales from 0 to 100. Statistical analyses were performed with the SPSS 13.00/SAS 9.1 statistical package. As none of the outcome parameters were normally distributed, non-parametric tests were used. Wilcoxon signed-rank test was applied to compare baseline data with data measured, respectively, 3 months and 15 months after baseline. Differences were considered significant at $p < 0.05$

Table I. Most frequently used methods in the physiotherapy treatment

	Patients <i>n</i> = 46	Treatments/ patient, <i>n</i> Mean
Individual exercise	37	9
Massage	36	9
Information on polio from individual physiotherapist	34	2
Stretching	33	8
Home training programme	33	3
Joint mobilization	19	6
Ultrasound	14	6
Walking exercise	12	2
Balance exercise	11	4
Patient education programme	35	3 times 2 h
Self training after individual physiotherapy		
Group training	2	
Fitness centre training (individual programme)	42	
Warm water exercise (individual programme)	22	

RESULTS

The comparison between the baseline data and reference values (Table II), showed that the patients with polio had significantly lower values in the 6MWT, TST and the 5 first dimensions in SF-36 and they were significantly more tired than the Danish population.

The increase in 6MWT (Table II) from 378 m to 418 m (11% improvement) 3 months later and to 419 m at one-year follow-up was statistically significant ($p=0.004$ at both measurements). The 12 patients who started to use assistive devices for walking improved their walking speed even more, by 18% ($p=0.008$). The improvements in TST from 31 sec to 27 sec 3 months later (13% improvement) and 28 sec at one-year follow-up were both significant ($p=0.001$). Three months after baseline the mean values for SF-36 in the dimensions BP, GH and VT where significantly increased ($p < 0.05$) (i.e. less pain, better health and vitality), but only in the dimension GH did it stay significantly better at the one-year follow-up ($p=0.006$). Three months after baseline MFI-20 showed a significant reduction in fatigue in the “Physical Fatigue” dimension ($p=0.004$), but the reduction was not maintained at the one-year follow-up. There were no significant differences in the other dimensions between baseline and the test 3 months later or at one-year follow-up (Table II).

DISCUSSION

This study shows that it is possible for patients with polio to improve their physical capacity and general health up to 15 months through an individually planned rehabilitation, although at the time of reference they experience a decline in physical capacity. Unlike many other studies this study

Table II. Outcome measure at baseline, 3 months after and at one-year follow-up. The reference values are calculated according to gender and age for each person, for the 6MWT, also according to height and weight according to Enright & Sherill (4). The significant differences between baseline data and reference values: # $p < 0.05$ and ### $p < 0.001$; and baseline 3 and 15 months later, respectively: * $p < 0.05$ and ** $p < 0.001$

	Ref values Mean	Baseline Mean (SD) <i>n</i> = 50	3 months Mean (SD) <i>n</i> = 47	15 months Mean (SD) <i>n</i> = 46
6MWT	518##	378 (131)	418 (122)**	419 (138)**
Timed-Stands Test	17##	31 (10)	27 (7)**	28 (8)**
MFI-20				
General Fatigue	34##	56 (29)	49 (29)	51 (28)
Physical Fatigue	36##	62 (26)	51 (24)*	56 (26)
Reduced Activity	31#	41 (29)	35 (24)	37 (30)
Reduced Motivation	20	20 (18)	16 (17)	20 (18)
Mental Fatigue	22	20 (27)	20 (28)	21 (27)
SF-36				
Physical Function	80##	56 (24)	60 (23)	54 (24)
Role Physical	74##	48(42)	60 (39)	54 (36)
Bodily Pain	76##	53 (24)	64 (23)*	57 (28)
General Health	70##	51 (22)	57 (23)*	58 (24)**
Vitality	68##	52 (27)	59 (22)*	57 (24)
Social Function	89	81 (26)	85 (23)	83 (23)
Role Emotional	82	74 (37)	83 (29)	87 (31)*
Mental Health	81	75 (19)	77 (18)	76 (20)

6MWT: Six-Minute Walk Test; SD: standard deviation; MFI-20: Multidimensional Fatigue Inventory 20; SF-36: Short Form-36.

describes the outcome of physiotherapy as a part of a multidisciplinary rehabilitation in an unselected polio population.

The significant improvement in functional capacity, at 11% measured by 6MWT and 13% at TST, may have several explanations, because the patients received multiple kinds of intervention depending on their personal needs. We assume that training and use of assistive devices are the main reasons for the physical improvement. One study shows improvement in outcome measures without intervention (13), but we consider an improvement of more than 10% to be a clinically relevant change and not just an adaptation to the test.

The reason for the discrepancy between the improvement in the physical tests and the SF-36 dimension Physical Function could be that there are only 3 measurement steps in the SF-36 (a lot, a little, not at all limited) and therefore SF-36 in this dimension will rarely detect improvements in patients with a physical disability.

