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Hip fractures in Finland and Great Britain – a comparison of patient characteristics and outcomes

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Abstract All hip fracture patients (age <50 years, pathological and subtrochanteric fractures excluded) were registered at admission to hospital and at 4 months (mortality up to 1 year) between 1989 and 1997 in Peterborough District Hospital (2083 patients) and Oulu University Hospital (1702 patients). The mean age at fracture was 80.3 years in Peterborough and 78.3 years in Oulu. Respectively, 69% and 62% of the patients had been living in their own homes, 50% and 54% had been able to walk alone unassisted. In Oulu, the patients were discharged after a mean stay of 7.1 days, most of them to health care centre hospitals (71%) and only 21% to their original place of residence. In Peterborough 81% were discharged to their original place of residence after a mean stay of 15.6 days. At 4 months, 54% were living at their own homes in Peterborough and 44% in Oulu. The overall mortality at 1 year was 27.1% in Peterborough and 24.9% in Oulu.

Résumé Tous les patients de moins de 50 ans avec une fracture de la hanche (fractures pathologiques et sous-trochantériennes exclues) ont été suivi pendant quatre mois à partir de l'admission (mortalité jusqu'à une année) durant la période 1989–1997 dans le Peterborough District Hôpital (2083 patients) et le Oulu Université Hôpital (1702 patients). L'âge moyen à la fracture était 80.3 années à Peterborough et 78.3 années à Oulu. Respectivement, 69% et 62% des patients vivaient à leur domicile, 50% et 54% étaient capables de marcher seul. A Oulu, les patients ont eu un séjour moyen de 7.1 jours, et pour la plupart d'entre eux (71%) sont allés ensuite dans des hopitaux de suite et seulement 21% à leur résidence originale. A Peterborough 81% ont regagné leur résiden-

ce initiale après un séjour moyen de 15.6 jours. À quatre mois, 54% habitaient à leur propre domicile après traitement à Peterborough et 44% après traitement à Oulu. La mortalité totale à une année était 27.1% pour Peterborough et 24.9% pour Oulu.

Introduction

The relevance of comparing hip fracture treatments in different countries, based on figures obtained from methodologically different studies with no possibility of proper statistical analysis, has not previously been considered. Differences may exist between countries with regard to background factors and outcomes related to different treatment methods. Investigation of such factors using the same setting might provide valuable possibilities to improve the treatment of hip fractures. A study of this kind may also answer the question of whether comparison of outcome studies of hip fracture treatments in different countries is justified.

A review of the literature appears to indicate that there are major discrepancies in the outcomes of patients with hip fracture treated in Great Britain and in the Scandinavian countries. In 1979 the 6-month mortality in Great Britain was reported to be 40% and 44% [2, 4], while the corresponding mortality rates in Sweden and Denmark were reported to be 19% and 21% [1, 6]. More recent studies indicate that similar differences still persist in 6-month mortality, which is 21% in Denmark and 28% in Great Britain [7, 13].

The aim of this study was to compare, in greater detail, the patient characteristics and outcomes of a large series of patients treated in two centres: Oulu, Finland, and Peterborough, UK over the same time period.

Materials and methods

In Peterborough District hospital, all patients admitted with a proximal femoral fracture have been registered using a standardised form since January 1989. Oulu University hospital has regis-

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tered all hip fracture patients using a similar standardised form. These databases were combined for comparable variables. In accordance with the standardised audit guidelines for hip fracture [8], all patients aged 50 years and over with an acute hip fracture were included. For the purpose of this comparison, pathological fractures and subtrochanteric fractures were excluded.

Peterborough District hospital

Peterborough District hospital serves the population of the city of Peterborough (150,000) and the surrounding area, which consists of rural villages and the town of Stamford. The total catchment population is approximately 330,000. The region is located in the eastern part of the country approximately 140 km north of London.

Oulu University hospital

Oulu University hospital serves the population of 115,000 of the city of Oulu and the surrounding region, the primary catchment area consisting of 43 municipalities with a total population of 365,000. The city of Oulu is situated 200 km south of the Arctic Circle on the coast of the Gulf of Bothnia. The Oulu region is one of the fastest growing urban areas in Finland and the major academic, scientific, industrial, shopping, service and cultural centre of Northern Finland.

Both hospitals are the only centres within their catchment areas to which patients with acute hip fracture are admitted. Both countries provide community support services, including help and assistance in the patient's own home.

