

A Prospective Study of Urinary Retention and Risk of Death after Proximal Femoral Fracture

NIGEL K. G. SMITH, MOHAMMED K. ALBAZZAZ

Summary

Older age, dementia syndrome and impaired mobility are well recognized risk factors for fatality after fracture of the proximal femur. Urinary retention is recognized as a common complication of elective total hip replacement. In this investigation, we estimated the incidence of urinary retention associated with hip fracture in older women and assessed its relationship to 2-year post-operative fatality.

Over a 7-month period, 309 women aged 65 and over were admitted to one trauma unit with hip fracture. Readings of post-voiding residual volume were taken on admission (pre-operative), within 24 hours of operation (post-operative) and 5–7 days post-operatively (recovery).

Of the 309 patients, 244 (79%) had readings of post-voiding residual volume taken on admission; 90/244 (37%) had retention pre-operatively, 122/216 (56%) post-operatively and 40/183 (22%) in the recovery phase. One year after operation 305 patients were traced and median follow-up was 2 years. Older age, cognitive impairment, polypharmacy, impaired mobility and urinary retention on admission and during recovery were associated with a higher fatality in the first post-operative year.

Pre-operative urinary retention is common among older women with proximal femoral fracture and affects over half post-operatively. Retention is one of several factors associated with higher fatality.

Introduction

Proximal femoral fracture is regarded as a complication of osteoporosis. The incidence of hip fracture rises exponentially with age and risk of fracture is related to measures of bone mass. Cognitive impairment, age and pre-fracture disability are well recognized risk factors for fatality in the first 6 months after a proximal femoral fracture [1, 2]. A prospective study of 518 patients found that life expectancy was related to a four-point scale of social dependence before the fracture [1]. A study involving 279 proximal femoral fractures identified 'residence in an institution' as a factor predicting fatality, in addition to impaired mental function. Pre-existing medical illnesses, such as diabetes, have also been found to influence survival following fracture [3].

Post-operative urinary retention is the inability to void with a full bladder during the post-operative period. It may be identified by symptoms ('not passing urine'), urethral catheterization or ultrasound. Studies of catheterization reveal that urinary retention occurs in over half of women following elective total hip replacement [3, 4]. Reports of randomized, controlled trials in patients undergoing total hip replacements recommend peri-operative catheterization to prevent retention [4, 5] but this recommendation has not been implemented in the operative fixation of hip fracture in the United Kingdom.

It is now possible to measure post-voiding residual volume by means of portable ultrasound, so that urinary retention can be identified using an easily repeatable, non-invasive and well tolerated method [6].

We prospectively studied 309 consecutive women aged 65 and over presenting with proximal femoral fracture to one trauma unit to estimate the incidence of pre- and post-operative urinary retention and identify their correlates.

Patients and Methods

A daily register was kept of all women aged 65 and over admitted to the University Hospital, Nottingham with proximal femoral fractures between 13 December 1990 and 10 July 1991. The study was approved by the University Hospital Ethical Committee. The object of the study was explained to patients and they were invited to undergo an ultrasound examination, which provided additional information of value in their peri-operative care.

An abbreviated mental test score [7] was administered by the two observers and a medical history was taken, including past medical diagnoses, such as stroke, urinary symptoms, present medications, circumstances of fall, duration of lie, site of fracture and living accommodation. Pre-morbid mobility was assessed using modified functional ambulation categories [8] (1 = fully ambulant, including stairs, 2 = usually independent, not stairs, 3 = walking with supervision, 4 = walks with aids or careful supervision, 5 = bed- or chair-fast).

We recorded the operative procedures undertaken, the type of anaesthesia and use of analgesia. We made daily visits to the

wards to record urinary symptoms and operative complications, until the patients were discharged from hospital.

A Bladderscan BVI 2000 portable ultrasound [Diagnostic Ultrasound, PO Box 2655, Kirkland, WA 98083] was used to take two measurements of post-voiding residual volume. Each patient was given the opportunity to void. Non-weight-bearing patients were transferred to a bedpan by two nurses. Two readings of post-voiding residual volume (PVRV) were made with the patient lying supine. The highest reading was used for analysis as recommended [6]. Two observers (N.K.G.S. and M.K.A.) recorded all the bladder volumes. The equipment and techniques of both observers were validated alongside catheterized volume in over 100 examinations of female patients aged 65–95. Inter- and intra-observer variation had been assessed and found to be negligible.