The fact that 38 out of 46 patients continued their training for the whole period, could explain why the results are maintained at one-year follow-up, as training is known to improve physical endurance and strength in patients with polio, shown by Ernstoff et al. (14) and Einarsson & Grimby (15). The 12 patients who started to use ambulatory aids, such as canes, orthoses and handmade shoes, had the largest improvement in 6MWT. As this group apparently had the largest potential for improvement, it is important to be aware of ambulatory aids in the rehabilitation, as shown by Wise (16). The explanation for the significant improvement in "Physical Fatigue" in MFI-20, "Vitality" and "Bodily Pain" in SF-36 after 3 months could be a combination of training and, as mentioned by Willén & Grimby (17), focus on energy management through patient education. The improvements in 6MWT and in "Vitality" are equivalent to the medication study by Gonzalez et al. (8). The social and psychological dimensions (Table II) were not significantly different from the Danish population, determined at the SF-36 questionnaire, which was surprising, as we know from clinical practice and other studies by Schanke et al. (9), that childhood hospitalization and decrease in physical functioning later in life might affect the psychological well-being of patients with polio.

Many of the patients might have PPS, as 74% complained of a decline in muscle strength, and our study showed that, despite this, many of these patients have a potential for improvement if the training is individually designed.

A weakness of this study is that no specific treatment is assessed, and as a consequence of this design we cannot conclude which of the different interventions is the cause of the improvement.

The outcome of our study supports the results of the intervention study of treatment of patients with polio in warm climate by Strumse et al. (7), which showed improvement in both groups of patients who received an individually planned physiotherapy programme either in Norway or on Tenerife. Their study group had more severe polio than our patients and, despite this, they improved in physical tests, which supports our hypothesis that physiotherapy is an effective treatment of polio-related problems.

In conclusion, this study shows that patients with late effects of polio, who experience a decline in functional capacity, can benefit from an individually planned multidisciplinary intervention with emphasis on physiotherapy and the improvement can remain for

at least 1 year. The present results need to be confirmed in controlled trials, where specific parts of the rehabilitation programme (i.e. strength training, use of assistive devices, treatment of pain, etc.) can be tested and compared with a control group.

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REFERENCES

1. March of Dimes International Conference on Post-polio Syndrome. Identifying best practices in diagnosis & care. Warm Springs, GA, USA; 2000. Homepage on the Internet [accessed 2007 Oct 18]. Available from: URL: <http://www.modimes.org>
2. Nollet F, Beelen A, Prins MH, de Visser M, Sargeant AJ, Lankhorst JG, et al. Disability and functional assessment in former patients with polio with and without postpolio syndrome. *Arch Phys Med Rehabil* 1999; 80: 136–143.
3. Farbu E, Gilhus NE, Barnes MP, Borg K, de Visser M, Driessen A, et al. EFNS guideline on diagnosis and management of post-polio syndrome. Report of an EFNS task force. *Eur J Neurol* 2006; 13: 795–801.
4. Enright P L, Sherril DL. Reference equations, for the six minute walk in the healthy adults. *Am J Respir Crit Care Med* 1998; 158: 1384–1387.
5. Enright PL. The six-minute walk test. *Resp Care* 2003; 48: 783–785.
6. Csuka M, McCarty DJ. Simple method for measurement of lower extremity muscle strength. *Am J Med* 1985; 78: 77–81.
7. Strumse YAS, Stanghelle JK, Utne L, Ahlvin P, Svendsby EK. Treatment of patients with post polio syndrome in a warm climate. *Disabil Rehabil* 2003; 25: 77–84.
8. Gonzalez H, Stibrant K, Sjöberg I, Kaponides G, Borg K. Intravenous immunoglobulin for post-polio syndrome: a randomised controlled trial. *Lancet Neurol* 2006; 5: 493–500.
9. Schanke AK, Lobben B, Oyhaugen S. The Norwegian Polio Study 1994 part II: early experiences of polio and later psychosocial well-being. *Spinal Cord* 1999; 37: 515–521.
10. Bjørner JB, Thunedborg K, Kristensen TS, Modvig J, Bech P. The Danish SF-36 health survey: translation and preliminary validity studies. *J Clin Epidemiol* 1998; 51: 991–999.
11. Smets EMA, Garssen B, Bonke B, De Hayes JCJM. The multidimensional fatigue inventory (MFI) psychometric qualities of an instrument to assess fatigue. *J Psychosomatic Research* 1995; 39: 315–325.
12. Grønvold M, editor. Report of the translation of the Multidimensional Fatigue Inventory (MFI-20) from English to Danish. Copenhagen: Rigshospitalet; May 1997.
13. Nollet F, Beelen A, Twisk I, Lankhorst G, de Visser M. Perceived health and physical functioning in postpoliomyelitis syndrome: a 6-year prospective follow-up study. *Arch Phys Med Rehabil* 2003; 84: 1048–1056.
14. Ernstoff B, Wetterqvist H, Kvist H, Grimby G. Endurance training effect on individuals with poliomyelitis. *Arch Phys Med Rehabil* 1996; 77: 843–848.
15. Einarsson G, Grimby G. Strengthening exercise program in post-polio subjects. In: Halstead LS, Wieckers DO, editors. Research and clinical aspects of the late effects of poliomyelitis. White Plains, NY: March of Dimes Birth Defects Foundation; 1987: p. 275–283.
16. Wise HH. Effective intervention strategies for management of impaired posture and fatigue with post-polio syndrome: a case rapport. *Physiother Pract* 2006; 22: 279–287.
17. Willén C, Grimby G. Pain, physical activity and disability in individuals with late effects of polio. *Arch Phys Med Rehabil* 1998; 79: 915–919.