

## Significance of arcus senilis in Caucasians<sup>1</sup>

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**Summary:** A study of arcus senilis in Caucasian men and women is reported. The prevalence of arcus senilis increases with age in both sexes and occurs more frequently in men. In women arcus senilis is uncommon before the menopause. The occurrence of arcus senilis in Caucasians is not a significant finding, except in men under the age of 40 years, when it is associated with an increased risk of coronary artery disease.

### Introduction

Although arcus senilis is a common finding in Caucasians, its significance still remains obscure. In recent years great emphasis has been placed on the prevalence of arcus senilis in men and its relation to coronary artery disease. The prevalence of arcus senilis in women, and especially women with coronary artery disease, is less well documented.

The incidence of arcus senilis has been studied in a hospital population. Comparisons with the results of other studies in the literature have been made to try to clarify the significance of arcus senilis in Caucasians.

### Methods

Six hundred and eighteen Caucasian men and 532 Caucasian women, over the age of twenty years, in the medical and surgical wards of the General Infirmary, Leeds, were studied. Patients with known diabetes mellitus or a history of acute or chronic ocular disease were excluded.

Each subject was examined for the presence of arcus senilis using the unaided human eye in daylight. An arcus senilis was said to be present if the cornea showed an opaque arc (which is greater than a quarter of the circumference of the cornea) or ring in either or both eyes. No attempt was made to grade the severity of each arcus senilis.

In each patient the presence or absence of clinically overt coronary artery disease was assessed. Clinically overt coronary artery disease was defined as (a) a documented myocardial infarction, or (b) patients receiving medical treatment for angina pectoris. In women, the age at menopause and whether it was natural or artificial was recorded.

### Results

All results were analysed using the chi-squared test with Yates's correction. In the male population the prevalence of arcus senilis was found to increase with age (Table 1). A significant ( $P < 0.01$ ) association between arcus senilis and clinically overt coronary artery disease was found in men aged 30–39, but not in any other age group.

In the female population the prevalence of arcus senilis also increased with age (Table 2), but did not occur as frequently as in men in any age group. There was no association in women between the presence of arcus senilis and clinically overt coronary artery disease. Of the 532 women studied, 317 had undergone natural menopause, the average age at menopause being 48 years. Arcus senilis was noted in only 2 premenopausal women.

### Discussion

Arcus senilis is a peripheral opaque ring in the cornea. The different stages of its development were described by Forsius (1954), who found that almost all Finnish men over the age of 40

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*Table 1. Prevalence of arcus senilis in male hospital patients with (CAD) and without (N) clinically overt coronary artery disease*

Decade	N		CAD	
	No. of patients	Arcus No. (%)	No. of patients	Arcus No. (%)
20-29	44	0 (0)	—	—
30-39	59	2 (3.4)	5	3 (60)
40-49	62	5 (8)	28	5 (18)
50-59	107	48 (45)	41	24 (58.8)
60-69	93	62 (66.7)	53	39 (73.6)
70-79	65	49 (75.4)	38	32 (84.2)
80-89	15	15 (100)	8	7 (87.5)

had some degree of arcus senilis when studied microscopically. Histochemical studies (Andrews 1962, Cogan & Kuwabara 1959) have shown that arcus senilis is formed by a deposition of cholesterol, phospholipids and natural fats, presumably derived from the bloodstream. On examination with the naked eye, a developing arcus senilis usually appears as an opaque arc in the upper and/or lower parts of the cornea. Each arc increases until it forms a complete opaque ring which is easily visible. The opaque ring is limited by a sharp line on the outer limbal edge.

Table 3 compares the results of surveys on the prevalence of arcus senilis in Caucasian men. The finding in the present survey (Table 1) of a significant increase in the prevalence of arcus senilis in men with clinically overt coronary artery disease in the 30-39 year age group supports the results of several other surveys. Beaumont *et al.* (1960) found arcus senilis occurring more frequently in men aged 30-39 with coronary artery disease. In studies on post-cardiac infarction patients, an increase in the occurrence of arcus senilis was found by Shanoff & Little (1964) in those under 40 years, and by Rifkind (1965) in those aged 40-49 years. Rosenman *et al.* (1974) observed that there was a significantly higher prevalence of myocardial infarction in men under 50 years of age with arcus senilis. Klein *et al.* (1975) showed that coronary artery disease was more prevalent in men with arcus senilis than in those without; but in a seven-year follow up the presence of arcus senilis did not seem to be a predictor of eventual coronary artery disease. In men under the age of 40 years the presence of arcus senilis is associated with an increased risk of coronary artery disease.

