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Ga-67 citrate scan in vascular graft infection

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The clinical utility of the Ga-67 scan has been studied in 9 patients with clinical suspicion of vascular graft infection. Eleven grafts were analyzed: 4 aortobifemoral, 2 iliofemoral, 3 femoropopliteal, 1 axillofemoral, and 1 axillobifemoral. The Ga-67 scan was positive in 8 grafts with bacteriological proof of infection and negative in 3 grafts in which infection was ruled out by clinical follow-up. A Ga-67 scan also demonstrated the spread of infection to the thigh in two patients and to the pelvis in another two patients. In 4 patients CT was performed. The CT findings included graft thrombosis, perigraft fluid collection and thickened graft wall. No discrepancies were found between the CT scan and Ga-67 scan. In three patients a control Ga-67 scan was carried out after specific antibiotic and surgical treatment. Two of these showed increased Ga-67 uptake and spreading of infection along the graft; in the other patient, a Ga-67 scan revealed normalization after resolution of an abdominal abscess. In conclusion, the Ga-67 scan proved useful in the diagnosis of vascular graft infection, the definition of location of the extent of the disease and in the evaluation of the efficiency of treatment.

Key words: vascular graft, infection, Ga-67 scan

INTRODUCTION

VASCULAR GRAFT INFECTION is an uncommon complication of vascular surgery, but results in high morbidity and mortality rates and an increase in the number of limb amputations required.[1] Fever and suppuration from the surgical incision are usually the only clinical findings when graft infection is present.[2] These non-specific symptoms do not help to locate and evaluate the extent of the infection, so an accurate diagnostic method is required.

This paper presents our experience in the diagnosis of vascular graft infection by means of Ga-67 citrate scintigraphy.

MATERIALS AND METHODS

We made a retrospective study of the clinical records of 9 vascular graft patients given a Ga-67 scan on suspicion of vascular graft infection. Eleven grafts were analyzed: 4 aortobifemoral, 2 iliofemoral, 3 femoropopliteal, 1 axillofemoral, and 1 axillobifemoral. The graft infection was presented between six days and eleven years after the vascular surgery.

Clinical manifestations were fever in three cases, suppuration through the surgical incision in four cases, one patient was admitted in a septic state, and one patient developed an abscess in the thigh.

The Ga-67 scan was performed 48 hours after intravenous injection of 111–185 MBq of Ga-67 citrate. Images were obtained over the sites where vascular grafts were located and 450,000 to 650,000 counts per image were obtained. Two patients were scanned three times and one patient twice, so the total number of Ga-67 scintigraphies was 14. Ga-67 images were considered positive when uptake was found in any part of a vascular graft. Uptake found at a recient surgical incision was considered normal.

In four patients CT scan was also performed concurrently with the Ga-67 scan. CT criteria for vascular graft infection were: thickened graft wall or increased perigraft soft tissue, perigraft fluid, pseudo-

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aneurism at anatomosis, graft occlusion, and gas in the graft bed.[3]

RESULTS

Infection was established in 8 of 11 vascular grafts studied, including 6 cases that had positive graft culture and two cases that had positive culture of the surgical incision exudate. In three cases clinical follow-up ruled out infection. Table 1 shows the microorganisms isolated. From a therapeutical point of view, three grafts were removed and three cases underwent limb amputation; two patients were treated with antibiotics alone.

Ga-67 scan was positive in all 8 infected grafts (Figs. 1, 2) and negative in the three non-infected grafts (Table 1). Apart from graft uptake, Ga-67 scan also revealed the spread of infection to the thigh in two cases and the formation of abscesses in two patients (Fig. 3). In the four patients with graft infection that underwent paired CT and Ga-67 scan, no discrepancies were found. Ga-67 scan was performed previous to CT in 3 patients and the CT scan was ruled out to confirm Ga-67 findings. In these patients, CT findings included graft thrombosis in one patient and perigraft fluid in association with wall thickness in two patients. In the remaining patient, CT scan showed thickened wall, perigraft fluid and

Table 1 Summary of patient population, Ga-67 scan, and final diagnosis

Patient No.	Age (y)	Sex	Location	Age of the graft	Bacteriology	Graft infection	Ga-67 scan	Treatment
1.	45	M	Iliofemoral	10 days	Negative	No	(−)	Clinical follow-up
2.	81	F	Femoropopliteal	6 days	P. aeruginosa	Yes	(+)	Surgery***
3.	67	M	Aortobifemoral	7 months	Proteus E. coli St. aureus	Yes	(+)	AB, surgery***
4.	63	M	Aortobifemoral	14 days	Serratia	Yes	(+)	AB
5.	56	M	Iliofemoral	11 years	St. epidermidis	Yes	(+)*	AB, surgery****
			Femoropopliteal	8 years	Negative	No	(−)	Clinical follow-up
6.	65	M	Aortobifemoral	1 month	Aspergillus	Yes	(+)**	Surgery***
7.	61	M	Axillofemoral	8 years	Bacteroides	Yes	(+)	Surgery****
			Aortobifemoral	1 month	Bacteroides	Yes	(+)*	AB, surgery****
8.	78	F	Axillobifemoral	1 month	Proteus	Yes	(+)	AB
9.	60	M	Femoropopliteal	12 days	Negative	No	(−)	Clinical follow-up

*Two follow-up scans; **One follow-up scan; ***Amputation of the limb; ****Graft removal;
AB: antibiotic therapy

Fig. 1 Patient No. 7. Anterior views of the thorax, abdomen and pelvis showed uptake of Ga-67 along the left axillofemoral graft.

