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Inflammatory Aortic Aneurysms: Regression of Fibrosis after Aneurysm Surgery

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Objectives: *To evaluate the fate of perianeurysmal fibrosis (PF) following aneurysm surgery.*
Methods: *In this single centre study, pre- and postoperative abdominal CT-scans on 21 consecutive patients with inflammatory abdominal aortic aneurysms were compared. CT-scans of 10 randomly chosen patients operated on for abdominal aortic aneurysms without PF in the same period, served as reference group.*
Results: *Preoperative thickness of PF was assessed as >1 cm in 11 and <1 cm in 10 patients. Ureterolysis was performed in seven patients where the fibrosis caused ureteral obstruction. Postoperative CT-scans performed at a median of 24 (range 3–108) months after surgery showed complete regression of the fibrosis in 29%, partial regression in 57% and no change in 14% of the patients. Progression of the fibrosis or persistence of hydronephrosis was not seen. No sign of fibrosis were seen in the 10 controls.*
Conclusion: *This study supports the findings that PF tends to regress after repair of the abdominal aortic aneurysm.*

Introduction

The combined findings of abdominal aortic aneurysm (AAA) and perianeurysmal fibrosis (PF), often described as inflammatory abdominal aortic aneurysm, have been reported since 1935.[1] Although the aetiology is still speculative, PF is a well-defined clinical and pathologic entity.[2–5] PF is found in 2–15% of all AAA[2,5–8] and the superimposed layer of fibrosis adheres to adjacent structures particularly to the duodenum, and sometimes even to the left renal vein and ureters. A high quality CT-scan permits preoperative diagnosis, which is mandatory for proper planning when treating AAA complicated by PF. Aneurysm repair has been reported to be followed by partial or complete regression of the inflammatory process.[6,7,9–11]

In this single study, we have followed the course of 21 AAAs with PF by comparing the pre- and postoperative CT-scans.

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Patients and Methods

Twenty-four consecutive patients underwent an abdominal CT-scan prior to surgery for AAA combined with PF during the period 1986–1994. The diagnosis was based on preoperative CT-scan, gross appearance at surgery and histology. In all patients a transperitoneal approach was used and a dacron tube prosthesis was inserted except for one patient with bilateral iliac aneurysms who had a bifurcation graft. There were no perioperative deaths.

All patients were invited to a follow up CT-scan but three refused to attend. Thus 21 patients (19 M, 2F) were available for the study. The age of the patients was 47–78 years, median 64 years. The postoperative CT-scans were done without contrast enhancement in a Siemens 1 Somatom Plus or a GE Prospeed body CT-scanner. In order to evaluate the magnitude of the fibrosis, the pre- and postoperative CT scans of 10 randomly chosen patients, operated on for AAA without PF in the same period, served as a reference group. On the CT scans, the borders of the PF were not well demarcated in all regions of the aneurysms and a precise assessment of the volume of the fibrosis was,

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Table 1. Data on 21 patients with inflammatory aortic aneurysms, indicating presence (y) or absence (n) of preoperative hydronephrosis (HN), degree of preoperative perianeurysmal fibrosis (thickness ≥1 cm concluded as major, <1 cm as minor), time from surgery to follow-up CT-scan (months) and changes in fibrotic masses on follow-up CT-scan (cr: complete regression; pr: partial regression; nc: no change).

Age	Sex	Preoperative HN	Degree of PF	Time for CT follow-up	Follow-up status
47	m	y	major	43	pr
54	f	y	major	47	pr
54	m	n	major	21	pr
56	m	n	major	72	pr
59	m	y	minor	12	cr
60	m	y	major	20	pr
60	m	y	major	12	pr
61	m	n	minor	73	cr
62	m	n	major	12	cr
64	m	n	major	15	pr
64	m	n	minor	4	nc
66	m	n	major	58	cr
66	m	n	major	16	pr
67	m	n	minor	11	pr
67	m	n	minor	85	nc
69	f	n	minor	30	pr
70	m	n	minor	33	pr
72	m	y	minor	24	pr
73	m	n	major	12	cr
76	m	y	minor	40	nc
78	m	n	minor	108	cr

therefore, not possible. Instead, the degree of fibrosis was classified as minor (thickness <1 cm) or major (thickness ≥1 cm). When the pre- and postoperative CT-scans were compared, they were categorised as showing either complete regression, partial regression, no change, or progression of the fibrosis.

