

# THE SIGNIFICANCE OF AN ABSENT ANKLE REFLEX

M. G. BOWDITCH, P. SANDERSON, J. P. LIVESEY

*From the Northern General Hospital, Sheffield, England*

**We assessed the prevalence of abnormal ankle reflexes in 1074 adult patients attending orthopaedic clinics and related it to age. Those with possible pathological causes of reflex loss were excluded.**

**The absence of one or both reflexes was significantly related to increasing age; all patients under 30 years had both reflexes. Few had absent reflexes between 30 and 40 years, but over 40 years, the proportion with both reflexes absent increased rapidly from 5% (40 to 50 years) to 80% (90 to 100 years). Unilateral absence did not show the same pattern of increase being 3% to 5% at 40 to 60 years and 7% to 10% at over 60 years.**

**Our results suggest that a significant number of 'normal' adults have unilateral absence of an ankle reflex, but this finding is rare enough to be a definite clinical sign, irrespective of age.**

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A patient with low back pain or sciatica and an absent ankle reflex is often seen by orthopaedic and spinal surgeons. An absent ankle reflex has been described as a definite neurological sign, possibly indicating nerve-root compression (Maurice-Williams 1987; Frymoyer 1991; Donaghy 1993; Dickson and Butt 1995).

For a clinical test to have useful significance, it must have a high specificity and sensitivity with positive or negative predictive values. Useful predictive values depend strongly on prevalence (Altman 1991a). The predictive value and the significance of an absent ankle reflex in respect to nerve-root compression therefore depend on the

prevalence of absence in 'normal patients' from the same population. Medical causes of absent ankle reflexes such as vitamin deficiency, endocrine or inflammatory neuropathies and vascular disorders (Maurice-Williams 1987) must be excluded.

The prevalence of absent ankle reflexes in the normal adult 'orthopaedic' population is uncertain. Several authors have studied elderly populations by clinical (Critchley 1931; Howell 1949; Smith 1956; Bryndum and Marquardsen 1964; Milne and Williamson 1972) and electrical methods (Bhatia and Irvine 1972); most of them report an increase in prevalence of absent ankle jerks after the age of 70 years. There is some controversy over the pathological significance of this finding (Ellenberg 1960; Bryndum and Marquardsen 1964) but it has been attributed to a peripheral neuropathy caused by either arteriosclerotic obstruction of the vasa vasorum or subclinical vitamin B deficiency (Bryndum and Marquardsen 1964). These studies have examined small select numbers of elderly patients over the age of 60 years and have not tried to exclude known medical causes.

We have studied the prevalence of absent ankle reflexes in a 'normal' orthopaedic population.

## PATIENTS AND METHODS

Between May and November 1994 we made a prospective study of the presence or absence of ankle reflexes in 1074 adult patients attending the orthopaedic outpatient department in two hospitals. Patients under 16 years of age and those with a past or present history of spinal disease, low back pain or sciatica, diabetes mellitus and neuropathic or systemic medical disease (including rheumatoid arthritis) which are associated with absent reflexes, were excluded. There were 541 men and 533 women with an age range of 16 to 99 years.

The patients were examined by one of the authors using a standard reflex hammer, in three positions:

- sitting on a padded chair or couch with lower legs hanging free;
- kneeling on a padded chair with the feet over the edge (Monrad-Krohn and Refsum 1964); and
- lying on the bed either supine, with legs bent at the knee and rotated outwards at the hip and the ankle in gentle dorsiflexion (Monrad-Krohn and Refsum 1964), or in the lateral position with some knee flexion and the ankle in a neutral position (Bhatia and Irvine 1972).

To minimise interobserver error the examiner alone

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M. G. Bowditch, BSc, FRCS, Orthopaedic Registrar  
West Suffolk Hospital, Hardwick Lane, Bury St Edmunds, Suffolk IP33 2QZ, UK.

P. Sanderson, FRCS Ed(Orth), Senior Orthopaedic Registrar  
J. P. Livesey, FRCS, Senior House Officer  
Northern General Hospital, Herries Road, Sheffield S5 7AU, UK.

Correspondence should be sent to Mr M. G. Bowditch at 41 Saffron Road, Histon, Cambridge CB4 4LJ, UK.

