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AMYLOID IN OSTEOARTHRITIC HIP JOINTS

Depositions in Cartilage and Capsule. Semiquantitative Aspects

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Amyloid depositions in tissue from 116 osteoarthritic hip joints were examined. There was no significant correlation between amyloid and age although there was a tendency for joints from older patients to have more marked amyloid degeneration. We found significantly more amyloid in the joint capsules from male patients than from females. No difference in amyloid deposition was found between the right and left side, and pressure-loaded/less pressure-loaded parts of the femoral head contained equal amounts of amyloid. With the exception of two cases amyloid depositions in the joint capsule were always accompanied by amyloid in the joint cartilage ($P < 0.001$). Conversely the cartilage was often positive when the capsule was negative for amyloid.

Key words: amyloid; cartilage; osteoarthritis; hip joint

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Depositions of amyloid in hip joint cartilage from an unselected autopsy material were described by Ladefoged & Christensen in 1980.

Amyloid depositions in the osteoarthritic fibrous capsule have also been described earlier (Christensen & Sørensen 1972, Sørensen & Christensen 1973) but, to the knowledge of the authors, never in relation to amyloid depositions in the joint cartilage.

The object of the present investigation is to give a semi-quantitative description of amyloid depositions in osteoarthritic hip joint cartilage in relation to age, sex, side and pressure-loaded/less pressure-loaded parts of the femoral head, as well as to correlate the findings to amyloid depositions in the hip joint capsule.

MATERIAL AND METHODS

The material consisted of tissue from 116 consecutive alloplastic operations *ad modum* Charnley performed because of severe osteoarthritis of the hip. The operations were carried out at the Department of Orthopaedic Surgery O of the Odense University Hospital. The removed tissue consisted partly of the femoral head itself and partly of a 5 × 3 × 2 cm large piece of the synovial membrane and the fibrous capsule.

None of the patients had clinical signs of primary amyloidosis, myelomatosis or tuberculosis. One had rheumatoid arthritis. The age distribution is shown in Table 1. The average age was 61 years (range 32–74) and 47 were women.

Immediately after the operation the tissue was fixed in 10 per cent formalin and kept in this for 24 hours. Thereafter cartilage was taken from both upper pressure-loaded parts and lower less pressure-loaded parts of the femoral head. Furthermore representative specimens of the synovial membrane and the fibrous capsule were removed. The tissue was subjected to routine treatment and 6 micron thick sections were stained with haematoxylin and eosin and with alkaline Congo red according to the method of Puchtler et al. (1962). Amyloid degeneration was interpreted as being present when the reddish colour of the alkaline Congo red gave green dichroism in polarized light.

The findings were classified semiquantitatively, so that 0 indicated none, + slight, ++ moderate and +++ severe amount.

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Table 1. Distribution of amyloid in joint cartilage (cart) and joint capsules (caps) in the different age groups

Age, Years	Amyloid											
	0		+		++		+++		Total		Per cent positive	
	cart	caps	cart	caps	cart	caps	cart	caps	cart	caps	cart	caps
31–40	2	3	1	0	0	0	0	0	3	3	33	0
41–50	3	7	6	2	2	2	1	1	12	12	75	42
51–60	11	30	10	2	11	0	1	1	33	33	66	9
61–70	20	42	20	4	11	7	3	1	54	54	63	22
71–80	5	7	3	2	4	1	2	4	14	14	64	50
Total	41	89	40	10	28	10	7	7	116	116	65	23

RESULTS

Relation to age. In the present material we found more severe amyloid degenerated hip joints with increasing age (Table 1), although there were not significantly more joints with amyloid degeneration in the older age groups. The amyloid was found in a zone immediately below the surface of the cartilage, while the material had a more spotted distribution in the joint capsules (Figures 1 and 2). Amyloid was not seen in the synovial membrane.

Relation to sex. Sixty-nine men and 47 women were operated on. In the joint cartilage from the men, 71 per cent contained amyloid while the cartilage from the women was only positive in 55 per cent. Concerning the joint capsules the percentages were 29 and 15, respectively.

For the capsules these figures – taken together with those from the study of Sørensen & Christensen from 1973 – are significantly different with $0.001 < P < 0.01$ (Table 2).

Relation to side. Fifty-seven operations were done on the right side and 59 on the left. No difference in amyloid degeneration could be found on the two sides.

Relation between pressure loaded/less pressure loaded parts of the femoral head. There was no difference in the extent of amyloid degeneration in the two areas. Thus amyloid in one area predicted amyloid in the other and to the same degree.

Relation between amyloid in cartilage and capsule. Amyloid depositions in the joint capsules were found in 23 per cent and with the exception of two cases were always accompanied by amyloid in the joint cartilage. Amyloid in the cartilage was found in 65 per cent of the cases. Cartilage was positive in 50 cases where the capsules were negative for amyloid.

It should be pointed out that, in the two cases where amyloid was only found in the capsules, moderate chondromatous metaplasia was also present.

Calculated with the χ^2-test the relation is significant with $P < 0.001$.