Results

Perianeurysmal fibrosis had been overlooked on the preoperative CT-scans in four patients and was misinterpreted as haematomas in two patients. Four of these six patients was operated as an emergency. A higher morbidity was not seen in this group. Retrospectively, the fibrosis could be seen on all scans. The degree of fibrosis was minor in 48% (10/21) and major in 52% (11/21). In all the preoperative CT-scans, the fibrosis involved the duodenum without involvement of the posterior aspect of the aneurysm against the spine. The bifurcation was frequently involved in the fibrosis, but in only one case of bilateral iliac aneurysms did the fibrosis extend to the iliac vessels.

Surgery was performed transperitoneally with mobilisation of the duodenum including a thin layer of the fibrosis. In seven patients, hydronephrosis was found, and ureterolysis was performed in all patients placing the ureters intraperitoneally. In one patient a nephrectomy was done. There were no perioperative deaths.

The median observation time from surgery to follow-up scan was 24 (4–108) months. None of the patients had progression of fibrosis. In three patients (14%), the fibrosis was unchanged and in the remaining 18 patients the fibrosis had disappeared or regressed markedly (Fig. 1). In six of these patients (29%) the regression was complete and in 12 patients (57%), the regression was partial. Hydronephrosis had disappeared in all patients. There was no correlation between the degree of regression and the time span from operation to follow-up CT scan or between the preoperative degree of fibrosis and the degree of regression. No signs of fibrosis were seen in the 10 controls.

Discussion

Abdominal aortic aneurysms with PF may be inferred to be a variant of the normal atherosclerotic ones, characterised by a particular prominence of inflammation and fibrosis. A minor degree of inflammation and fibrosis has also been demonstrated in ordinary AAA.[12] Several theories have been put forward about the aetiology of PF.[13–15] Insoluble lipid leaking through a thinned arterial wall from atheromatous plaque is believed to induce an autoimmune response with secondary formation of fibrosis.[16,17] The fact that the fibrosis regresses when the aneurysm has been repaired supports this thesis, as a vascular

