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Consumption of hospital resources for femoral neck fracture

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In 1,673 patients with femoral neck fracture, the utilization of hospital and rehabilitation resources following primary operations and necessary reoperations was assessed in relation to type of treatment center and outcome of the fracture. All the patients were admitted from their homes to either orthopedic or general surgery departments, urban or rural. The fractures were treated by one of four osteosynthesis methods and followed for 6 years postoperatively.

About 30 per cent of the fractures developed healing complications. Patients treated in surgical departments utilized more acute and rehabilitation bed days than those treated in orthopedic departments. The patients stayed longer in city surgical departments than in rural surgical departments.

The Thornton osteosynthesis used by general surgical specialists resulted in 29 percent, mainly early complications, whereas the Rydell osteosynthesis used by orthopedic specialists had 24 percent, mainly late complications. This difference resulted in more than 40 percent higher consumption of bed days by the Thornton-nailed patient.

In sum, a fracture without complications consumed, on an average, 31 cost standardized bed days compared with 101 bed days for fracture with complications. Thus, every fracture with complications was SEK 112,000 more expensive than the complication-free one.

The technologies for treatment in orthopedics, including choice of operative methods and the rehabilitation schemes, have for many years been based on a mixture of local tradition and newly developed methods. In fracture treatment the introduction of new methods is usually based on published follow-up experience of the clinical outcome for the patients in terms of function and complications.

With the increasing costs of medical care, an analysis of the resource consumption for different diagnoses and types of treatment becomes important as well. This is particularly imperative for the femoral neck fracture because it has become a heavy social and economic burden to the health care system (Owen et al. 1980, Jensen et al. 1980, Söreide et al. 1980, Bauer 1985, Holmberg 1985). We report the effect of different techniques for treatment of femoral neck fracture on costs in terms of consumption of hospital resources in a large population of femoral neck fractures treated with primary osteosynthesis.

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Patients and methods

During a 3-year period, 1975–1977, 3,053 patients with femoral neck fracture were treated in Stockholm County (SC), of which 2,418 (79 percent) were admitted from their own homes (Holmberg and Thorngren 1987). From this material a subset of patients was studied. We included patients over 50 years of age admitted from their homes, operated on with osteosynthesis, and even after necessary reoperation were eventually discharged to their homes. They numbered 1,673; 75 percent

were females (mean age 74 years) and 25 percent were males (mean age 70 years).

The patients were divided into three groups: patients operated on 1) at five orthopedic departments (811 patients), 2) at three central city general surgical departments (604 patients), and 3) at four rural general surgical departments (258 patients). A further subclassification of each of these groups was made according to the outcome of the treatment: no complications (1,186 fractures, 71 percent) or complications (487 fractures, 29 percent), such as early displacement (214 fractures), pseudarthrosis (93 fractures), and segmental collapse (180 fractures). In the orthopedic departments, four types of osteosyntheses were used: von Bahr, Rydell, Nyström, and Thornton. In the general surgical departments, von Bahr screws were mostly used.

When rehabilitation in the acute care hospital did not progress satisfactorily, the patients were discharged either to a long-term care hospital or to a convalescent home. Patient referral to different hospitals in Stockholm County is strictly based on defined catchment areas for each hospital department. This makes population-based comparisons possible. Access to beds in long-term hospitals was similar for all the catchment areas based on their population above 70 years of age.

The average length of stay in days (LOS) was recorded from the patient records, separating the time spent in acute hospitals and rehabilitation units. As for patients readmitted because of fracture complications, the total average LOS was calculated for all the primary and rehabilitation care. Patients primarily treated at surgical departments were, in the event of complications, in the majority of instances readmitted there before referral to orthopedic departments for reoperation, after which they were referred back to the surgical departments. The hospital stay during nail extraction was considered only if this operation was done because of a complication of fracture healing. Other nail extractions were mostly performed on an out-patient basis.

All the patients were followed for a minimum of 6 years regarding complications and hospital stay following the fracture. The bed-day cost for 1985 was calculated by personnel in the administrative office of each institution. The average bed-day cost in an orthopedic or general surgical department was set at a unit of 1.0 corresponding to SEK 1,600 in 1985. The cost for a rehabilitation bed day was then 0.5 units. The average consumption of bed days in different institutions was converted to total LOS using the same method as for the cost calculation (one LOS = one acute bed day = two rehabilitation bed days).

