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Published in:
Acta Orthopaedica Scandinavica

DOI:
10.1080/00016470310018252

2003

Link to publication

Citation for published version (APA):
Olsson, C., Petersson, C., & Nordquist, A. (2003). Increased mortality after fracture of the surgical neck of the humerus: a case-control study of 253 patients with a 12-year follow-up. *Acta Orthopaedica Scandinavica*, *74*(6), 714-717. https://doi.org/10.1080/00016470310018252

Total number of authors:
3

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Increased mortality after fracture of the surgical neck of the humerus

A case-control study of 253 patients with a 12-year follow-up

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Submitted 02-10-17. Accepted 03-03-31

Background **Several studies have shown a higher mortality rate in patients with osteoporosis-related fractures of the hip and vertebrae.**

Method **In 1999, we did a long-term follow-up case-control mortality study of 253 patients, mean age 72 years, who had sustained a fracture of the surgical neck of the humerus in 1987.**

Results **We found a higher mortality in fracture patients giving at end point a cumulative survival difference of 16%. The median survival time was 8.9 years in patients and 12 years in controls (p = 0.005). The mortality rate was higher in men during the first 3 years after fracture and fewer than half of the male patients survived this period. The median survival time was 6.5 years in male patients and 12 years in their male controls (p = 0.02). The mortality was only slightly higher in women (p = 0.06).**

Interpretation **Cardiovascular disease and malignancy were the commonest causes of death in both groups. We could not explain the higher mortality rate in patients with a fracture of the surgical neck of the humerus.**

Several studies on osteoporosis-related fractures, especially of the hip and vertebrae have shown higher mortality rates, especially in elderly men, but only a few have evaluated the rates after other types of osteoporotic fractures—i.e., those that did not affect the hips and vertebrae. The Dubbo study, a population-based study of osteoporosis including men and women above 60 years of age, found an association between higher rates and the latter types of fractures in a cohort of patients, but it included fractures of the proximal humerus (Miller 1978, Sernbo 1988, Baudoin et al. 1996, Cooper 1997, Center et al. 1999).

We determined these rates and the causes of death after fracture of the surgical neck of the humerus and compared them with a sex- and age-matched control group.

Patients and controls

In 1987, we did a prospective epidemiological study of injuries to the shoulder in an urban population, which included 269 patients with a fracture of the surgical neck of the humerus (Nordqvist and Petersson 1995). In 1999, they were reevaluated in a follow-up study. We excluded 8 children, aged 0–14 years old, 1 patient who had his fracture recorded twice and 1 with bilateral fractures. The records of 6 other patients were not available. Thus, 253 patients, 199 women and 54 men with an average age of 72 (22–98) years (women 74 (22–98) years, men 66 (24–90)) years were studied. 2 age- and sex-matched controls were randomly selected from a community data register at the time of injury in 1987. The controls, like the patients, resided in the same community, but no other socioeconomic or physical matching was done. It later became clear that, due to a delay in computer registration, several controls had already died when they were included in the study. Therefore the records of only 475 controls were available.

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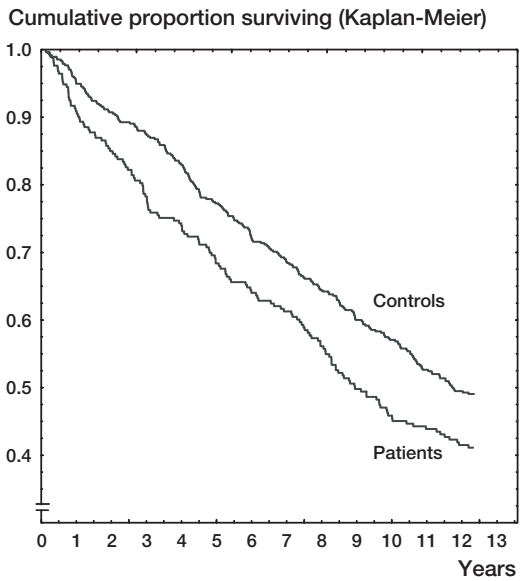

Cumulative proportion of patients surviving with fracture of the surgical neck of the humerus and that of their age- and sex-matched controls.

The date of death was obtained from the community data register. Information about the cause of death was obtained from the national register on mortality rates, which is continuously updated on the basis of death certificates.

Approval was obtained from the local ethics committee.

Statistics

The baseline data are presented as means and range. Survival curves were estimated by the Kaplan-Meier method. Gehan's Wilcoxon probability calculation was used to compare the samples. All calculations were done with STATISTICA 99.

The level of significance was set at $p < 0.05$.