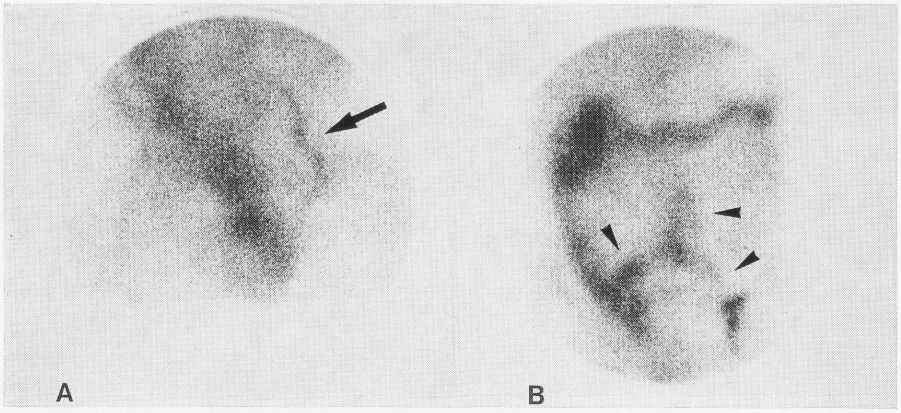

Fig. 2 Patient No. 7 (continuation). A. After graft removal and implantation of an aortobifemoral graft, the anterior image of the pelvis shows longitudinal uptake in the left groin (arrow). B. One month later, the Ga-67 citrate scan shows abnormal accumulation in an inverted-Y distribution (arrow heads) corresponding to aortobifemoral graft.

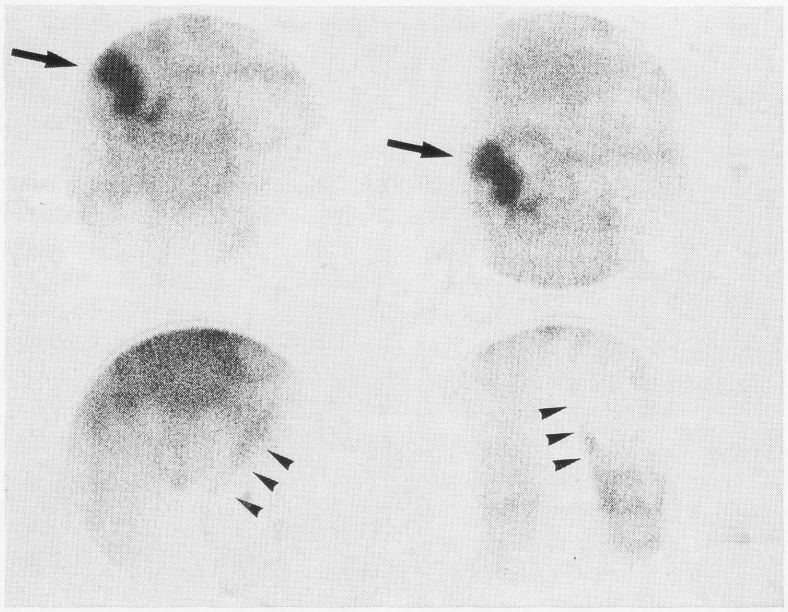

Fig. 3 Patient No. 2. Anterior images of the pelvic and femoral region (bottom) demonstrated uptake along the left femoropopliteal graft (arrow heads). Activity in the right lower quadrant (arrows) represent uptake in a pelvic abscess (top) (See text).

inflammatory changes adjacent to the graft; Ga-67 scan was performed to evaluate the extent of infection. The CT likewise revealed abscesses in 3 out of the 4 patients.

Three patients also were explored following the initiation of antibiotic and surgical treatment (Table 1). Patient No. 5 had a pelvis abscess after removal of an iliofemoral graft infected by S. epidermidis; two Ga-67 follow-up scans showed clearing of the abscess with antibiotic therapy. Ga-67 scan of patient No. 6 showed uptake on the right side of the aortobifemoral graft infected by Aspergillus; a follow-up scan 15 days after the initiation of Anphotericine treatment revealed a thigh abscess. In patient No. 7 an axillofemoral graft infected by Bacteroides fragilis was removed (Fig. 1) and in the same operation an aortobifemoral graft was done; two control scans showed whole graft infection from the distal anastomosis of a femoral branch (Fig. 2).

