ENDOVASCULAR AND SURGICAL TECHNIQUES

Importance of Plain X-ray in Endoluminal Aortic Graft Surveillance

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Introduction

There is general agreement that all patients undergoing endoluminal repair of abdominal aortic aneurysms (AAA) should be carefully followed since the long term outcome is unknown. Contrast enhanced computerised tomography (CT) is considered to be the most reliable method of detecting a persistent communication between the circulation and aneurysmal sac. Carefully planned aortography using oblique and lateral views is extremely useful in identifying the site of such a communication once its presence is known. The place of plain X-ray of the abdomen, however, is less well recognised. All endografts have radiopaque markers to aid in their deployment and much useful information can be gained from examination of subsequent plain films. We present a case in which plain X-ray of the abdomen demonstrated faulty fixation more clearly and 6 months earlier than contrast enhanced CT.

Case Report

A 57-year-old male patient presented with lumbar back pain. CT demonstrated an infrarenal abdominal aortic aneurysm 4.3cm in transverse diameter. Further investigation including contrast enhanced CT and aortography using a calibrated pigtail catheter (Fig. 1) showed that the patient fulfilled the criteria for inclusion in the FDA-approved pilot study of the Endovascular Technologies (EVT) aortic endograft.

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Approval had been given for the pilot study by the institutional review board and the Therapeutic Goods

Fig. 1. Preoperative aortogram demonstrating AAA suitable for endoluminal tube graft repair.
Administration, the Federal Government regulating body. Informed consent was obtained from the patient.

Endoluminal repair was undertaken on 1st September 1993 using the EVT endovascular grafting system (EGS). Operative time was 1 h 50 min and blood loss 200 ml. An on-table post-procedure aortogram and postsoperative contrast enhanced CT (Fig. 2) confirmed exclusion of the AAA sac from the general circulation. The procedure was uncomplicated except for postoperative fever which occurred in the absence of any evidence of infection or raised white blood cell count.

The FDA-approved follow-up protocol consisted of clinical evaluation, plain X-ray of the abdomen, duplex ultrasound and contrast enhanced CT at 6 weeks, 6 months, 12 months and 18 months after operation. Plain X-ray of the abdomen at 6 weeks confirmed satisfactory deployment of the endograft (Fig. 3a). The superior and inferior attachment devices can be seen to be in the correct position in relation to

Fig. 2. Contrast enhanced CT 6 weeks after operation confirming exclusion of the aneurysmal sac from the circulation. Maximum transverse diameter 4.3cm.

Fig. 3. (a) Plain antero-posterior X-ray of the abdomen 6 weeks after operation demonstrating the attachment devices in the appropriate position and orientation in relation to the vertebrae and aortogram in Fig. 1. (b) Plain lateral X-ray of the abdomen 6 weeks after operation confirming absence of kinking in the overlying lateral radio-opaque markers.
Fig. 4. Contrast enhanced CT 12 months after operation demonstrating reduction in maximum transverse diameter of the aneurysmal sac (3.7 cm) and its continued exclusion from the circulation.

Fig. 5. Plain anteroposterior X-ray of the abdomen 12 months after operation demonstrating rotation through 45° of the inferior attachment device.

Discussion

Examination of reports of endoluminal AAA repair reveals that, in the majority, outcome is assessed by contrast enhanced CT.\(^1\)\(^-\)\(^5\) While there is no denying that this is the most reliable method of detecting a communication between the aneurysmal sac and the aortic lumen, it is not the only criteria of success. This case suggests that not only migration of an attachment device inferiorly or superiorly but any movement or rotation is indicative of a lack of fixation and healing between the endograft and aortic wall. Early kinking in the line of the laterally placed radio-opaque markers indicates foreshortening of the endograft and by implication migration of one or other of the attachment devices. These changes, visible on plain X-ray are more subtle than, and may precede, changes of sufficient magnitude to show extravasation of contrast into the aneurysmal sac on CT. The early awareness of inadequate fixation of an attachment device affords the surgeon the opportunity for endovascular intervention before further migration removes this option.

A standardised technique is desirable when plain

the lumbar vertebrae and correctly orientated in relation to the angulation of the proximal and distal necks of the AAA as demonstrated in Fig. 1. The radio-opaque markers on the lateral aspects of the endograft confirmed the absence of twisting or lateral compression except for the indentation at the upper left end of the endograft where it conforms to the angle in the neck of the aneurysm. In the lateral view (Fig. 3b) these markers are superimposed and their straight line orientation confirms the absence of any angulation of the graft in an anteroposterior plane.

At 6 and 12 months after operation contrast enhanced CT confirmed continuing exclusion of the sac and diminution in the maximum transverse diameter from 4.3 cm to 3.7 cm (Fig. 4). Plain X-ray of the abdomen 12 months after operation, however, showed that the inferior attachment device had rotated through 45° in the lateral plane (Fig. 5). Plain X-ray of the abdomen taken 18 months after operation demonstrated further rotation of the inferior attachment device to 90°. This was accompanied by superior migration of the attachment device and kinking of the endograft (Fig. 6a and b). By this time, 6 months after the initial changes on plain X-ray were seen, contrast enhanced CT demonstrated extravasation of contrast and an increase in maximum transverse diameter to 4.6 cm (Fig. 7).
Fig. 6. (a) Plain lateral X-ray of the abdomen 18 months after operation demonstrating further rotation and superior migration of the inferior attachment device. (b) Plain lateral X-ray of the abdomen 18 months after operation demonstrating kinking of the lateral radio-opaque markers of the endograft.

Fig. 7. Contrast enhanced CT 18 months after operation demonstrating extravasation of contrast into the aneurysmal sac and increase in its maximum transverse diameter to 4.6cm.

X-ray is performed. Centering the field on the umbilicus reduces paralex errors. The use of anteroposterior, lateral and oblique views gives additional information particularly in relation to twisting of the endograft.

Plain X-ray of the abdomen was the most useful investigation in identifying fatigue fractures in nine EVT attachment devices in 1995. Although the original fracture was noted in an explanted specimen, the nine subsequent cases were noted on plain X-ray. Modifications have now been made and recruitment in the trial of the EGS is due to recommence in late 1995.

We conclude that plain X-ray of the abdomen is a useful and simple means of follow up for patients with endoluminal repair of AAA. The cost of plain X-ray also compares favourably with the more sophisticated methods of imaging. Lack of movement in radio-opaque parts of the endograft should be accepted as one of the criteria of success for endoluminal AAA repair.
References


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