Results

At follow-up 12 years after fracture, 104 patients (41%) and 233 controls (47%) were still alive. Their mean age at death was 79 years in all men, and 86 years in all women. The mortality rates of the patients rose during the first years after the shoulder trauma. After the initial 3 years of follow-up, they were similar in patients and controls and resulted in an end point cumulative survival difference of 16%. Thus, the median survival time after the shoulder trauma was 8.9 years in patients and 11.8 years in controls ($p = 0.005$) (Figure).

The median survival times were 6.5 years, and 11.8 years in male patients and their controls, respectively ($p = 0.02$), versus 9.0 years in female patients and 11.5 years in their controls ($p = 0.06$).

According to data from the national register on mortality rates, cardiovascular disease was the most frequent cause of death in males, both patients and controls. In men, 63% of the patients and 45% of the controls died of cardiovascular disease during the observation time (ns). In women, 55% and 51% of the patients and controls, respectively, died of cardiovascular disease. Malignancies were the second commonest diagnosis in this material (Table).

Certified causes of death in patients and controls

	Men				Women				Total	
	Patients		Controls		Patients		Controls			
Cause of death	n	%	n	%	n	%	n	%	n	%
Cardiovascular	20	63	23	45	64	55	97	51	204	52
Malignancies	3	9	9	17	15	13	35	18	62	16
Central nervous system	0	0	5	10	9	8	17	8	31	8
Respiratory	3	9	5	10	10	9	12	6	30	7
Gastrointestinal	2	7	3	6	4	3	11	6	20	5
Endocrine	0	0	1	2	5	4	5	3	11	3
Collagen diseases	1	3	1	2	5	4	3	2	10	3
Genitourinary	3	9	1	2	0	0	3	2	7	2
Nonspecific	0	0	3	6	5	4	8	4	16	4
Sum	32	100	51	100	117	100	191	100	391	100

Discussion

Fractures of the upper part of the humerus are common, yet little is known about their medical consequences. The SOF study, including 9704 postmenopausal women in the US, suggested that it is unlikely that fractures of the proximal humerus increase the mortality rate, as it did in women after vertebral and hip fractures (Browner et al. 1996). We found a higher mortality rate, mainly in men, of whom fewer than half survived 3 years after the fracture. This survival pattern is similar to that reported in many studies of hip fracture, with an increase in the mortality rate 6–18 months after the fracture and a higher mortality rate in men than in women (Gordon 1971, Miller 1978, Jensen and Tøndevold 1979, Holmberg et al. 1986, Sernbo and Johnell 1993, Cooper 1997).

In the literature, the mortality rate after humerus fractures is rarely discussed and, if mentioned, it is usually analyzed together with other fractures that do not affect the hips and vertebrae. This makes it difficult to compare the data with our findings (Center et al. 1999, Cauley et al. 2000). In our study, the commonest causes of death in patients and controls were cardiovascular disease and malignancies—i.e., the same as in patients with vertebral fractures (Cooper et al. 1993).

Poor general health has been suggested as a significant contributory cause of the higher mortality rate in men with osteoporosis-related fractures (Baudoin et al. 1996). Center et al. (1999) found a higher mortality rate in men with fractures that did not affect the hips and vertebrae and suggested that osteoporotic bone is a more likely marker of underlying poor health in men than in women in whom fragility fractures are commoner. The relation between low bone mass and fragility fractures is well known, and in our series with a fracture of a classic fragility site, it would be interesting to know whether there is a correlation between low bone mass and a higher mortality rate. Low bone mass predicts proximal humerus fractures in women (Kelsey et al. 2002) and serves as an independent predictor of mortality (Johansson et al. 1998). However, we know of no study that has specifically determined the bone mineral density of the proximal humerus. Measurements of the distal forearm have shown a relationship between low bone mass and a shorter than average life expectancy in men (Gärdsell and Johnell 1993). Thus low bone mass could partly explain the higher mortality rate we found.

Our study was limited to patients seeking medical attention for a fracture of the surgical neck of the humerus and who agreed to participate. Only a few male patients were included, but they are nevertheless representative of all consecutively-treated patients with fractures of the surgical neck of the humerus in our hospital during 1 year. A few cases may have ben missed, but estimates in our city have shown that fewer than 3% of the patients with a fracture are treated by a private orthopedic surgeon (Jónsson et al. 1993). Major fractures are referred to our hospital and we believe that in 1987, virtually all surgical neck fractures of the humerus in Malmö were treated by us.

Death certificates are usually based on clinical examination and medical records and hardly any on autopsy findings. Moreover, the frequency of death certificates based on autopsies did not seem to be higher in either group. Therefore the certificates are in our opinion a source of reliable data.

No competing interests declared.

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