

Chapter 15. Atherosclerosis and myocardial lesions in subjects dying from fresh cerebrovascular disease

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Taking into account age, sex, geographical distribution, obesity, and associated cause of death, it was concluded that: (1) the extent of aortic calcification was much lower in cerebral haemorrhage than in cerebral infarct. In deaths due to cerebral haemorrhage aortic calcification was at about the same level as in those due to cancer of the stomach, while in deaths due to cerebral infarct it was at the same level as in those due to coronary heart disease; (2) the prevalence of large myocardial scar was low in deaths due to cerebral haemorrhage (at about the same level as in those due to prostatic cancer), while in deaths due to cerebral infarct it was more frequent (at the same level as in deaths due to diabetes); (3) the extent of coronary calcification and prevalence of coronary stenosis and fresh myocardial infarction were low in the cerebral haemorrhage and cerebral infarct deaths, but a little lower in the former; and (4) the extent of raised lesions of the aorta and coronary arteries was similar in the cerebral haemorrhage and cerebral infarct deaths, the level of aortic lesions being high and overlapping in level with those in the coronary heart disease and hypertensive deaths, and the levels of coronary lesions being much lower and well below those in the coronary and diabetic hypertensive deaths.

Views on the relation of atherosclerosis of the aorta and coronary arteries to cerebral haemorrhage and cerebral infarct are speculative and to some extent conflicting. The prevailing view is that both are "atherosclerotic diseases", by which is usually meant that atherosclerosis is extensive in the aorta and coronary arteries as well as in the cerebral vessels.

In this chapter we do not consider atherosclerosis of cerebral vessels, but the relationship of atherosclerosis of the aorta and coronary arteries, coronary stenosis, and myocardial infarction to fresh cerebral haemorrhage and fresh cerebral infarct is examined. By taking into account differences in geographical distribution and myocardial infarction distribution in the two disease groups, we demonstrate that some differences in atherosclerotic lesions are likely to be intrinsic to the disease condition.

In order to make the comparison of cerebral haemorrhage and cerebral infarct more clear, all cases of cerebral infarct were excluded from the first group—cerebral haemorrhage without infarct. Similarly, all cases of cerebral haemorrhage were excluded from the cerebral infarct group.

The cerebral haemorrhage and cerebral infarct

groups were compared with each other and with the three atherosclerosis reference groups.^a Since the standardized average atherosclerosis group consisted mainly of deaths due to cerebrovascular and coronary heart disease, the cerebral haemorrhage and cerebral infarct groups were also compared with deaths due to coronary heart disease without cerebrovascular lesions.

PREVALENCE OF CEREBRAL HAEMORRHAGE AND OF CEREBRAL INFARCT AS PRINCIPAL CAUSE OF DEATH

In all towns taken together there were 552 deaths due to cerebral haemorrhage in men and women aged 40–79. The prevalence was similar in each of the decades 40–49, 50–59, 60–69, and 70–79, with a tendency to fall in the older age groups for women. In men the prevalence was about 3% of all deaths and in women it was 5%. Rates tended to be higher in Tallin and lower in Prague than in the other towns.

^a See p. 499.

There were 579 deaths due to cerebral infarct in men and women aged 40–79. The prevalence of cerebral infarct increased with age by 1–5% in men (average 4%) and 1–7% in women (average 5%). Tallin males had a higher prevalence and Yalta males a lower prevalence than those from other towns.

PREVALENCE OF ATHEROSCLEROTIC LESIONS,
CORONARY STENOSIS, AND MYOCARDIAL INFARCTION

Three groups of subjects—those dying from cerebral haemorrhage, cerebral infarct, or coronary heart disease as principal cause of death (without fresh cerebrovascular lesions)—were compared with subjects in the low atherosclerosis group.