We took three readings of PVRV: pre-operative—within 24 hours of admission to hospital; post-operative—within 24 hours of operation; and recovery—5–7 days post-operatively. If the patient was catheterized at any time in hospital, we recorded the volume of urine drained in the first hour after catheterization. We defined urinary retention as a PVRV > 300 ml.

After discharge, patients were traced using the hospital information system or by contacting their general practitioners.

Statistical analysis: We divided the data into four age groups and used a χ^2 test to search for age trends. Patients who had measurements of PVRV were compared with the 'absent data' group using variance analysis including a non-parametric test, the Kruskal–Wallis H. We analysed the relationship between urinary retention and other variables using the Mantel–Haenszel procedure to estimate the corrected odds ratios for each factor across the four age groups. Kaplan–Meier survival curves were calculated and a step-wise Cox's regression was used to identify factors which influenced survival. We used the statistical package, SPSS-X3.

Results

Patient characteristics: Three hundred and nine women aged 65–103 (median age 83 years) were admitted over the 7-month period. Two-thirds (211) were admitted from home and three-quarters (239) fell indoors. For 27 women details of their falls were unobtainable and 20 patients walked after their fall, unaware of their fracture until between 1 and 4 days later. Of the remaining 262 patients 226 (80%) lay for less than 1 hour after falling.

Fracture of the femoral neck (230) was commoner than trochanteric fracture (79). One hundred and eighty-two patients (60%) were taking two or more medications and the commonest prescribed drugs were nonsteroidal anti-inflammatory drugs and diuretics. Analgesia was received by 188 women on admission, almost exclusively diclofenac 75 mg intramuscularly. The commonest past medical conditions were stroke (39), diabetes mellitus (26), Parkinson's disease (11) and psychiatric disorder (9). Over a third of patients (111/287, 39%) scored less than 7/10 on mental testing, indicating possible cognitive impairment.

Of the 309 patients, 299 (97%) underwent operation and for over three-quarters this was within 2 days of

admission. Three patients died pre-operatively and seven were judged too ill for operation. The commonest procedures were insertion of a dynamic hip screw (115) and hemi-arthroplasty (99). Operations lasted between 30 and 200 minutes, median 60 minutes; 239 patients had a general anaesthetic, 60 patients had epidural anaesthesia, 59 received local anaesthetic peri-operatively, one patient had a morphine epidural.

Post-operative progress: Five patients developed wound infections. Forty-six patients died in hospital (15%). The main causes of death were myocardial infarction, stroke and pneumonia. Median length of hospital stay was 28 days (interquartile range 14–50 days).

Association with age: Younger patients were more likely to live at home with a partner, to fall outdoors, to score fully on mental testing and to be independently mobile. Older patients tended to sustain trochanteric fractures, had a higher fatality and were less likely to be discharged home (Table I).

Urinary retention: Post-voiding residual volumes were obtained in 244 cases (79%) on admission to hospital. Forty-four patients were not examined because they were operated on within hours of admission to hospital. No differences were found in age or mental test score between those included and those not included.

An estimate of residual volume was made in 73% of subjects post-operatively and 62% in the recovery phase. Four subjects refused to undergo repeat ultrasound examinations. Residual volumes could not be obtained from patients with indwelling catheters. By the fifth post-operative day, 89 patients (29%) had indwelling catheters which prevented a measure of PVRV being taken.

Post-voiding residual volume: PVRV ranged from 0 to greater than 1 litre at all three sample points. Median PVRV was 120 ml on admission, 397 ml post-operatively and 0 ml in the recovery period. Retention was commoner in older age groups (Table II); two-thirds of patients with retention on admission remained in retention throughout the study. No relationship was found between pre-operative urinary symptoms and no residual volume. The commonest symptom experienced by a sub-sample of 100 patients with post-operative urinary retention was urinary incontinence (34%), followed by no urine output (27%) and asymptomatic (25%); 14% had frequency, small volumes and nocturia. Symptoms were of no value in predicting bladder volume. Pre-morbid mobility, mental test score, number of medications being taken, duration of lie, fracture site and use of intramuscular analgesia showed no relation to retention. No relationship was found between retention and delayed operations, spinal anaesthesia, procedure undertaken or length of operation.