Table 4 compares the results of surveys on the prevalence of arcus senilis in Caucasian women, and most studies confirm that men are more frequently affected than women at all ages (Forsius 1954, Rifkind 1965, Lindholm 1960, Rodstein & Zeman 1963). While Macaraeg

*Table 2. Prevalence of arcus senilis in female hospital patients with (CAD) and without (N) clinically overt coronary artery disease*

Decade	N		CAD	
	No. of patients	Arcus No. (%)	No. of patients	Arcus No. (%)
20-29	43	0 (0)	—	—
30-39	64	1 (1.6)	1	0 (0)
40-49	63	2 (3.2)	5	1 (20)
50-59	90	13 (14.4)	18	3 (16.7)
60-69	72	34 (47.2)	35	20 (57)
70-79	85	54 (63.5)	31	18 (58)
80-89	16	12 (75)	9	9 (100)

Table 3. Comparison of surveys showing percentage prevalence of arcus senilis in Caucasian men, with (CAD) and without (N) clinically overt coronary artery disease

Decade	Boas (1945)		Shanoff & Little (1964)		McAndrew & Ogston (1965)		Rifkind (1965)		Forsius (1954)	Lindholm (1960)	Macaraeg <i>et al.</i> (1968)	
	N	CAD	N	CAD	N	CAD	N	CAD	N●	N	N <sub>1</sub>	N <sub>2</sub>
20-29	—	—	—	—	—	—	—	—	0	—	0	0
30-39	3.7	9	0	44	—	—	14	27	2	4.3	0	8
40-49	4.6	14.5	48	58	25	30	47	67	8	13.6	0	18
50-59	19	29.6	63	46	45	50	71	70	30	29.6	24	36
60-69	34.2	37.8	78	78	53	63	75	82	53	55.5	45	83
70-79	80	66.6	90	92	—	—	—	—	70	57.8	53	—
80-89	—	—	—	—	—	—	—	—	—	69.2	80	—

● Cases with 'marked' arcus senilis.  
 N<sub>1</sub> = hospital population, N<sub>2</sub> = steel works population.

*et al.* (1968) showed an equal sex prevalence, their results were based on only a small sample. In the present survey, arcus senilis was found in only a small proportion of women up to and including the sixth decade, but the prevalence increased markedly thereafter – supporting the results of Lindholm (1960) and Klein *et al.* (1975). It is a common finding in postmenopausal women and was recorded in only 2 premenopausal women in the present study. There have been few large studies on arcus senilis in women with coronary artery disease and there is currently no evidence to suggest any relationship.

The results of studies on the relationship between serum lipid levels and arcus senilis are confusing. While most have found an increased serum cholesterol level in patients with arcus senilis, several studies have failed to confirm any relationship (Lindholm 1960, Rodstein & Zeman 1963, McAndrew & Ogston 1965*a, b*, Hickey *et al.* 1970). In a study of 214 cases of primary hyperlipidaemia, Schatz (1969) found that although arcus senilis was common, its presence was in no way correlated significantly with severity of serum lipid elevation or type of hyperlipidaemia. McAndrew & Ogston (1965*a, b*) found that all men with a serum cholesterol of over 350 mg/100 ml had an arcus senilis. They stated that 'it would seem that a substantially elevated serum cholesterol level contributes to the development of an arcus senilis, but that hypercholesterolaemia is not necessary for its development'. Rosenman *et al.* (1974) and Rifkind (1965) both showed that serum cholesterol was significantly raised in men with arcus senilis under 50 years of age. Postmenopausal women are frequently found to have arcus senilis, and serum lipid levels have been shown to rise significantly in women after age 50 years (Oliver & Boyd 1959). Since there is an increase with age both in the prevalence of arcus senilis and in serum lipid levels, it is difficult to prove an association.

Table 4. Comparison of surveys showing percentage prevalence of arcus senilis in Caucasian women, with (CAD) and without (N) Clinically overt coronary artery disease

Decade	Forsius (1954)	Lindholm (1960)	Rifkind (1965)	Macaraeg <i>et al.</i> (1968)	Boas (1945)	
	N●	N	N	N	N	CAD
20-29	0	—	—	0	—	—
30-39	3	0	8	0	0	—
40-49	6.5	3.6	30	15	4.4	0
50-59	25	14.4	41	22	16.8	20
60-69	33.3	35.1	67	32	18.5	31.2
70-79	61	44.8	—	91	0	33.3
80-89	—	68	—	80	—	—

● Cases with 'marked' arcus senilis

A significant association between life-time alcohol consumption and arcus senilis was found by Hickey *et al.* (1970) in a comprehensive study of 534 men with coronary artery disease. However, Thomas *et al.* (1972) studied the prevalence of arcus senilis in a population of male alcoholics and failed to confirm this finding.

The present survey of Caucasian men and women has shown that the prevalence of arcus senilis increases with age in both sexes, although it occurs more frequently in men at all ages. In women it is uncommon before the menopause. The occurrence of arcus senilis is not a significant finding, except in men under the age of 40 years, when it is associated with an increased risk of coronary artery disease.

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