Comparison of the prevalence of atherosclerotic lesions in the abdominal aorta, by age and sex (all towns combined), showed that the low atherosclerosis group had the lowest prevalence of raised lesions. The prevalence of these lesions was generally similar in the cerebral haemorrhage, cerebral infarct, and coronary heart disease groups, with a slight tendency for it to be lowest in the cerebral haemorrhage group and highest in the coronary heart disease group. Notable differences occurred in the prevalence of complicated and calcified lesions in males, the cerebral haemorrhage subjects having a lower prevalence than the cerebral infarct subjects. The prevalence in the cerebral haemorrhage group generally approximated to that in cerebral infarct subjects 10 years younger. Table 51 shows that there were no marked inter-town differences in the prevalence of raised

lesions of the aorta in the cerebral haemorrhage and cerebral infarct groups (whereas Prague males were high and Ryazan males low in the case of “all deaths”). Inter-town differences for the prevalence of aortic calcification in the cerebral haemorrhage and cerebral infarct groups were similar to the relationships for “all deaths”.

Comparison of the prevalence of atherosclerosis in the left anterior descending coronary artery in subjects dying from the different causes showed that complicated, calcified, and raised lesions were least prevalent in low atherosclerosis deaths and, on the whole, most prevalent in the coronary heart disease deaths. The cerebral haemorrhage and cerebral infarct groups resembled each other, occupying an intermediate position between the coronary heart disease and low atherosclerosis groups. Table 51 shows that there were no marked inter-town differences for the prevalence of raised lesions of the coronary arteries in the cerebral haemorrhage and cerebral infarct deaths (whereas Malmö and Prague were high and Ryazan low for “all deaths”). Inter-town differences in the prevalence of coronary calcification were found less often in the cerebral haemorrhage and cerebral infarct deaths than in all deaths, but when they were found they showed the same trend.

Coronary stenosis and fresh and old myocardial infarction occurred most frequently in the coronary heart disease group, less in the cerebral infarct group, still less in the cerebral haemorrhage group, and least in the low atherosclerosis group. These trends were highly significant for myocardial infar-

Table 51. Inter-town comparison^a of prevalence of lesions in the average aorta, average coronary artery, and myocardium (cerebral haemorrhage group, cerebral infarct group, and all deaths compared)

		Raised lesion (aorta)		Calcified lesion (aorta)		Raised lesion (coronary)		Calcified lesion (coronary)		Stenosis (any coronary)		Fresh myocardial infarction		Large myocardial scar	
		High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
Cerebral haemorrhage group	Males	—	—	P	—	—	—	—	—	—	—	—	—	—	—
	Females	—	—	T	R	—	—	—	—	—	—	M	T	—	R
Cerebral infarct group	Males	—	—	—	—	—	—	—	—	—	—	P	—	T	R
	Females	—	—	M	R	—	—	R	P	—	—	R, T	—	—	R
All deaths	Males	P	R	M, P	R	M, P	R	M, P	R	M	R	M, P	R, Y	M, P	R
	Females	—	—	M, P	R	M, P	R	M, P	R	M	R	M, P	—	M, P	R, Y

^a Based on the number of times out of all possible age/sex/town comparisons that a particular town is highest or lowest. All highs or lows shown are statistically significant ($P < 0.05$). M = Malmö; P = Prague; R = Ryazan; T = Tallin; Y = Yalta.

tion and stenosis of the right coronary artery. Table 51 shows that there were no clear inter-town differences in the prevalence of stenosis in the cerebral haemorrhage group; in the cerebral infarct group, women tended to be high, and in "all deaths" Malmö was high and Ryazan low. Tallin women with cerebral haemorrhage had a surprisingly low prevalence of fresh myocardial infarction, and those with cerebral infarct had a low prevalence of large myocardial scar, while the corresponding prevalence in Tallin males was surprisingly high.

