

chance finding. The results suggest that the risk of childhood cancer in the vicinity of these power lines is not a major public health concern. The relation between a risk of childhood cancer and exceptionally high levels of residential exposure to magnetic fields should not, however, be inferred from this study.

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Arthroscopic surgery compared with supervised exercises in patients with rotator cuff disease (stage II impingement syndrome)

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Abstract

Objective—To compare the effectiveness of arthroscopic surgery, a supervised exercise regimen, and placebo soft laser treatment in patients with rotator cuff disease (stage II impingement syndrome).

Design—Randomised clinical trial.

Setting—Hospital departments of orthopaedics and of physical medicine and rehabilitation.

Patients—125 patients aged 18-66 who had had rotator cuff disease for at least three months and whose condition was resistant to treatment.

Interventions—Arthroscopic subacromial decompression performed by two experienced surgeons; exercise regimen over three to six months supervised by one experienced physiotherapist; or 12 sessions of detuned soft laser treatment over six weeks.

Main outcome measures—Change in the overall Neer shoulder score (pain during previous week and blinded evaluation of function and range of movement by one clinician) after six months.

Results—No differences were found between the three groups in duration of sick leave and daily intake of analgesics. After six months the difference in improvement in overall Neer score between surgery and supervised exercises was 4.0 (95% confidence interval -2 to 11) and 2.0 (-1.4 to 5.4) after adjustment for sex. The condition improved significantly compared with placebo in both groups given the active treatments. Treatment costs were higher for those given surgery (£720 v £390).

Conclusions—Surgery or a supervised exercise regimen significantly, and equally, improved rotator cuff disease compared with placebo.

Introduction

Pain in the shoulder is a common medical problem. Its prevalence was 14% in a Swedish epidemiological study.¹ Work or leisure activities that entail raising the arms or working with hand tools increase the risk of

developing shoulder pain.^{2,5} The prevalence of supraspinous tendinitis was 18% among welders.³

Ischaemia, inflammation, and degeneration are related to age and overload of the tendons of the short rotator muscles and are present in rotator cuff disease.⁶⁻⁸ Impingement of the cuff and the subacromial bursa on elevation increases the pain and may contribute to long term changes. Rotator cuff disease or the impingement syndrome is classified according to its progression: acute inflammation (tendinitis or bursitis) (stage I); degeneration or chronic inflammation,⁷ or both (stage II); rupture and arthritis (stage III).⁹

Commonly, rest, analgesics, anti-inflammatory drugs, local steroid injections, and remobilisation with simple exercises will resolve most cases of tendinitis.¹⁰ The results of the long term outcome of these treatments, however, is not promising,¹¹ although open anterior and arthroscopic acromionplasty have a success rate of 80-90%.¹²⁻¹⁴ We compared arthroscopic subacromial decompression and supervised exercises in a controlled, randomised series of patients with rotator cuff disease. To our knowledge, such a study has not been published before.

Subjects and methods

SELECTION OF PATIENTS

General practitioners serving a population of half a million were invited to refer patients with rotator cuff disease.

Patients were included if they were aged 18-66; had had pain in the shoulder for at least three months that had been resistant to outpatient physiotherapy and non-steroid and steroid anti-inflammatory drugs; had dysfunction or pain on abduction; had a normal passive glenohumeral range of movement; had pain during two of the three isometric-eccentric tests (abduction at 0° and 30° and external rotation)¹⁵; and had positive results in tests for impingement.⁹ Lignocaine (6 ml; 10 mg/ml) was injected anteriorly into the subacromial space.¹⁵ The diagnosis was confirmed if pain was

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appreciably reduced on re-examination after 15 minutes.

Patients were excluded if they had arthritis of the acromioclavicular joint; had the cervical syndrome; had rotator cuff rupture; had glenohumeral instability; had bilateral muscular pain with tenderness and severely decreased ability to relax the shoulder, neck, and temporomandibular joints on examination; and were reluctant to accept one or more of the treatment regimens of the study.

All eligible patients were informed about the three treatments: arthroscopic surgery, supervised exercise regimen, or detuned laser (placebo). They were told that the placebo option was a new type of laser treatment. Treatments were allocated by the method of random permuted blocks. The ethics committee for medical research in health region I of Norway approved the study.

Of the total of 444 patients referred, 125 agreed to participate and gave their informed, signed consent (figure).

TREATMENTS

In Norway patients usually have to wait for six months to two years for elective arthroscopic surgery to the shoulder. The average time between randomisation and the first day of treatment in this study was two months in all groups.

