Age and sex influences on fall characteristics

T W O'Neill, J Varlow, A J Silman, J Reeve, D M Reid, C Todd, A D Woolf

Abstract

Objective—To investigate age and sex influences on fall characteristics.

Methods—A total of 1243 subjects (517 males and 726 females) aged 50 years and over and drawn from population based sampling frames were invited to complete an interviewer administered questionnaire concerning descriptive characteristics of falls experienced in the previous four months. Information collected included details about the part of the body to strike the ground, direction of the fall, level of trauma and whether or not injury or fracture was sustained.

Results—One hundred and seventy two subjects reported a fall in the previous four months. Restricting analysis to the 142 subjects who fell from a standing height or less, females aged 50-64 years were more than twice as likely to fall onto their hand compared with older females (odds ratio (OR) = 2.2; 95% confidence interval (CI) 0.8 to 6.2) and at all ages (50+) were more than three times as likely to fall on their hip compared with males (OR = 3.4; 95% CI 1.0 to 11.5). Compared with older males, males aged 50-64 were more likely to fall sideways (OR = 5.1; 95% CI 1.5 to 17.4) and less likely to fall forwards (OR = 0.4; 95% CI 0.1 to 1.1).

Conclusion—There is a potentially clinically important variation in fall type by age and sex. In particular, this variation might explain patterns of occurrence of hip and Colles' fracture.

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of falls with age may be responsible for the plateau in incidence of Colles' fracture during the mid-60s, older women being less likely to fall on an outstretched hand and thus less prone to Colles' fracture⁸; however, there is little empirical evidence to support this hypothesis.

We investigated fall characteristics in a population sample of males and females aged 50 years and over to assess whether variation in fall type may contribute to differences in the epidemiological patterns of wrist and hip fracture by age and sex.

Patients and methods

The subjects who participated in this study were recruited during the course of a large multicentre prevalence survey of vertebral osteoporosis (the European Vertebral Osteoporosis study) in four centres: Aberdeen, Truro, Cambridge, and Harrow. The detailed methods are described elsewhere.⁹ In brief, each centre was invited to recruit subjects aged 50 years and over from population based sampling frames using primary care age sex registers. Stratified sampling was used with sex and five year age bands (50-54, 55-59, 60-64, 65-69, 70-74, 75+) as stratification groups. Subjects received a letter of invitation to attend. In the four centres a consecutive sample of approximately 76% of participants were invited to complete a short interviewer administered questionnaire concerning falls. A follow up letter was sent to those who failed to attend and, to some, a third letter.

Subjects who reported falling in the previous four months were asked further details concerning their most recent fall. Questions were asked about first part of the body to strike the ground (hip, buttock, hand), direction (forwards, backwards, to the side), the level of trauma (fall from standing height or less, fall from greater than standing height, external trauma), and whether fracture or other injury (laceration, bruising, or abrasion) was sustained. Odds ratios (OR) and 95% confidence intervals (CI) were used to examine the influence of age and sex on fall characteristics. OR is a measure of the degree of association between an exposure and an outcome variable: an OR greater than 1 implies an *increased* likelihood of outcome as a result of a particular exposure variable. The statistical analysis was performed using STATA.¹⁰

Results

There were 517 males, mean age 65 years (range 50-95) and 726 females, mean age 64.4 years (range 50-95). Each centre recruited

ARC Epidemiology
Research Unit,
Manchester
University,
Manchester M13 9PT,
United Kingdom
T W O'Neill
J Varlow
A J Silman

Bone Disease Research
Group, MRC Clinical
Research Centre and
Northwick Park
Hospital, Harrow,
Middlesex, United
Kingdom
J Reeve

Department of
Rheumatology, City
Hospital, Aberdeen,
United Kingdom
D M Reid

Health Services
Research Group,
Institute of Public
Health, University of
Cambridge, United
Kingdom
C Todd

Department of
Rheumatology, Royal
Cornwall Hospital,
Truro, Cornwall,
United Kingdom
A D Woolf

Correspondence to:
T W O'Neill.

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The descriptive epidemiology of the common osteoporotic fractures is well characterised.^{1 2} The incidence of Colles' fracture increases in females from age 35-39 until the mid-60s and then plateaus, the fracture being four to five times more frequent in females than in males.³ In contrast, the incidence of hip fracture increases exponentially with age with a twofold female excess.^{1 2} A reduction in bone mass⁴ and an increase in fall frequency⁵ are in part responsible for the increased incidence of these fractures with age, and there is some evidence that sex differences in Colles' fracture may in part be explained by differences in fall frequency.⁶ Other factors, including orientation of falls and the protective response to trauma are also thought to play a role in pathogenesis,⁷ though there are few data exploring their potential influence on patterns of occurrence of osteoporotic fractures. It has been proposed that changes in the orientation

Table 1 Descriptive characteristics of fall type by age and sex

	Male		Female	
	<65 yr (n = 29)		<65 yr (n = 42)	
	No.	(%)	No.	(%)
Direction of fall				
Forwards	11	(38)	26	(62)
Backwards	5	(17)	9	(21)
To the side	13	(45)	7	(17)
Don't know	0	(0)	0	(0)
Part of body to hit ground first				
Hand	9	(31)	13	(31)
Hip	2	(7)	7	(17)
Buttock	7	(24)	8	(19)
Other	11	(38)	13	(31)
Don't know	0	(0)	1	(2)