The median period of follow-up was 2 years and 132 deaths were identified. There were 90 deaths in the first post-operative year: a fatality of 29%. Life tables are

Table I. Association of age with other variables, percentages in brackets

	Age-group				χ^2 for linear trend	p
	65-69 (n = 18)	70-79 (n = 82)	80-89 (n = 152)	90-103 (n = 57)		
Living at home	17 (94)	69 (84)	100 (66)	25 (44)	30.6	< 0.00001
living alone	8/17 (47)	26/69 (38)	56/100 (56)	18/25 (77)	7.6	< 0.01
Indoor fall	10 (56)	51 (62)	126 (83)	52 (91)	24.6	< 0.00005
Duration of lie \geq 1 h	1/16 (6)	6/80 (8)	21/137 (15)	8/49 (16)	2.68	0.1
Mental test score < 7/10	2/18 (11)	12/75 (16)	61/142 (43)	36/52 (69)	41.2	< 0.00001
Stroke	2 (11)	11 (13)	31 (20)	3 (5)	0.88	0.4
\geq 2 medications	10 (55)	49 (60)	92 (62)	31 (56)	0.089	0.8
Drugs affecting bladder	6 (33)	35 (43)	49 (32)	20 (35)	2.59	0.5
Mobility score > 3/5	4/18 (22)	29/81 (36)	65/149 (44)	32/54 (59)	10.26	< 0.005
Trochanteric fracture	1 (6)	17 (21)	43 (28)	20 (35)	7.48	< 0.01
Fatality	1 (6)	6 (7)	24 (16)	15 (26)	10.2	< 0.005
Survivors admitted from home and discharged home	16/16 (100)	57/65 (88)	65/87 (75)	6/17 (35)	22.2	< 0.00001
Length of stay \geq 6 weeks	0	26 (32)	51 (34)	21 (37)	4.76	< 0.05

The numbers in parentheses are percentages.

shown for urinary retention, mental test score, age group and mobility score. PVRV on admission and recovery, mental test score and mobility score influence 3-year fatality after femoral fracture (Figures 1-4, Table III).

Discussion

Ours is the first study to have investigated retention on admission to hospital with a fracture. Urinary retention was present in a third of patients with proximal femoral fractures before their operation. Over half had retention within 24 hours of operation and about one in five had persistent retention 5-7 days post-operatively.

The median functional bladder capacity for women aged 70 and over is reported to be 300 ml [J. Malone-Lee, personal communication, 1989], and has been used as a criterion for retention in a previous study [9] and was suggested by Lapides and co-workers as the

volume associated with bladder over-distension and a higher risk of infection [10]. Symptoms were a poor guide to the bladder volume; incontinence of urine was the commonest symptom associated with retention.

Our estimate of post-operative urinary retention (POUR) is close to estimates after total hip replacement [4, 5]. The finding of retention before operation is previously unreported; its incidence rose from 20% in the 65-69 age group to 50% in 90-year-olds. Retention appeared to be short-lived in the majority of women aged under 75, while nearly half of those aged 90 and over were in retention a week after operation.

Table II. Association of age with the incidence of retention and proportion of patients with PVRV \geq 300 ml in four age groups

	Pre-operative	Post-operative	Recovery
Age group:			
65-69	3/15 (20)	9/16 (56)	0/13 (0)
70-79	20/66 (30)	29/61 (48)	11/56 (19)
80-89	42/114 (29)	60/105 (57)	17/89 (19)
90-103	25/49 (51)	24/34 (71)	12/25 (46)
χ^2 for trend	6.88	2.93	8.81
p	< 0.01	0.09	< 0.005

The numbers in parentheses are percentages.