Two experienced orthopaedic surgeons at Menighetssøsterhjemmets Hospital performed the arthroscopic surgery. The aim of the procedure is to make better space for the rotator cuff to reduce the risk of impingement. Standard treatment consisted of bursectomy and resection of the anterior and lateral

part of the acromion and the coracoacromial ligament. Postoperative rehabilitation was started on the first postoperative day. Physiotherapy was started within the first week. The exercises prescribed by the surgeon were performed against low resistance and repeated many times. Patients visited a physiotherapist where they lived, so several physiotherapists were engaged and somewhat different approaches used. Unrestricted activities were usually allowed after four to six weeks.

The patients who were randomised to receive supervised exercises and placebo laser treatment were all treated by the same experienced physiotherapist at the department of physical medicine and rehabilitation at this hospital. The purpose was to normalise dysfunctional neuromuscular patterns and to increase the nutrition of the collagen in the rotator cuff.¹⁵ To eliminate gravitational forces and to start the exercises the arm was suspended in a sling fixed to the roof. Relaxed repetitive movements (first rotation, then flexion-extension, and finally abduction-adduction) were performed for about an hour in a daily training session. Patients were supervised twice weekly. On the other days they followed the same exercise programme at home. Resistance was added gradually to strengthen the short shoulder rotator and the scapular stabilising muscles. The training continued for three to six months, with the supervision gradually being reduced. In addition, three lessons were given on the anatomy and function of the shoulder, pain management, and ergonomics.

Placebo treatment was given in 12 sessions. Each consisted of exposure to a detuned soft laser and was scheduled twice weekly for six weeks.

In all treatment groups analgesics, including anti-inflammatory drugs but not cortisone injections, were allowed.

TABLE 1—Reasons why treatment varied from that originally allocated. Values are numbers of patients

Reason	Original allocation to:		
	Arthroscopic surgery (n=13)	Placebo laser (n=4)	Supervised exercises (n=7)
Diagnosis changed	3	1	1
Adhesive capsulitis	1	1	1
Muscular pain	1		
Synovial chondromatosis	1		
Condition improved	3		1
Did not attend for follow up	4		
Lack of motivation			4
Operated on		2	1*
Had exercises	3	1	

*Did not attend for follow up.

TABLE 2—Baseline characteristics of study population according to treatment group. Values are numbers (percentages) of patients unless stated otherwise

	Arthroscopic surgery		Placebo laser		Supervised exercises	
	Intention to treat (n=45)	Treatment different (n=13)	Intention to treat (n=30)	Treatment different (n=4)	Intention to treat (n=50)	Treatment different (n=8)
Mean age (years)	48	54	48	47	47	44
Women	16 (36)	5 (39)	15 (50)	4 (100)	28 (56)	3 (38)
Duration of complaint:						
< 6 months	8 (18)	5 (39)	5 (17)	1 (25)	6 (12)	2 (25)
6 months-1 year	8 (18)	1 (8)	5 (17)	0	6 (12)	0
1-3 years	9 (20)	1 (8)	5 (17)	1 (25)	13 (26)	4 (50)
> 3 years	20 (44)	6 (46)	14 (48)	2 (50)	25 (50)	2 (25)
Bilateral pain	11 (24)	4 (31)	7 (23)	1 (25)	12 (24)	(38)
Dominant arm affected	28 (62)	9 (69)	16 (53)	3 (75)	31 (62)	6 (75)
Shoulder pain affected by work	36 (80)	11 (85)	24 (79)	4 (100)	41 (81)	7 (88)
Sickness leave:						
Currently taken	27 (60)	9 (71)	18 (60)	3 (75)	27 (54)	6 (75)
Median duration (months)	4.6	4.3	4.1	3.3	4.5	5.1
Receiving pension from work on grounds of incapacity	2 (4)	0	9 (3)	0	3 (5)	0
Unable to participate in previous leisure activities	28 (62)	9 (71)	11 (37)	2 (50)	27 (54)	4 (50)
Taking analgesics	30 (67)	8 (62)	23 (75)	3 (75)	39 (77)	3 (38)
Mean Neer score at entry:						
Overall	63.6	63.0	64.7	67.5	66.2	66.2
Pain	13.8	14.2	14.8	15.0	14.7	15.0
Function	22.3	22.0	22.1	24.0	23.0	23.0
Range of motion	17.5	16.8	17.8	18.5	18.5	18.2
Hopkins symptom checklist	1.6	1.5	1.6	1.6	1.6	1.8

OUTCOME MEASURES

Blind follow up measurements were carried out at three and six months after the first day of treatment. At follow up tests the patients wore a T-shirt to hide a possible scar from surgery. They were carefully told not to talk about their treatment.