DISCUSSION

Vascular graft infection is a complication of vascular surgery with an incidence of 1–6%, which is responsible for a high rate of morbidity and mortality, between 25–78%.[1,4] Clinical signs of infection are non-specific and may manifest either immediately following surgery or some years later. Also they are

not helpful in the evaluation of the extent of infection.

Many techniques have been employed in order to detect vascular graft infection: angiography,[5] ultrasonography,[6] CT,[3,7] RNM,[8] In-111 IgG,[9] In-111 leukocytes,[10,11] Tc-99m-HMPAO leukocytes,[12,13] and Ga-67 citrate scan.[14,15]

Although the Ga-67 scan has demonstrated a sensitivity of 78–100% and a specificity greater than 90% for graft infection,[3,15] it has excited little interest and received only limited attention from a few researchers.[6,16,17] In 1980, Causey et al.[14] first reported Ga-67 uptake in 5 vascular grafts with proven infection. Subsequently, Thivolle et al.[15] reported 11 patients with vascular grafts, 7 of which were infected; the Ga-67 scan correctly identify uptake in these grafts and it was negative in the four non-infected grafts. Moreover, Ga-67 scan and Tc-99m-HMPAO leukocytes were found useful in the detection of 8 infected vascular grafts in the series reported by Vorne et al.[13] Our results are similar to previous reports; all infected vascular grafts were successfully identified by Ga-67 scan.

The extent of infection in vascular grafts determines the treatment to be applied. In general, infection limited to the groin is treated with antibiotics; surgical therapy is employed in the cases in which medical treatment fails.[1] The spread of infection to the retroperitoneum requires graft removal and extraanatomic revascularization of the lower limbs.[2,4] In our study, Ga-67 scan revealed the spread of infection beyond the graft in 4 patients. Figure 3 is a good example of these findings. The scan was performed on a patient carrying a left femoropopliteal graft that had undergone leg amputation below the knee. Scintigraphy revealed Ga-67 uptake along the vascular graft at which distal end Pseudomona aeruginosa was isolated. Right iliac fossa uptake related to a pelvis abscess was also noted. Therefore it may be considered from these findings that the Ga-67 scan is able to identify those patients with local graft infection which are susceptible to medical treatment, patients with infection involving the whole vascular graft which requires surgical treatment, as well the patients with infectious complications such abscess formation.

The principal disadvantage of the Ga-67 scintigraphy in diagnosis of infection is the necessary period of waiting before the scan may be performed. This drawback resulted in an unfavourable comparison with the labelled leukocyte method, especially with Tc-99m-HMPAO leukocytes.[18] We have always obtained images 48 hours after injection, although Thivolle et al.[15] found Ga-67 uptake in vascular graft at 24 hours after radiotracer administration and Causey et al.[14] were able to locate the infection site in all vasculsr grafts studied 6 hours after injection, but this uptake was more clearly seen at 24–48 hours.

The physiological Ga-67 uptake in abdominal structures (liver, spleen and colon) and surgical incisions has been considered as a potential disadvantage of the Ga-67 scan.[19] However thoroughly abdominal cleaning is carried out, the vascular graft is not close to the liver or spleen, and surgical incision uptake tends to decrease after the first week.[3,14]

CT utility for graft infection has also been demonstrated previously.[3,7,20] CT is also able to detect other complications of vascular surgery such as retroperitoneal haematomas, aortoduodenal fistula, pseudoaneurism, vascular thrombosis, intestinal infarction, and postsurgical pancreatitis.[21,22] We have found no discrepancies between CT and Ga-67 scan, but our experience is limited. However, Johnson et al.[3] reported greater sensitivity of CT in the diagnosis of the retroperitoneal spread of infection. In a comparative study CT-Ga-67 scan, Ga-67 was negative in two patients with retroperitoneal infection; Ga-67 scan was more specific than CT in facilitating the differentiation between vascular graft infection and postsurgical inflammatory changes. From these results, the authors recommend the CT as the initial choice for exploration, leaving the Ga-67 scan to those cases where the results of the CT scan are not conclusive.[3]

In conclusion, vascular graft infection as a complication of vascular surgery is difficult to diagnose and may have dramatic consequences in terms of morbidity and mortality rates, and the need to carry out limb amputation. Several medical explorations are required to confirm its presence and extent. From our results, some conclusions can be drawn. First, Ga-67 scan was a useful technique in the diagnosis of vascular graft infection, with 100% specificity and sensitivity. Secondly, in all cases studied, Ga-67 scan identified the location and extent of the infection, including abscess formation beyond the graft area. Thirdly, the Ga-67 scan facilitated the evaluation of the treatment efficiency in patients who underwent surgical and/or antibiotic therapy. Fourthly, our limited experience with regard to the CT does not enable us to reach firm conclusions concerning its utility, and further investigations are therefore necessary.

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