The mean age of the patients returning home through rehabilitation units was 6 years higher (75 years) than that of the patients returning directly

Table 1. Consumption of hospital resources (LOS) for patients with noncomplicated outcome following osteosynthesis of femoral neck fracture. All the patients admitted from their own homes and eventually returned there. Range in parenthesis

	Discharged							
	Directly home				Home via rehabilitation unit			
Treatment department	n	%	Mean age	Acute LOS	n	Mean age	LOS Acute	LOS Rehabilitation
Orthopedic	340	58	69	18 (17–19)	250	74	22	21
City surgical	137	33	69	23 (20–26)	276	75	24	47
Rural surgical	109	60	67	25 (20–32)	74	74	33	26
Total	586	53	69	21	600	75	24	34

Table 2. Consumption of hospital resources (LOS) for patients with complicated outcome following osteosynthesis of femoral neck fracture. All the patients admitted from their own homes and eventually returned there

Treatment department	n	Mean age	LOS Acute	LOS Rehabilitation	Total mean LOS	Complication rate
Orthopedic	221	70	49	54	76	27
City surgical	191	74	63	117	121	32
Rural surgical	75	71	75	98	124	29
Total	487	72	59	86	101	29

to their homes (69 years; Table 1). In all, 58 and 60 percent, respectively, of the patients admitted to orthopedic and rural surgical departments were discharged directly to their homes, whereas from central city hospitals only 33 percent were similarly discharged (Table 1). On an average, 29 percent of the fractures developed complications, such as early redisplacement, pseudarthrosis, or segmental collapse (Table 2). Fractures treated at surgical departments had a higher rate of complications than those treated at orthopedic departments.

The average total rate of complications was slightly higher for the Thornton osteosynthesis (29 percent) than for the Rydell nail (24 percent) used by orthopedic specialists (Table 3). However, most of the complications with the Thornton nail were early ones, with two thirds within three months. Most of the complications after Rydell osteosynthesis were late segmental collapses (67 percent of the complications with the Rydell nail).

Results

In all the series, patients referred to rehabilitation units stayed longer in the acute hospitals than those discharged directly to their homes (Table 1). Patients with fracture complications consumed three to four times as many acute and rehabilitation bed days as those with a noncomplicated fracture outcome (Tables 1 and 2). The average stay in acute and rehabilitation departments was similar for both of these osteosyntheses in cases without fracture complications when operated on at an orthopedic department (Table 3). Patients developing complications after Thornton osteosynthesis, however, stayed 50 percent longer in an acute hospital and more than three times as long in rehabilitation departments than those treated with the Rydell nail (Table 3). Patients treated with von Bahr osteosynthesis in general surgical departments had a slightly higher complication rate (29 percent) compared with orthopedic departments (23 percent). The distribution of early and late complications, however, was similar between the treatment centers. The consumption of both acute and rehabilitation resources was about twice as high in surgical departments compared with orthopedic departments after von Bahr osteosynthesis (Table 3).

The cost for hospitalization for patients admitted from their homes with no complication of the femoral neck fracture was SEK 43,000 when the patients were treated in orthopedic departments and SEK 68,000 in surgical departments. When the fractures developed complications, the cost more than tripled to SEK 137,000 and SEK 220,000 at orthopedic and surgical departments, respectively (Table 4). Thus, fractures treated at

Table 3. Average consumption of hospital resources related to type of osteosynthesis and healing complications of the fracture

Osteosynthesis method	n	Noncomplicated LOS Acute	Noncomplicated LOS Rehab	Complicated Percent Total	Complicated Percent Early/Late	Complicated LOS Acute	Complicated LOS Rehab
Thornton[a]	54	20	12	29	64/36	43	77
Rydell[a]	104	17	10	24	33/67	30	22
von Bahr[a]	66	23	15	23	55/45	34	37
von Bahr[b]	146	25	30	29	57/43	60	80

[a] Operated on by orthopedic specialists.
[b] Operated on by general surgical specialists.

Table 4. Cost of femoral neck fracture treatment in SEK. The cost is calculated on the average acute bed-day cost for 1985 in Stockholm County

Department	Noncomplicated n	Noncomplicated Total mean LOS	Noncomplicated Cost per fracture	Complicated n	Complicated Rate	Complicated Total mean LOS	Complicated Cost per fracture	Total cost per fracture
Orthopedic	590	24	43,000	221	27%	76	137,000	68,000
General surgery	596	38	68,000	266	31%	122	220,000	115,000

a general surgical department were, on an average, almost twice as expensive (SEK 115,000) as those treated at an orthopedic department (SEK 68,000).