The main outcome measure was the Neer shoulder score.^{16,17} This has three parts: scoring of pain during the previous week by patients (verbal rating scale) (35 points); clinical testing of function (muscle strength, reaching ability, and stability) (30 points) and active range of motion (25 points); and an anatomical or radiological evaluation (10 points). All radiographs were assessed as normal according to the Neer criteria, so the overall scores ranged from 10 to 100 points. The active range of motion was measured bilaterally at an accuracy of 5° while the patient was sitting. To eliminate interobserver influence on reliability all tests were assessed by the same physician (J I Brox).

Secondary outcome and demographic variables were assessed in a standard questionnaire, which was always completed before the consultation. Patients scored their degree of pain on activity, at rest, and at night during the previous week on nine point scales (1=no pain, 9=worst possible). Emotional distress was rated by the Hopkins symptom checklist (25 items).¹⁸

STATISTICAL ANALYSES

The study was planned to detect a difference of 10 points between groups, which equals a reduction from moderate to mild pain. After a pilot study the standard deviation was estimated at 13 points. With α set at 0.05 (type I error) and β at 0.10 (type II error) 36 patients were required for each treatment group to complete the trial.

We analysed the results according to the method of intention to treat. The Kruskal-Wallis one way analysis of variance rank test and the Mann-Whitney rank

always scored on nine point scales in questionnaires before the clinical examination, and they may therefore have been biased. Clinically, the modest but significant difference in verbal pain ratings (table III) between surgery and the exercise regimen is hard to interpret.

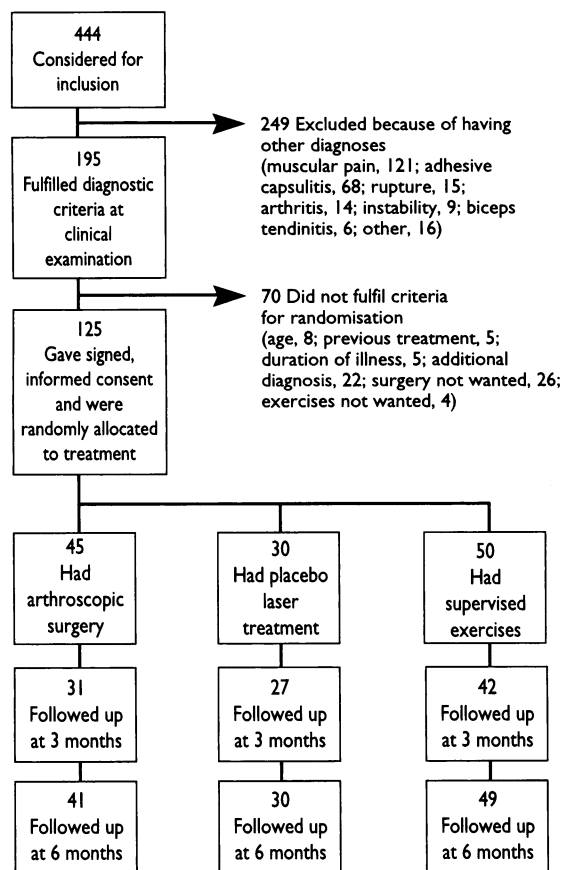
The most common reason why eligible patients were not randomly allocated to the three treatments was reluctance to undergo surgery: unexpectedly, many patients dropped out from surgery. Four of them did not attend the follow up examination at six months, which might have biased our results.

There were no differences between the groups in the use of analgesics. Other possible confounding factors such as the pain associated with working, the duration of disease, and the degree of psychological distress were equally distributed in all groups at entry (table II).

Our strict criteria for inclusion were necessary to allow for the effects of the different treatments. For that reason the external validity is low with respect to the 444 patients considered for inclusion. Despite a thorough clinical examination, five patients were misclassified (figure). They all had an excellent outcome.

Pathological changes in the rotator cuff have been attributed to mechanical impingement. The role of primary impingement as the major aetiological factor has been questioned.^{7,8,21,22} Furthermore, current techniques of subacromial decompression may not affect the structures that can enlarge the space.²³ Pain inhibition after resection of nerves and postoperative rehabilitation and analgesia may also explain the improvement in the group treated surgically.

Compared with muscle, tendons have poorer nutrition and a slower turnover.^{24,25} The long rehabilitation period observed in both actively treated groups in our study may be attributed to an effect on slowly adapting collagen tissue.



Recruitment and follow up of patients in study

Clinical implications

- Rotator cuff disease is related to overload of the short rotator muscles of the shoulder and results in pain and reduced function
- In this study patients whose condition was resistant to conventional treatment were randomised to receive arthroscopic surgery, an exercise regimen supervised by a physiotherapist, or placebo laser treatment
- After six months both active treatments were significantly better than placebo in reducing pain and improving function, but neither was significantly better than the other
- The stay in hospital accounted for the higher costs of surgery
- Rotator cuff disease may be effectively managed by a supervised exercise regimen with surgery as an alternative

We conclude that after six months of follow up both arthroscopic surgery and supervised exercises are better than placebo treatment. The difference between the two active treatments was neither clinically important nor significant, but the costs of a supervised exercise regimen were lower. Active treatment did not reduce the time of absence from work. We conclude that most cases of rotator cuff disease can be managed by a supervised exercise regimen, with arthroscopic subacromial decompression and postoperative physiotherapy as an effective alternative.