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**Table I.** The numbers of male and female patients and the outcome of their ankle reflex examination in each age group

Age (yr)	Reflex outcome					
	Both present		Both absent		One absent	
	M	F	M	F	M	F
16 to 20	19	19	0	0	0	0
21 to 30	75	58	0	0	0	0
31 to 40	63	45	1	2	0	1
41 to 50	71	61	1	3	2	2
51 to 60	76	66	6	7	5	2
61 to 70	63	55	31	25	6	7
71 to 80	43	57	32	36	7	11
81 to 90	19	21	16	33	3	7
91 to 100	1	2	1	12	0	1
Totals	430	384	88	118	23	31
		814		206		54

decided between presence or absence of the reflex. A reflex was recorded as present if elicited in any of the above positions and absent if not obtained even after reinforcement or attempts to relax the patient. The age and sex of the patient were also recorded.

Fifty patients were examined separately by each of the authors and the results compared. The kappa value (Altman 1991b) was then calculated to assess the interobserver error.

The results from all patients were considered in nine groups, each representing a decade.

**Statistical analysis.** The percentage proportion (prevalence) and its 95% CI limits for each result of the reflex examination namely 'both present', 'both absent' or 'one absent' at each age group were calculated. The relationship between the prevalence of absent (one or both) ankle reflexes and increasing age was assessed using the chi-

**Table II.** The prevalence (% proportion of total) of each ankle reflex outcome and the 95% CI for both male and female patients in each age group

Age (yr)	Total patients	Reflex outcome					
		Both present		Both absent		One absent	
		%	95% CI	%	95% CI	%	95% CI
16 to 20	38	100.0	-	0.0	-	0.0	-
21 to 30	133	100.0	-	0.0	-	0.0	-
31 to 40	112	96.4	93 to 99.8	2.7	-0.3 to 5.6	0.9	0.8 to 2.6
41 to 50	140	94.7	90.5 to 98.1	2.9	0.1 to 5.6	2.9	0.1 to 5.6
51 to 60	162	87.7	82.6 to 92.7	8.0	3.8 to 12	4.3	1.2 to 5.6
61 to 70	187	63.0	56.2 to 70	30.0	23 to 36	7.0	3.3 to 10
71 to 80	186	53.7	46.6 to 60.9	36.6	29.7 to 43.5	9.7	5.4 to 14
81 to 90	99	40.4	30.8 to 50.1	49.5	39.6 to 59.3	10.1	4.2 to 16
91 to 100	17	17.6	-0.5 to 35.7	76.5	66.2 to 86.8	5.9	-5.3 to 17.1

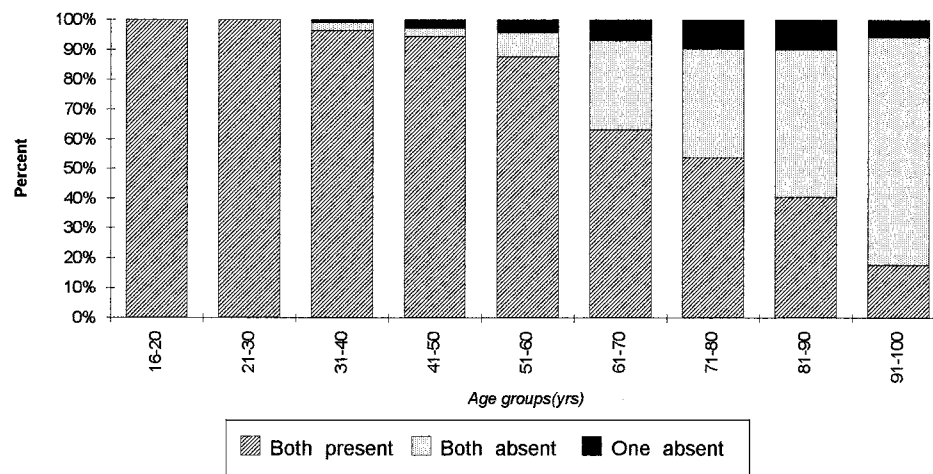


Fig. 1

The prevalence of each ankle reflex outcome as a percentage within each age group, showing both the degree and pattern of the changes with increasing age.