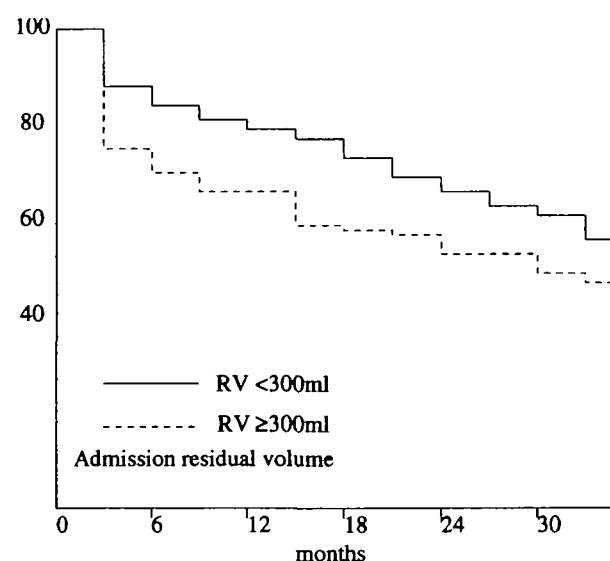


Figure 1. Survival plot related to admission residual volume. Lee-Desu statistic = 5.5; df = 1; p = 0.019.

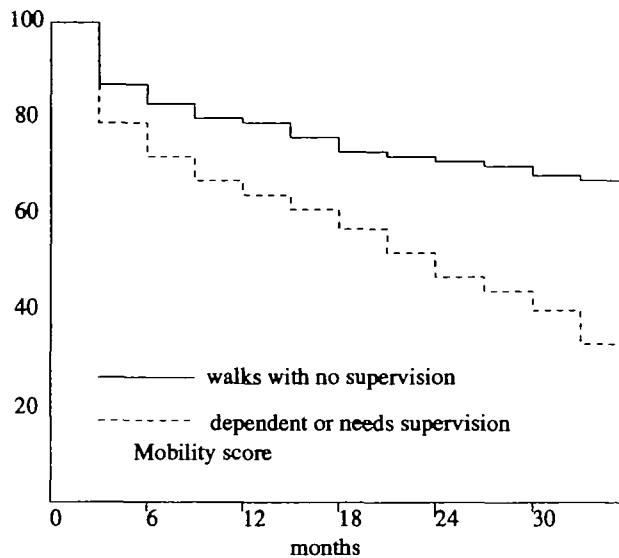


Figure 2. Survival plot related to mobility score. Lee-Desu statistic = 16.0; df = 1; $p = 0.0001$.

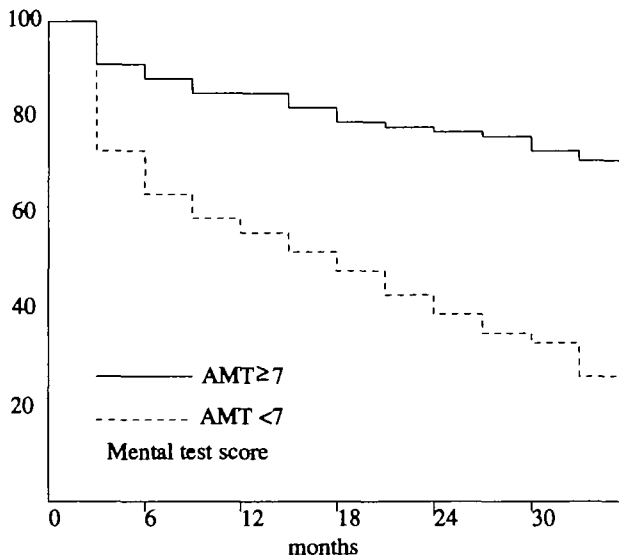


Figure 3. Survival plot related to mental test score. Lee-Desu statistic = 46.1; df = 1; $p = 0.0000$.

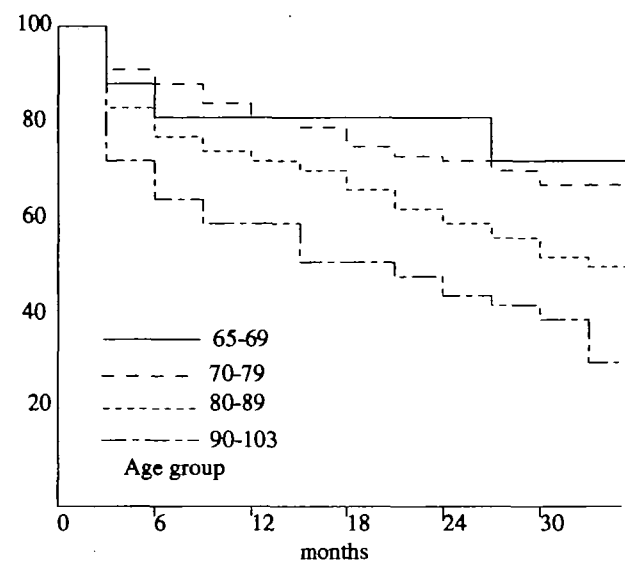


Figure 4. Survival plot related to age group. Lee-Desu statistic = 16.7; df = 3; $p = 0.0008$.