Table 2. Distribution of joint capsule amyloid in men and women. The figures in parentheses are percentages

	Women		Men		Total
	Amyloid pos.	neg.	Amyloid pos.	neg.	
Sørensen et al. (1973)	3 (16)	16	14 (44)	18	51
Present material	7 (15)	40	20 (29)	49	116
Total	10 (15)	56	34 (34)	67	
	66		101		167

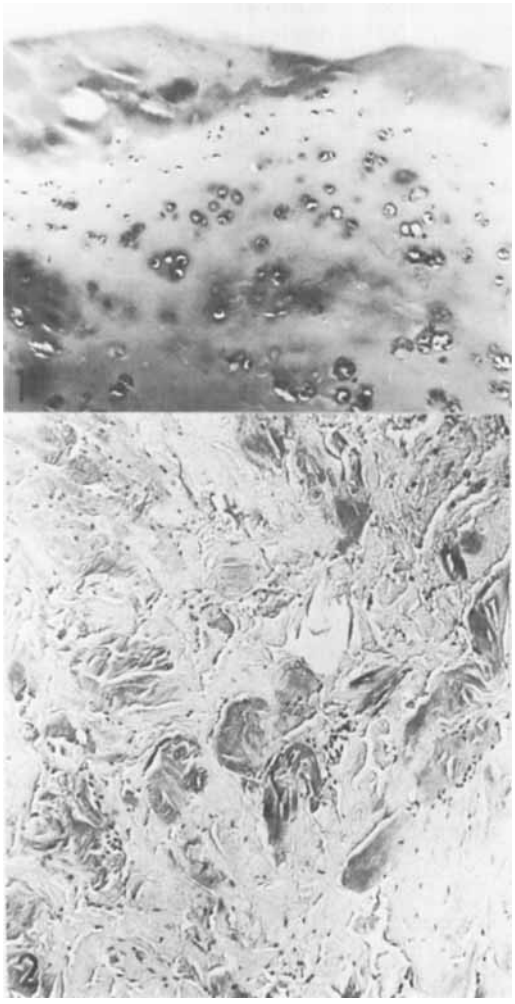

Figure 1. Severe amyloid degeneration on the surface of joint cartilage. Alkaline Congo red. (×100).
Figure 2. Severe amyloid degeneration in the fibrous part of the joint capsule. Alkaline Congo red. (×100).

DISCUSSION

Gamarski & Netto described in 1959 a case of amyloid degeneration in the *joint cartilage* from a patient suffering from primary amyloidosis. Some years later Bywaters & Dorling (1970) found two cases of amyloid deposition in joint cartilage in primary amyloidosis and myelomatosis, respectively. More recently Ladefoged & Christensen (1980) reported amyloid in joint cartilage in a high percentage of cases in an autopsy material.

Amyloid depositions in *joint capsules* have previously been described in connection with primary amyloidosis (Bernhard & Hensley 1969, Bywaters & Dorling 1970, Gamarski & Netto 1959), myelomatosis (French 1980, Hamilton & Bywaters 1961, Kruse 1971, Magnus-Levy 1938, Pruzanski et al. 1978), rheumatoid arthritis (Chopman & Crowell 1977, Laine et al. 1955, Pasternack & Tiilikainen 1977) and osteoarthritis of the hip (Christensen & Sørensen 1972, Sørensen & Christensen 1973).

In our autopsy material we found a significant correlation between severe amyloid degeneration and old age (Ladefoged & Christensen 1980). This is in good agreement with the reported occurrence of amyloid degeneration in other organs (Pirani 1976, Thung 1957, Wright et al. 1969). Also in the present material heavier amyloid depositions could be demonstrated among the oldest patients (Table 1). However, there was not, as in the autopsy material, a significant correlation between amyloid and age. For the joint cartilage, and possibly also for the joint capsules, this can be explained by the fact that most of the severely changed femoral heads were covered with a very narrow peripheral zone of reparative secondary cartilage or even fibrocartilage neither of which contain amyloid. This also explains why amyloid was found in a higher percentage of cases in our autopsy material than in the present osteoarthritic material.

In the present series amyloid degeneration was found more often among men then among women. A similar tendency has been demonstrated in an earlier study concerning the joint capsule alone. Sørensen & Christensen (1973) found amyloid degenerated joint capsules among 44 per cent of men and only 16 per cent of women. From Table 2 it can be seen that among 167 cases 34 per cent of hip joint capsules from men were positive for amyloid while only 15 per cent of the capsules from women were positive. Calculated with the χ^2-test this is a significant difference ($0.001 < P < 0.01$). The reason for this difference between men and women is obscure.

As in our autopsy material (Ladefoged & Christensen 1980) no difference in amyloid depositions could be demonstrated between the upper pressure-loaded parts and the lower less

pressure-loaded parts of the femoral head. This indicates that amyloid degeneration is a diffuse process which involves the whole joint cartilage surface equally.

Except for two cases, amyloid degeneration was only found in the joint capsules when the cartilage was positive, while the reverse was seen in 50 cases. This is also in good agreement with the findings in our autopsy material and indicates that amyloid degeneration is initiated in the chondroid tissue and spreads from there to the other joint structures.

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