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Cost analysis of early discharge after hip fracture

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Abstract

Objective—To ascertain the economic impact of an early discharge scheme for hip fracture patients.

Design—Population based study comparing costs of care for patients who had "hospital at home" as an option for rehabilitation and those who had no early discharge service available in their area of residence.

Setting—District hospital orthopaedic and rehabilitation wards and community hospital at home scheme.

Patients—1104 consecutively admitted patients with fractured neck of femur. 24 patients from outside the district were excluded.

Main outcome measures—Cost per patient episode and number of bed days spent in hospital.

Results—Patients with the hospital at home option spent significantly less time as inpatients (mean of 32.5 v 41.7 days; $p < 0.001$). Those patients who were discharged early spent a mean of 11.5 days under hospital at home care. The total direct cost to the health service was significantly less for those patients with access to early discharge than those with no early discharge option (£4884 v £5606; $p = 0.048$).

Conclusions—About 40% of patients with fractured neck of femur are suitable for early discharge to a scheme such as hospital at home. The availability of such a scheme leads to lower direct costs of rehabilitative care despite higher readmission costs. These savings accrue largely from shorter stays in orthopaedic and geriatric wards.

Introduction

Achieving the correct balance between inpatient and community care is important in all areas of health care, but is particularly relevant to the treatment and rehabilitation of patients who have fractured their femoral neck. The incidence of hip fracture has risen over recent years¹ and will continue to do so over coming decades.² Once in hospital, hip fracture patients occupy orthopaedic beds for a long time.³ Despite the significant improvement in surgical treatment in recent years,⁴ there is still scope for change. Robbins and Donaldson noted that 51% of patient days were spent recovering from surgery without complications, and a further 28% were spent awaiting discharge after acute medical and surgical care had been completed.⁵ Given these factors it has been suggested that community services should care for patients to relieve pressure on acute services and decrease the risk of institutionalisation.⁶

The Peterborough hospital at home scheme now cares for these patients in the belief that nursing care for convalescing hip fracture patients can be carried out in the patient's home.⁷ The surgical treatment of hip fracture patients in Peterborough has been described in detail elsewhere.^{8,9} Briefly, it is based on the principle that, whenever practical, patients should be operated on immediately after admission and

mobilised shortly afterwards. Once the postoperative recovery has begun some patients are able to be discharged to the hospital at home scheme. The scheme provides care from trained nurses, nursing auxiliaries, physiotherapists, and occupational therapists in the patient's home for up to 24 hours a day under the medical supervision of the general practitioner. The service also musters social services, meals on wheels, and home helps. The amount of care is tailored to meet the patient's needs, and the scheme is generally continued for up to two weeks before other community services take over.

Previous studies of the early discharge of hip fracture patients showed no significant difference in mortality between the hospital at home group and a comparison group over a 40 month period¹⁰ and equal return of functional ability at three months.¹¹ This paper is a cost analysis comparing patients who had access to hospital at home services as an option for rehabilitation with patients who had no such early discharge scheme available. We focused on direct costs to the NHS and the impact of hospital at home on bed use in the orthopaedic and rehabilitation wards.

Patients and methods

From 1 January 1987 until 31 December 1991, 1104 patients were admitted to Peterborough District Hospital with a fractured neck of femur. Twenty four of these lived outside the hospital's catchment area and were excluded from the analysis. The remaining 1080 patients were followed up. Information was recorded on variables such as age; functional,¹² social,¹³ and mental¹⁴ status; type of treatment received; and length of stay under NHS care.

The hospital at home scheme is currently available only to patients who come from Peterborough city and the villages to the south of Peterborough. Patients resident in Stamford and villages to the north of Peterborough have no early home rehabilitation scheme available. The patients were divided into two groups on this basis.

We used the cost apportionment approach.^{15,16} The cost of treatment is broken down into its various components: hotel costs, theatre costs, medical costs, ward costs, overheads, and other treatment expenses. A distinction is then made as to which components vary with length of stay and are therefore the variable costs affected by early discharge.

The resources used by each hip fracture patient were assessed by three methods. Where possible, information on actual individual use of resources—for example, the number of minutes spent in the operating theatre and the cost of the implant each patient received—was used. The nursing time of hospital at home staff and travel costs could also be estimated directly as they are routinely recorded. The large numbers of patients under study meant that detailed individual information could not be recorded for all patients in all aspects of care. For drugs, laboratory

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