Our own unpublished study of PVRV among older women living at home reveals that retention is rare in this age group. Among 62 older women aged 65–92, 95% had a PVRV of less than 50 ml. Retention may be a marker of general ill-health, carrying with it a higher risk of death.

Two patterns of fatality are seen. Admission residual volume and number of medications appear to affect fatality particularly in the first 6 months, after 6 months, survival proportion is roughly parallel in the two groups. Other risk factors, such as older age group and impaired mental test score and mobility score lead to higher fatality throughout the observation period. Mental test score was by far the most influential factor, followed by recovery residual volume and mobility score.

The use of portable ultrasound reveals that older women with proximal femoral fractures are at high risk of developing urinary retention. Retention is present before operation and appears to be triggered by some factor related to the fall or fracture. Operation

Table III. Results of forward, step-wise Cox's regression of survival (days)

	B	SE	Wald	df	p	R
Mental test score/10	−0.14	0.025	33.4	1	0.0000	−0.15
Mobility score/5	0.18	0.079	5.09	1	0.024	0.047
Recovery PVRV (ml)	7.6×10^{-4}	3.2×10^{-4}	5.86	1	0.016	0.053
Variables not in the equation:						
Number of medications			2.54	1	0.11	0.020
Age (years)			1.21	1	0.27	0.000
Pre-operative PVRV (ml)			0.74	1	0.39	0.000
Post-operative PVRV (ml)			1.01	1	0.32	0.000

Overall score: $\chi^2 = 68.0$; df = 3; $p < 0.0001$.

contributes further to the prevalence of retention which is often prolonged. Retention of urine needs to be excluded in patients presenting with urinary incontinence. Urinary retention is associated with higher hospital fatality.

Acknowledgements

We thank Dr Carol Coupland, Lecturer, Department of Public Health Medicine and Epidemiology, University Hospital, Nottingham, for advice on data analysis. This study was supported with a grant from the Nuffield Foundation.

References

1. Jensen JS. Determining factors for mortality following hip fractures. *Injury* 1984;**15**:411–14.
2. Kreutzfeld J, Haim M, Bach E. Hip fractures among the elderly in a mixed urban and rural population. *Age Ageing* 1984;**13**:111–19.
3. Grimley Evans J, Prudham D, Wandless I. A prospective study of fracture of the proximal femur: incidence and outcome. *Public Health* 1979;**93**:235–41.
4. Ritter MA, Fains PM, Keating EM. Urinary tract catheterisation following total joint arthroplasty. *Orthopaedics* 1989;**12**:1085–7.
5. Michelson JD, Lotke PA, Steinberg ME. Urinary bladder management after total joint replacement surgery. *N Engl J Med* 1988;**319**:321–6.
6. Ireton RC, Krieger JN, Cardenas DD, *et al.* Bladder volume determination using a dedicated, portable scanner. *J Urol* 1990;**143**:909–11.
7. Hodkinson HM. Evaluation of a mental test score for the evaluation of mental impairment in the elderly. *Age Ageing* 1972;**1**:223–8.
8. Wade DT, Wood VA, Heller A, Maggs J, Langton Hewer R. Walking after stroke. *Scand J Rehabil Med* 1987;**19**:25–30.
9. Abrams PH, Dunn M, George N. Urodynamic findings in chronic retention of urine and their relevance to the results of surgery. *Br Med J* 1978;**2**:1258–60.
10. Lapidus J, Diokno AC, Silber SJ, Lowe BS. Clean intermittent self-catheterisation in the treatment of urinary tract disease. *J Urol* 1972;**107**:459–61.

Authors' addresses

N. K. G. Smith
Department of Health Care of the Elderly,
University Hospital, Nottingham NG7 2UH

M. K. Albazzaz
Department of Integrated Medicine,
Grantham and District General Hospital,
Lincolnshire NG31 8DG

Received 26 August 1995