The data recorded for all patients included age, sex, pre-fracture walking ability and walking aids, residential status, type of fracture, admission-operation delay and method of treatment. Follow-up data were collected for 120 days following the injury, including the length of stay in the primary hospital, the place of discharge and residential status. Re-operations and mortality data were also recorded for a 1-year period following the injury. To

allow meaningful comparison between the centres, the patients were divided into those with cervical (intracapsular) and trochanteric (extracapsular) fractures, and the results were analysed according to type of fracture.

Statistical analysis was performed using the SPSS statistical software (SPSS for Windows 9.0.1, SPSS Inc.). Chi-square test was performed for categorical variables, Student's *t*-test for continuous variables with normal distribution and Mann-Whitney U-test for other continuous variables.

Results

In Peterborough District hospital, 2083 hip fracture patients who fulfilled the entry criteria were admitted, while in Oulu University hospital, 1702 corresponding hip fracture patients were admitted between 1989 and 1997. In Oulu, 10 patients (0.6%) were lost to 4-month follow-up but the mortality data obtained from the Finnish Census Register using the unique identification codes assigned to each Finnish citizen was 100% complete for a 1-year period. In Peterborough, 10 patients (0.5%) did not complete the 1-year follow-up period (mean follow-up 261 days) but again any deaths within these cases could be determined from central records.

Background characteristics

Table 1 lists the patient characteristics recorded in the two centres. The mean age was 2 years older in Peterborough and there were more female patients there than in Oulu. The cervical to trochanter ratio was identical in

Table 1 Background characteristics of the patients

| | All patients | | <i>P</i> -value | Cervical | | <i>P</i> -value | Trochanteric | | <i>P</i> -value |
|-------------------------------------|--------------|--------------|-----------------|----------|--------------|-----------------|--------------|--------------|-----------------|
| | Oulu | Peterborough | | Oulu | Peterborough | | Oulu | Peterborough | |
| Number of patients | 1702 | 2083 | | 1000 | 1243 | | 702 | 840 | |
| Mean age (years) | 78.3 | 80.3 | <i>P</i> <0.001 | 77.8 | 79.3 | <i>P</i> <0.001 | 79.0 | 81.9 | <i>P</i> <0.001 |
| Women (%) | 74 | 79 | <i>P</i> <0.001 | 75 | 81 | <i>P</i> <0.001 | 73 | 77 | NS |
| Living alone ^a (%) | 56 | 47 | <i>P</i> <0.001 | 55 | 46 | <i>P</i> <0.001 | 58 | 49 | <i>P</i> <0.001 |
| Walking ability (%) | | | <i>P</i> <0.001 | | | <i>P</i> <0.001 | | | <i>P</i> <0.001 |
| Alone outdoors | 54 | 50 | | 54 | 54 | | 53 | 44 | |
| Outdoors only with someone | 11 | 29 | | 12 | 28 | | 11 | 29 | |
| Alone indoors | 25 | 18 | | 25 | 16 | | 25 | 21 | |
| Indoors with help person | 8 | 3 | | 8 | 2 | | 9 | 5 | |
| Unable to walk | 2 | 0 | | 2 | 0 | | 3 | 0 | |
| Walking aids used (%) | | | <i>P</i> <0.001 | | | <i>P</i> <0.001 | | | <i>P</i> <0.05 |
| None | 56 | 57 | | 60 | 62 | | 51 | 50 | |
| One stick | 18 | 24 | | 16 | 22 | | 20 | 26 | |
| Two sticks | 2 | 2 | | 2 | 1 | | 3 | 2 | |
| Zimmer/crutches | 20 | 17 | | 19 | 15 | | 22 | 20 | |
| Wheelchair/bedbound | 3 | 1 | | 3 | 1 | | 4 | 2 | |
| Fracture type (%) | | | <i>P</i> <0.001 | | | <i>P</i> <0.001 | | | <i>P</i> <0.001 |
| Undisplaced cervical fracture | 14 | 11 | | 24 | 18 | | | | |
| Displaced cervical fracture | 45 | 49 | | 76 | 82 | | | | |
| Basocervical fracture | 3 | 2 | | | | | 7 | 4 | |
| Trochanteric two fragment fracture | 17 | 10 | | | | | 41 | 26 | |
| Trochanteric multifragment fracture | 22 | 28 | | | | | 53 | 70 | |