Table 2 Influence of age and sex on fall type: odds ratio and 95% confidence intervals

	<65 yr v ≥65 yr		Female v Male
	Males	Females	All ages
Direction of fall			
Forwards	0.4 (0.1 to 1.1)	1.1 (0.5 to 2.6)	1.5 (0.8 to 3.0)
Backwards	1.3 (0.3 to 5.1)	1.4 (0.5 to 4.0)	1.3 (0.5 to 3.1)
To the side	5.1 (1.5 to 17.4)	0.7 (0.3 to 2.1)	0.6 (0.3 to 1.2)
Part of body to hit ground first			
Hand	1.2 (0.4 to 3.6)	2.2 (0.8 to 6.2)	0.8 (0.4 to 1.6)
Hip	NC†	1.2 (0.4 to 3.8)	3.4 (1.0 to 11.5)
Buttock	1.5 (0.4 to 5.3)	1.7 (0.5 to 5.6)	0.7 (0.3 to 1.6)
Other	0.8 (0.3 to 2.1)	0.4 (0.2 to 1.0)	1.0 (0.5 to 2.0)

†Not calculated, because of small numbers.

approximately 300 subjects (range 294–328); the overall response rate for participation was 55%. In all, 172 subjects (74 (14%) males and 98 (13%) females) reported a fall in the previous four months. Of these, 83% (84 female, 58 male) occurred from a position of a standing height or less; subsequent analysis focused on these individuals. Compared with males, females were more likely to suffer an injury (self reported) as a result of their fall (OR = 2.7; 95% CI 1.3 to 5.4), though there was no difference in the small proportion who sustained a fracture. In total, six (4%) falls resulted in fracture—three in males (one wrist, two other) and three females (one wrist, one humerus and one other). Table 1 presents the descriptive characteristics of fall type by sex and age (65 years or more *v* less than 65 years) and table 2 gives odds ratios and 95% confidence intervals for the relationship of these characteristics between: males, 50–64 yr *v* 65+ yr; females, 50–64 yr *v* 65+ yr; all ages (50+ yr), females *v* males. Compared with older females, young females were more likely to fall on their hand (OR = 2.2; 95% CI 0.8 to 6.2). In addition females (both age groups) were more than three times more likely to fall on their hips than men (OR = 3.4; 95% CI 1.0 to 11.5). Compared with older males, young males more frequently fell to the side (OR = 5.1; 95% CI 1.5 to 17.4) and were less likely to fall forward (OR = 0.4; 95% CI 0.1 to 1.1).

Discussion

In this population based study, women aged less than 65 years were more likely to report that they hit their hand on the ground in a fall compared with women over the age of 65. The data are thus consistent with the hypothesis that the plateau in incidence of Colles' fracture

may be attributable to changes in the type of fall with age.⁸ In a recent study of women aged 65 and over, Nevitt *et al* showed that those aged over 74 were less likely to fall on their hand compared with those aged 65–74.¹¹ Our data suggest that changes in the type of fall occur at an earlier age and at a time coincident with the plateau in incidence of Colles' fracture.

Nevitt *et al* found an increased risk of hip fracture as a result of falls on or near the hip.¹¹ In our study, while the period prevalence of falls was similar between the sexes, females at all ages were three times more likely to report a fall on their hip compared with males. Mechanical factors and neuromuscular protective responses appear to be important in the pathogenesis of hip fracture, particularly in the elderly,^{12 13} and the increased susceptibility to hip trauma may therefore be a factor contributing to the female excess of fracture,² though clearly the effect would be additional to the excess risk due to sex differences in bone mass. Falls to the side or straight down also have been associated with an increased risk of hip fracture.¹¹ In our study, young men were more likely to report a fall on to their side compared with older men; however, the incidence of hip fracture in this age group is very low and any influence of fall type likely to be unimportant. Furthermore, the confidence intervals of our estimates are wide, especially for falls to the side, and therefore the data require care in interpretation.

Our study was retrospective and inquired about falls in the previous four months. Retrospective surveys relying on recall are subject to error both in terms of the occurrence of an event and its timing. This method of inquiry is nevertheless the most practical approach to estimating the characteristics of falling,¹¹ which was the major focus of our analysis. It seems unlikely that there would be non-random misclassification as a result of recall bias between the reported fall characteristics in the age and sex groups compared. It is also appropriate to consider the impact of non-response bias resulting from the overall response rate of 55%. For the reasons discussed above in relation to recall, any bias in the comparisons analysed as a result of non-response would be present only if both age (or sex) and fall characteristics were independently related to non-response, and this seems unlikely.

In summary, we have reported descriptive characteristics of falls in a population sample of men and women. There is a potentially clinically important variation in fall type by age and sex and in particular this variation might explain patterns of occurrence of hip and Colles' fracture. Further research is required to confirm the findings and to explore possible mechanisms for the observed differences.

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