EXTENT OF ATHEROSCLEROSIS

As regards the extent of atherosclerosis in the *aorta*, the cerebral haemorrhage and cerebral infarct groups were similar to the coronary heart disease group in terms of the total amount of atherosclerosis, raised lesions, and fibrous plaque, while they had more extensive atherosclerosis than the low atherosclerosis group. There was a barely significant tendency for males with cerebral infarct to have slightly more atherosclerosis (fibrous plaque and calcified lesions) than the cerebral haemorrhage or coronary heart disease groups. Complicated lesions were more extensive in the cerebral infarct group than in the cerebral haemorrhage group, the extent in males of the cerebral infarct group being equal to that in the coronary heart disease group and in females being greater than that in the coronary heart disease group; the low atherosclerosis group had the least extensive complicated lesions. Calcified lesions were less extensive in the cerebral haemorrhage group (which was similar in this respect to the low atherosclerosis group) than in the cerebral infarct group (which resembled the coronary heart disease group). No statistically significant inter-town differences were found.

The pattern of extent of lesions other than fatty streak in the *coronary arteries* was the same for each type of lesion. Lesions were most extensive in the coronary heart disease group, followed, in descending order, by the cerebral infarct group, the cerebral haemorrhage group, and the low atherosclerosis group. No statistically significant inter-town differences were found in the extent of raised or calcified coronary lesions.

DISCUSSION

The analysis has shown that (1) the cerebral haemorrhage and cerebral infarct groups were simi-

lar with regard to the prevalence and extent of fibrous plaque in the *aorta*, and fibrous plaque, calcified lesions and complicated lesions in the coronary arteries; (2) the prevalence of stenosis was a little lower in the cerebral haemorrhage group than in the cerebral infarct group; and (3) in comparison with the cerebral infarct group, the cerebral haemorrhage group had a lower prevalence and extent of calcified and complicated lesions of the *aorta* and a lower prevalence of fresh myocardial infarction and large myocardial scar.

In the cerebral haemorrhage group the extent of aortic calcification was about the same as in subjects with cancer of the stomach, while the level in the cerebral infarct group approximated to that in obese subjects who died of coronary heart disease or of non-hypertensive diabetes. The prevalence of fresh myocardial infarction was low in both the cerebral haemorrhage group (where it was at the top level for cancer deaths) and the cerebral infarct group (where it was somewhat higher, at the level for secondary hypertensive deaths). In the cerebral haemorrhage group the prevalence of large myocardial scar was at about the same level as in subjects with cancer of the prostate, while in the cerebral infarct group it was higher, between the levels for all diabetics and for non-hypertensive diabetics).

Effect of obesity

When diabetes and hypertension are not excluded, obesity is associated with coronary stenosis (see Chapter 16) and, presumably, if the cerebral infarct subjects were more obese than the cerebral haemorrhage subjects this might account for all or some of the differences in their manifestations of coronary stenosis. Table 52 shows that the reverse was the case, especially in women in Malmö and Yalta.

Effect of different geographical distribution

We have shown above that the prevalence of cerebral haemorrhage was relatively low in Prague and the prevalence of cerebral infarct was relatively low in Yalta males. It was seen in Chapter 14 that the prevalence of coronary stenosis and myocardial lesions also differed between towns. There was therefore a possibility that different geographical distribution in the cerebral haemorrhage and cerebral infarct groups could have accounted for the differences in coronary stenosis and myocardial infarction. To allow for age, sex, and geographical differences in disease groups we made use of the high, standardized average, and low atherosclerosis reference

Table 52. Mean thickness of fat (mm) in subjects aged 40–69 with cerebral haemorrhage (H) and cerebral infarct (I) in the five towns (age-standardized values)

Town	Males		Females	
	H	I	H	I
Malmö	20.7	16.6	26.4	19.5
Prague	23.0	28.4	38.6	^a
Ryazan	18.9	19.0	29.3	20.7
Yalta	18.4	^a	31.9	26.3
Tallin	21.9	21.5	31.9	31.1