^a Only applies to those who live in their own homes

Table 2 Operation data related to type of fracture

| | Cervical | | <i>P</i> -value | Trochanteric | | <i>P</i> -value |
|-------------------------------|----------|--------------|-----------------|--------------|--------------|-----------------|
| | Oulu | Peterborough | | Oulu | Peterborough | |
| Admission–operation delay (%) | | | NS | | | <i>P</i> <0.001 |
| 24 h or less | 68 | 71 | | 74 | 64 | |
| 25–48 h | 22 | 21 | | 19 | 24 | |
| 49–72 h | 5 | 3 | | 4 | 7 | |
| 73 h or more | 5 | 5 | | 3 | 6 | |
| Primary operation (number) | | | | | | |
| Osteosynthesis | 345 | 564 | | 11 | 4 | |
| Hemiarthroplasty ^a | 581 | 634 | | 22 | 6 | |
| Short Gamma nail | 5 | | | 429 | | |
| Total hip replacement | 36 | 10 | | 5 | 4 | |
| Sliding hip screw | 13 | 13 | | 225 | 805 | |
| Other method ^b | 2 | | | | 2 | |
| Girdlestone | 1 | | | 1 | | |
| Conservative treatment | 17 | 22 | | 9 | 19 | |

^a Bi- or unipolar, Thompson, Austin-Moore;

^b recon intramedullary nail, ao blade plate, medof plate

Table 3 Residential status before the fracture and at 4 months follow-up

| | All patients | | <i>P</i> -value | Cervical | | <i>P</i> -value | Trochanteric | | <i>P</i> -value |
|---------------------------|--------------|--------------|-----------------|----------|--------------|-----------------|--------------|--------------|-----------------|
| | Oulu | Peterborough | | Oulu | Peterborough | | Oulu | Peterborough | |
| Before the fracture (%) | | | <i>P</i> <0.001 | | | <i>P</i> <0.001 | | | <i>P</i> <0.001 |
| Own or rented house | 62 | 69 | | 63 | 71 | | 61 | 67 | |
| Sheltered housing | 2 | 3 | | 2 | 3 | | 2 | 3 | |
| Residential | 24 | 15 | | 24 | 14 | | 24 | 16 | |
| Nursing home | 10 | 8 | | 9 | 8 | | 11 | 9 | |
| Acute hospital | 1 | 5 | | 1 | 5 | | 1 | 6 | |
| Other | 1 | 0 | | 1 | | | 1 | | |
| At 4 months follow-up (%) | | | <i>P</i> <0.001 | | | <i>P</i> <0.001 | | | <i>P</i> <0.001 |
| Own or rented house | 44 | 54 | | 45 | 59 | | 42 | 48 | |
| Sheltered housing | 1 | | | 1 | | | 1 | | |
| Residential | 15 | 14 | | 16 | 14 | | 13 | 14 | |
| Nursing home | 23 | 9 | | 20 | 8 | | 26 | 10 | |
| Acute hospital | 1 | 7 | | 2 | 6 | | 0 | 8 | |
| Other | 1 | | | 1 | | | 2 | | |
| Dead | 15 | 16 | | 15 | 13 | | 15 | 22 | |

the two centres, but there were slightly more displaced cervical and trochanteric multi-fragment fractures in Peterborough. Slightly more patients in Oulu were able to walk unassisted outdoors, and they more often used walking aids.

Operation data

In both hospitals, the majority of fractures were operated on within 24 h after admission (Table 2), but there were more delayed operations for trochanteric fractures in Peterborough. Uncemented Austin-Moore hemiarthroplasty was used extensively for intracapsular fractures in both centres and was the treatment of choice for cervical fractures in Oulu, whereas the hemiarthroplasty to osteosynthesis ratio in Peterborough was close to 1. For trochanteric fractures, the sliding hip screw (SHS) was the only method used in Peterborough. In Oulu, one third of

the trochanteric fractures were treated using SHS and the rest using a short Gamma nail. For 1.5% of the patients in Oulu and 2.0% in Peterborough, the treatment of the fracture was conservative.

Rehabilitation

At the time of injury, more patients had been living in their own homes in Peterborough than in Oulu (Table 3). The distribution was almost the same in the cervical and trochanteric fracture groups. The mean period of hospitalisation in the primary orthopaedic ward was 7.1 days (median 6) in Oulu and 15.6 days (median 11) in Peterborough (*P*<0.001). The management of the patients following surgery was also markedly different in the two centres. In Oulu, 60% of the patients were discharged early from the orthopaedic ward to health care centre hospitals. This mode of rehabilitation was not used in

Peterborough, where 81% of the patients returned to their original place of residence directly from the orthopaedic ward. The corresponding figure in Oulu was 21%. At 4 months' follow-up, more patients were living in their own homes in Peterborough. In Oulu, 44% of the cervical and 41% of the trochanteric fracture patients admitted from their own homes were living at their own homes at 4 months' follow-up. The respective figures for Peterborough were 53% for cervical ($P<0.001$) and 43% for trochanteric patients ($P=0.412$).