Discussion

In previous studies (Söreide et al. 1980, Jensen et al. 1980, Jarnlo et al. 1984) some economic aspects of treatment of femoral neck fractures have been discussed within a single department with established treatment procedures. Stockholm County has a population of 1.5 million, comprising about one fifth of the Swedish population. Altogether, there are 12 hospitals where femoral neck fractures are treated in different ways (Holmberg et al. 1987) and with different attitudes to the rehabilitation of the patients (Holmberg and Thorngren 1985).

The mean age of the patients in all three groups was fairly low, indicating rather healthy patients. At least two thirds of these patients could be discharged directly to their homes from the the acute hospital according to the experience of Ceder (1980). The low frequency of home discharge from the city surgical hospitals, however, may reflect a more liberal attitude to institutional rehabilitation.

It has been reported that the utilization of rehabilitation hospitals for rehabilitating patients there instead of in the patient's home will reduce the length of stay in the acute hospitals (Jensen and Tøndevold 1980). However, in the present study the patients transferred to rehabilitation departments stayed even longer in the acute hospital than those directly discharged to their homes (Table 1). The mean age, however, was higher in Jensen's group, thus increasing the probability of additional diseases that may necessitate further rehabilitation care.

The high consumption in the present study compared with other studies (Jensen and Tøndevold 1980, Holmberg 1985, Zetterberg et al. 1985) of acute and rehabilitation bed days after complications of the fractures might be related to the long follow-up time of minimally 6 years, where complications after reoperations also have been considered in the total number of bed days.

The type of complication directly affects the consumption of hospital resources. Early complications often jeopardize the rehabilitation efforts, for the patient does not dare to apply weight on the operated on leg because of instability. These patients cannot be discharged to their homes, but must go to a rehabilitation unit until a reoperation breaks their disability. Late complications, such as segmental collapse, usually do not occur until 1–2 years after the operation, and can be handled as elective cases admitted from their homes, with a minimum of additional acute hospital stay during reoperation. Patients treated with a Thornton nail had the highest rate of especially early complications (Table 3), indicating an unstable fixation with this nail (Frandsen and Andersen 1981). This was reflected by a greater consumption of both acute and rehabilitation bed days than by those treated with the Rydell nail. Thus, we fully agree with the statement that the Thornton type of osteosynthesis should be abandoned (Frandsen and Andersen 1981).

Patients with a fracture complication after treatment at general surgical departments had a higher average acute LOS than those treated at orthopedic departments (Table 3). One reason for this could be that fracture cases with complications had to be referred to orthopedic departments for reoperation. These patients were in many instances admitted to general surgical departments both before and after being transferred to orthopedic departments for reoperation. Such irrational procedures might indicate that hip fractures should be treated at departments with full professional capacity to handle the fracture both primarily and after any complications that may arise.

A fracture without complications costs, on an average, SEK 25,000 more when treated at a general surgical department than at an orthopedic department (Table 4). This difference most likely reflects a less active attitude to rapid mobilization followed by early discharge of patients to their homes at the surgical departments (at least in the central city) as compared with the orthopedic departments. This difference in attitudes amounted to a total cost of SEK 15 million in this limited study.

There are several reasons for the differences in costs between orthopedic and surgical departments. One is the higher rate of complications in general surgical departments. Another concerns differences regarding rehabilitation, as is indi-

cated by a higher consumption of acute and rehabilitation resources by general surgical departments as compared with orthopedic departments after von Bahr osteosyntheses (Table 3). Also the lack of expertise in treating complications at general surgical departments resulted in additional unnecessary consumption of acute bed days following complications of the fractures. Altogether, the cost differences of treatment policy between the two types of treatment centers amounted to SEK 47,000 per fracture, which is SEK 39 million totally in this selected study. With this background, the total cost of a femoral neck fracture depends on three main factors: viz., 1) the technique used for primary treatment, 2) the method used for patient rehabilitation, and 3) the skills available at the treatment center for handling fracture complications.

Considerable improvements in the total treatment of hip fractures can be accomplished if interest and efforts are focused on these patients, as shown by Ceder (1980), Jarnlo et al. (1984), Bauer (1985), and Zetterberg et al. (1985). In spite of the increased incidence of hip fractures (Lewinnek et al. 1980, Zetterberg and Andersson 1982, Swanson and Murdoch 1983, Wallace 1983), the treatment programs started in Lund and Gothenburg have resulted in an increased proportion of patients being directly discharged to their own homes after operation in combination with decreased hospitalization time (Jarnlo 1984, Bauer 1985, Zetterberg et al. 1985). If all femoral neck fractures were treated by experienced orthopedic surgeons with optimal osteosynthesis methods, and with a policy of early discharge and home rehabilitation, considerable consumption of hospital resources could be saved.

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