^a The age-standardized mean could not be calculated because there were no cases of cerebral infarct in age group 40–49 years.

groups referred to in Chapter 1. When differences in age, sex, and geographical composition were allowed for, the extent of aortic calcification and the prevalence of fresh myocardial infarction and large myocardial scar were still considerably less in the cerebral haemorrhage group^a than in the cerebral infarct group, and the extent of raised lesions of the aorta and coronary arteries, the extent of coronary calcification, and the prevalence of coronary stenosis

^a In this analysis the cerebral haemorrhage group included all deaths in which fresh cerebral haemorrhage (principal or secondary) occurred in the absence of fresh cerebral infarct. The cerebral infarct group included all deaths in which fresh cerebral infarction (principal or secondary) occurred in the absence of fresh cerebral haemorrhage.

were only marginally less in the cerebral haemorrhage group than in the cerebral infarct group.

Effect of difference in prevalence of coronary heart disease

Of 694 subjects who died with cerebral haemorrhage, 98 (12%) had fresh or old myocardial infarction or both. The prevalence in the cerebral infarct group was three times as great (400 out of 983 subjects, or 40%). The differences in atherosclerotic lesions and coronary stenosis in the two groups could have been due to this differential association with coronary heart disease. We therefore compared the observed/expected ratios in subjects who died of cerebral haemorrhage^a without fresh myocardial infarction or large myocardial scar with the ratios in subjects who died of cerebral infarction without those two lesions of the myocardium. This comparison showed that when age, sex, and geographical distribution were allowed for and myocardial infarction was excluded, (1) the extent of aortic calcification remained less in the cerebral haemorrhage group than in the cerebral infarct group; (2) the extent of coronary calcification and prevalence of coronary stenosis remained marginally lower in the haemorrhage than in the infarct group; and (3) the extent of raised lesion in the aorta and coronary arteries was the same in both groups. The same conclusion was reached when cerebral haemorrhage deaths with large myocardial scar but without fresh myocardial infarction were compared with deaths due to cerebral infarct with large myocardial scar but without fresh myocardial infarction.

RÉSUMÉ

CHAPITRE 15. ATHÉROSCLÉROSE ET LÉSIONS DU MYOCARDE CHEZ DES SUJETS DÉCÉDÉS D'UNE MALADIE VASCULO-CÉRÉBRALE RÉCENTE

En tenant compte de l'âge, du sexe, de la distribution géographique, de l'obésité et des causes associées de décès, les conclusions ont été les suivantes: 1) le degré de calcification aortique est beaucoup plus faible dans l'hémorragie cérébrale que dans l'infarctus cérébral. Dans les décès consécutifs à la première, le degré de calcification aortique est sensiblement le même que dans les décès provoqués par le cancer de l'estomac, tandis que dans les décès par infarctus cérébral il est le même que dans les décès par cardiopathie coronarienne; 2) la prévalence de vastes cicatrices myocardiques est faible dans les décès par hémorragie cérébrale (elle est du même ordre de grandeur que pour les décès par cancer de la prostate), alors que dans les décès par infarctus cérébral leur fréquence est beaucoup plus

grande (du même ordre que dans les décès dus au diabète); 3) le degré de calcification coronarienne et la prévalence de la sténose coronarienne et de l'infarctus myocardique récent sont faibles chez les malades décédés d'hémorragie cérébrale ou d'infarctus cérébral, mais un peu plus bas dans le premier cas; et 4) le degré de lésions saillantes de l'aorte et des artères coronaires est similaire dans les décès par hémorragie cérébrale et par infarctus cérébral; le degré de lésions aortiques est alors élevé et se confond en partie avec celui que l'on rencontre dans les décès par cardiopathie coronarienne et par hypertension, alors que le degré de lésions coronariennes est bien moindre et bien inférieur à celui que l'on observe post-mortem chez les coronariens et diabétiques hypertendus.