Re-operations

The 1-year re-operation rate for cervical fractures was higher for osteosynthesis but, contrariwise, lower for hemiarthroplasty in Peterborough than in Oulu (Table 4). For trochanteric fractures in Oulu, the reoperation rate for short Gamma nail was two times higher than that of SHS, while the rate for SHS fixation in Peterborough was half of that in Oulu.

Mortality

One-year overall mortality was 27.1% in Peterborough and 24.9% in Oulu, the difference was not statistically significant (Table 5). Nor did the difference in overall

Table 4 Reoperation rates at 1 year (%)

| Primary operation | Oulu | Peterborough | <i>P</i> -value |
|-------------------------------|------|--------------|-----------------|
| Osteosynthesis | 15.2 | 20.6 | 0.045 |
| Hemiarthroplasty ^a | 9.0 | 3.8 | <0.001 |
| Short Gamma nail | 11.8 | | |
| Sliding hip screw | 6.7 | 3.2 | 0.022 |
| Total hip replacement | 9.8 | 0.0 | 0.562 |

^a Bi- or unipolar, Thompson, Austin-Moore

Table 5 One-year mortality

| | Oulu | | Peterborough | | <i>P</i> -value |
|------------------------|----------------------------|---------------|----------------------------|---------------|-----------------|
| | Total <i>n</i> of patients | Mortality (%) | Total <i>n</i> of patients | Mortality (%) | |
| Overall | 1702 | 24.9 | 2083 | 27.1 | 0.137 |
| Operated patients | 1674 | 24.6 | 2042 | 26.5 | 0.186 |
| Males | 426 | 32.6 | 420 | 36.4 | 0.248 |
| Females | 1248 | 21.8 | 1622 | 23.9 | 0.194 |
| Cervical fractures | 982 | 23.7 | 1221 | 23.1 | 0.723 |
| Undisplaced | 229 | 22.3 | 208 | 20.8 | 0.728 |
| Displaced | 753 | 24.2 | 1013 | 23.5 | 0.778 |
| Internal Fixation | 365 | 15.9 | 577 | 22.0 | 0.023 |
| Hemiarthroplasty | 581 | 29.4 | 634 | 24.4 | 0.052 |
| Trochanteric fractures | 646 | 25.4 | 788 | 32.0 | 0.007 |
| Two fragment | 278 | 24.8 | 208 | 27.4 | 0.532 |
| Multifragment | 368 | 25.8 | 580 | 33.6 | 0.011 |
| Short Gamma nail | 423 | 27.9 | | | |
| Sliding Hip Screw | 214 | 21.0 | 775 | 31.7 | 0.002 |
| Basicervical fractures | 46 | 30.4 | 33 | 21.2 | 0.443 |
| Total hip replacement | 41 | 9.8 | 14 | 14.3 | 0.638 |

mortality of cervical patients reach the limit of statistical significance, even though it varied significantly within the treatment groups: mortality for internal fixation was 15.9% in Oulu and 22.0% in Peterborough ($P=0.023$), the respective figures for hemiarthroplasty being 29.4% and 24.4% ($P=0.052$). For trochanteric fractures, mortality was statistically significantly lower in Oulu, 25.6% compared with 32.8% ($P=0.003$). A corresponding difference was seen in the patients with SHS fixation: 21.0% compared with 31.7% ($P=0.002$).

Discussion

Only a small number of studies have been undertaken to compare patient characteristics and outcomes following hip fracture in different countries, using similar variables for reporting [3, 5]. In a study of operation methods and rehabilitation routines for hip fractures in Rotterdam, the Netherlands, and in Sundsvall and Lund, Sweden, by Berglund-Rödén et al. [3], it was concluded that despite the different ways to solve the overall treatment of hip fractures, a similar functional outcome was achieved after 4 months. Jalovaara et al. [5], who prospectively compared hip fracture treatment and rehabilitation in Oulu, Finland, and in Sundsvall and Lund, Sweden, attributed the differences in outcome to be due to choice of treatment methods and rehabilitation routines used both of which were strongly influenced by the choices made by the orthopaedic surgeons and the traditions and the structural facilities for local medical care. It was concluded in both studies that all the details reported as basic data in these type of international multi-centre hip fracture studies gave the possibility of a more refined analysis of the results of operative methods and rehabilitation programs.