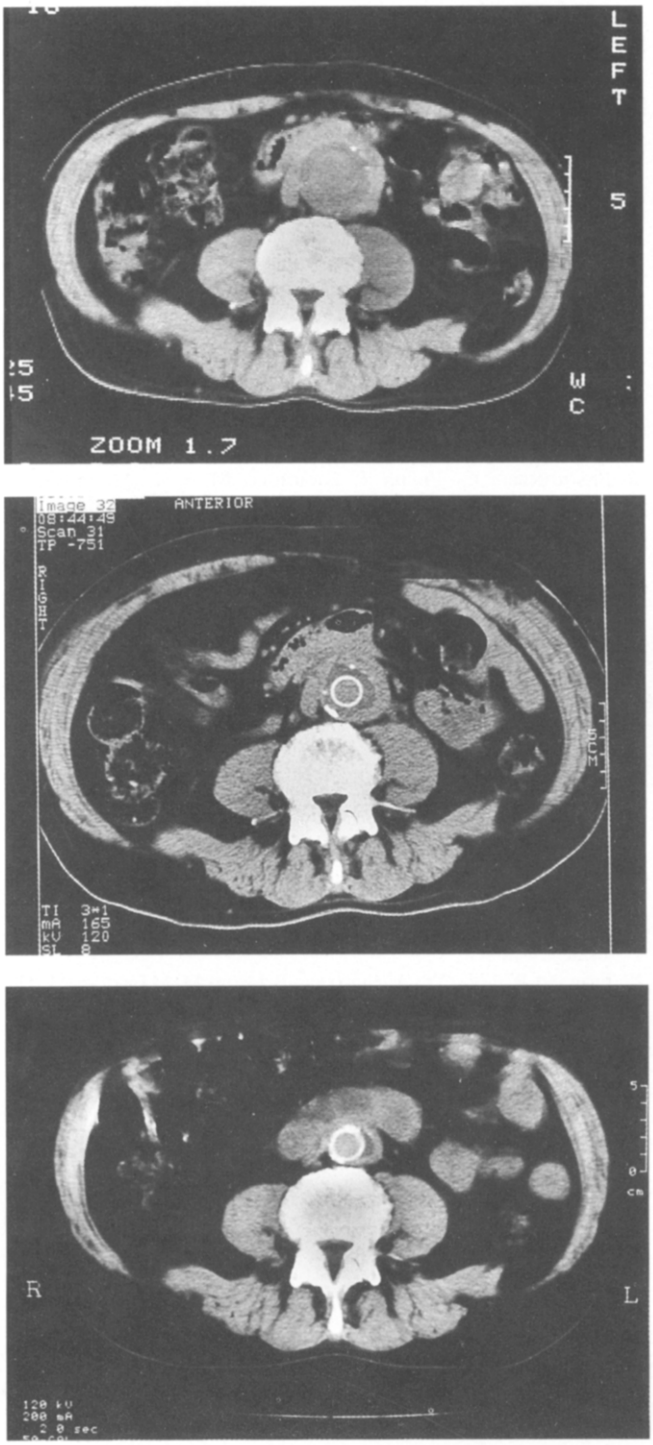

Fig. 1. (a) Male, 64 years. Preoperative CT scan showing a 1 cm thick perianeurysmal layer of fibrotic tissue, surrounding a 4 cm AAA. Note calcified media central to the fibrotic mass. (b) Same patient. Three months after implantation of vascular prosthesis, slight reduction of the fibrosis is seen. (c) Same patient, 15 months after surgery. Partial regression of the perianeurysmal fibrosis.

prosthesis will prohibit further leakage of antigenic material.

Several authors[6,7,9–11] have found regression of the fibrosis in the postoperative period. This single centre study reports the largest series which has been published to date. Ureteral obstruction is often included in the fibrotic plaque. Although it has been demonstrated that ureteral obstruction can disappear without any other procedure than repair of the abdominal aorta aneurysm.[6] Our routine procedure has been to perform ureterolysis in these cases. On follow-up we found no progression of fibrosis, and regression was found in 18 of 21 patients. In the CT follow-up of Stella *et al.*,[11] unchanged lesions and complete regression was found somewhat more frequently (32% and 47%, respectively), although the observation time (21 months) in this study was comparable to ours. In a previous study,[7] we found that the life expectancy of patients, operated on for AAA with PF does not differ from an age and sex matched Danish normal population or from aortic aneurysm patients in general.

Several authors[5,6,8] have reported that only a small proportion of PFs are diagnosed preoperatively, but this fact could be related to decreased awareness of the disease by radiologists or by the surgeon. Furthermore, the improved image quality of newer CT scanners may have contributed to the improved detection rate and a larger experience obtained in a single center. In our CT-study two cases were misinterpreted as haematomas but no false positive diagnoses were made. The improved quality of newer CT-scanners makes them adequate in outlining patients with inflammatory aneurysms. Perianeurysmal fibrosis has a characteristically multilayered appearance on MRI. Our experience with MR-scan is limited, but in the literature several reports found that the MR-scan may be somewhat superior to the CT-scan.[18–20] In accordance with other studies,[21] the authors found that ultrasound had a limited value in the evaluation of PF.

As PF is characterised by media thinning and marked fibrous thickening of the aortic adventitia, the calcified media will be placed centrally to the superimposed, homogenous fibrotic mass. In our opinion, looking for this clue makes it possible to recognise even small layers of fibrosis. A thin layer of fibrosis around an aortic aneurysm may be overlooked by both MRI and CT scans, but is of no clinical importance to the vascular surgeon. It has been stated that intravenous contrast may facilitate the diagnosis by enhancing the fibrosis.[18] We found enhancement to be poor and of no additional value.

The absence of fibrous tissue behind the aneurysm has made some surgeons favour a retroperitoneal approach in these patients.[22] However, no comparable studies have been made between the methods, and the present results do not necessitate an alteration in the approach.

In conclusion, this study supports the findings that PF tends to regress after repair of the abdominal aortic aneurysm. High-resolution, non-enhanced CT-scan is a suitable tool in monitoring the course of the fibrosis. The management of patients with PF should take place in centres with the necessary experience, especially when there is ureteral involvement. After successful repair, follow-up is only needed to ensure good renal function.

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