**Table III.** The percentage difference in prevalence and its 95% CI between each two consecutive age groups for bilateral and unilateral reflex absence

Consecutive age groups (yr)	Both absent			One absent		
	%	95% CI	p value	%	95% CI	p value
(16 to 20):(21 to 30)	0.0	-	-	0.0	-	-
(21 to 30):(31 to 40)	2.7	-	0.09	0.9	-	0.46
(31 to 40):(41 to 50)	0.2	-	0.99	2.0	-	0.39
(41 to 50):(51 to 60)	5.1	-	0.08	1.4	-	0.55
(51 to 60):(61 to 70)	23.8	14.9 to 32.6	<0.00001	2.7	-2.3 to 7.5	0.36
(61 to 70):(71 to 80)	6.6	-2.9 to 16.2	0.19	2.7	02.9 to 8.3	0.36
(71 to 80):(81 to 90)	12.9	0.9 to 25	0.04	0.4	-6.8 to 7.7	0.99
(81 to 90):(91 to 100)	27.0	-	0.06	4.2	-	0.70

**Table IV.** The level of significance for comparison of the reflex outcomes between male and female patients in each age group

Age groups (yr)	p value
16 to 20	-
21 to 30	-
31 to 40	0.3
41 to 50	0.5
51 to 60	0.55
61 to 70	0.83
71 to 80	0.78
81 to 90	0.3
91 to 100	0.4

**Table V.** The prevalence of ankle reflex outcome and age (AROPA) index: a 'working' guide

Age (yr)	Ankle reflex outcome prevalence		
	Both present	Both absent	One absent
<60	>90%	<5%	<5%
>60	60%	30%	10%

squared test for trends in contingency tables (Altman 1991c) and linear regression analysis.

To determine the age at which the most significant changes in prevalence occurred, the results in every two consecutive age groups (e.g. 51 to 60 and 61 to 70) were compared. The difference in prevalence (%), the 95% CI for this difference and the p value between the two consecutive groups, for both bilateral and unilateral absence, were calculated by comparing proportions in contingency tables and using Fisher's exact test.

The results for gender in each age group were compared separately using chi-squared tests.

We used the computer statistical software package GraphPAD Software v 1.13 (Molfinio, Toronto, Canada) and

a significance level of 5% on two-tailed tests throughout.

## RESULTS

The interobserver error was very small with a kappa = 0.94 representing only one disagreement in the 50 patients examined by two observers. Table I shows the number of male and female patients and the outcome of the ankle reflex examination in each age group.

Table II shows the percentage proportion (prevalence) of each outcome and the 95% CI for all patients in each age group. In all patients the prevalence of absent ankle reflexes in one or both sides rises significantly with increasing age (chi-squared trend = 41.7, correlation coefficient  $r = 0.88$ ,  $p < 0.001$  and chi-squared trend = 76.1,  $r = 0.9$ ,  $p < 0.0001$ , respectively).

The pattern and degree of this increase are different for bilateral and unilateral absence, however, being much greater for bilateral absence (Fig. 1). Table III shows the difference in prevalence for both bilateral and unilateral absence between consecutive age groups, with 95% CIs and p values to show when the most significant increases or changes occur. The prevalence of bilateral absence shows a steady rise with two significant jumps, between the fifth and sixth decades (23.8%, 95% CI 14.9% to 32.6%,  $p < 0.00001$ ) and between the seventh and eighth decades (12.9%, 95% CI 0.9% to 25%,  $p < 0.05$ ). Unilateral absence increases steadily, but much less, with no significant jumps between consecutive decades. We found no significant difference between male and female patients in any age group (Table IV).

## DISCUSSION

It is generally accepted that there is loss of the ankle reflexes with increasing age, but only the results for medical patients over the age of 60 years have been reported. We studied loss of the ankle reflex over the full adult age range in a population which represents those likely to be seen by orthopaedic and spinal surgeons.

Over the age of 40 years, in either sex, the proportion of

patients with absent ankle reflexes increases. The difference between consecutive decades is small until that between the fifth and sixth; at this level there is a significant increase, principally due to a large rise in the proportion of patients with bilateral absent reflexes (8% to 30%). This was not seen for unilateral absence of reflexes. This increase at about 60 years is similar to that reported in previous studies, at about 70 years, and reduces the clinical value of this sign.

The prevalence of unilateral loss of the reflex has been addressed by Bryndum and Marquardsen (1964) who reported four cases in 100 patients over 65 years of age. In our patients 1% to 10% of adults older than 40 years had unilateral absence of an ankle reflex. Unilateral loss is therefore a more useful neurological sign and, where appropriate, will require further investigation, irrespective of age.

The differences between bilateral absence and unilateral absence suggest different aetiologies. Bilateral loss may have a central or systemic cause, as suggested by Bryndum and Marquardsen (1964), and unilateral loss may be due to a peripheral or mechanical abnormality.

The predictive value of the absent ankle reflex for herniated lumbar disc is reported to be about 90% between 20 and 45 years of age and 60% over the age of 50 years (Spangfort 1972); our findings support this view.

We present a simple 'working' guide to the prevalence of ankle reflex outcomes with respect to the patient's age (Table V).

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