The comparison of outcomes in the two centres that participated in this study was possible because both cen-

tres had undertaken a full audit of the outcomes of all patients. For any comparison to be valid, it is essential to have a consecutive series of patients with identical inclusion and exclusion criteria and identical outcome measures. In addition, a sufficient number of cases are required, as in this study. Oulu University Hospital has participated in a prospective multi-centre study of operative methods and rehabilitation routines for hip fractures, which was first started in Sweden (Rikshöft) [5, 14]. Three standard forms have been used: one for preoperative functional variables and operative data, another for functional variables registered at 4 months' follow-up and a third for re-operations. In Peterborough an ongoing prospective audit and research project has recorded details of all hip fracture patients treated at that hospital since 1986.

The populations of hip fracture patients in the two centres were similar but not identical, the patients in Peterborough being an average of 2 years older and having a lower male-to-female ratio. In Oulu, fewer patients were living in their own homes, but of those living at home, a greater number were living alone. We consider this a cultural difference. Of the background factors, the use of walking aids is strongly influenced by the culture and the climate. For example, Finnish municipalities provide walking aids free of charge for their inhabitants. Walking ability, especially the patient's ability or inability to walk alone outdoors, is the most reliable variable in the evaluation of patients' functioning, as we think it is least influenced by the differences between the countries. It turned out that the patients with cervical fracture had slightly poorer functional capacity at the time of the fracture in Peterborough compared to Oulu. In addition, some of the differences in the distribution of the sub-categories of fracture types may be explained by errors in the classification process.

In Oulu, half of the operations are nowadays performed by trainee surgeons on a training scheme and only one fifth by qualified orthopaedists. In Peterborough, there is a hip fracture project in progress, in which hip fracture patients are managed by a specialised team and, whenever possible surgery is performed by one surgeon [10]. Early discharge of patients is also encouraged [11].

Some differences were apparent in the choice of the surgical treatment. In Oulu, hemiarthroplasty is the primary mode of treatment for cervical fractures, as it is in almost every hospital in Finland. Osteosynthesis is only used for younger patients with a fairly good pre-fracture ambulatory capacity. Total hip replacement is performed on patients with arthrosis or rheumatoid arthritis. Gamma nail is the primary fixation method for trochanteric fractures and the SHS is used as an alternative when preferred by the surgeon. In Peterborough, the Austin-Moore hemiarthroplasty was also used extensively for intracapsular fractures, but a greater proportion of displaced cervical fractures in the elderly were treated by internal fixation as part of an ongoing randomised trial comparing internal fixation with arthroplasty [9]. The higher revision rate in this group of patients for osteo-

synthesis accounts for the higher revision rate after internal fixation in Peterborough. The lower re-operation rate for hemiarthroplasty in Peterborough may be explained by the routine use of the anterior surgical approach, whereas in Oulu the posterior approach was used, and the main reason for re-operation in Oulu was dislocation of the prosthesis. The other reasons for the lower overall re-operation rate in Peterborough is the use of a specialised surgeon to perform or supervise the majority of the surgical procedures [12].

The main difference between the two centres was the mode of discharge following surgery. In Oulu, hip fracture patients were routinely discharged from the orthopaedic ward to health care centre hospitals or rehabilitation units as soon as the patient's general medical condition allowed. Therefore, the percentage of patients returning to their original place of residence was low. As was noted earlier by Jalovaara et al. [5], when, in the group of patients originally coming from their own homes, the mean hospitalisation time in the orthopaedic ward was related to the percentage of patients discharged directly to their own homes, an almost linear relationship was found. In Peterborough, the patients were generally kept in the admission unit in the orthopaedic ward until discharge to their own homes or their original places of residence. This is reflected in the outcomes at 120 days, with a greater proportion of patients being back at their own homes in Peterborough. This difference may also reflect the availability of institutional care in these centres.

In summary, this large comparative audit of hip fracture patients indicates that the characteristics of hip fracture patients and their final outcomes in terms of mortality are similar in two European countries. Some differences were apparent in the types of treatment and the methods of rehabilitation, which influenced the re-operation rate and the length of hospital stay. Further, large comparative audits between different centres are recommended to assist in finding the optimal method of treating hip fractures.

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