

TREATMENT OF CHRONIC OSTEOMYELITIS BY TRANSPLANTATION OF AUTOGENOUS OMENTUM WITH MICROVASCULAR ANASTOMOSIS

A Preliminary Report

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Free omental transplantation with vascular anastomosis was attempted in three clinical cases as a new method of treatment for chronic osteomyelitis. The bone cavity produced by debridement was completely eliminated by the transplanted omentum. Furthermore, the omentum, because of its biological characteristics, formed good vascular anastomoses with the adjacent bone tissue. Although sufficient time has not yet elapsed to prove the existence of healthy bone regeneration and, therefore, further evaluation for a longer period is necessary, this therapeutic method would seem to have considerable potential in the treatment of chronic osteomyelitis.

Key words: omentum; autologous transplantation; microsurgery; osteomyelitis

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Various methods have been used since the early days of medicine in an attempt to treat chronic osteomyelitis. However, no ideal method has yet been established. One of the most unfavourable factors making healing of chronic osteomyelitis difficult, is the ischaemia rather than the infection of the bone, because avascular bone or scar tissue acts as an impenetrable barrier to antibiotics.

The principle of management, therefore, consists of debridement of sequestra, scar tissue and sinuses, exposing fresh healthy bone, and then the administration of appropriate antibiotics. Here

the problem arises of how to eliminate the dead space upon closure of the wound, so as to prevent reinfection. For this purpose various techniques have been applied, such as free skin graft, pedicle muscle flap and bone graft, which, however, are not always applicable or successful.

The purpose of this paper is to describe a method, first developed by us, to utilize the omentum, rich in vascular structure, for filling the dead space. The idea developed after reading a paper by McLean & Buncke (1972) and was later reinforced by Hariu, one of the authors,

who reported a successful autotransplantation of the omentum with microvascular anastomosis for a large scalp defect (Harri & Ohmori 1973). According to the latter report, the omental transplant took well on the scalp and could be covered by a split-thickness skin graft.

In our animal experiments, the omental transplant with microvascular anastomosis showed good viability with a well preserved vascular structure and the development of a rich vascular connection with the surrounding bone tissue (Figure 1).

It was expected, therefore, that omental transplantation with vascular anastomosis could be applied to the treatment of osteomyelitis.

OPERATIVE TECHNIQUE

It is preferable to use a two-team approach—one team prepares the omental graft, while the other performs debridement of the diseased area.

Through an upper midline incision, the greater omentum is separated from the transverse colon and the greater curvature of the stomach, and an omental graft with the right or left gastroepiploic vessels as its pedicle is obtained. The

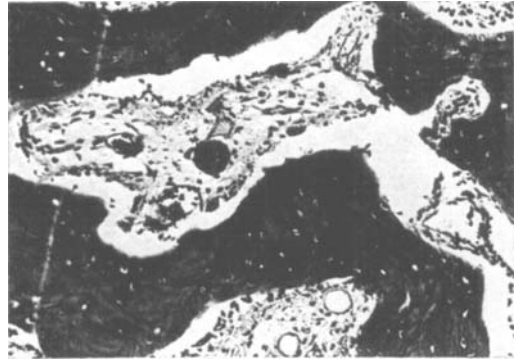


Figure 1. In an adult dog the femoral periosteum was stripped, the cortex was fenestrated and the bone marrow was completely curetted out. The omental graft with vascular anastomoses was then placed in the cavity. At sacrifice 5 weeks later, a microangiography of the transplanted omentum was performed via the anastomosis. The vessels within the newly developed bone marrow tissue are filled with the contrast material (Haematoxylin and eosin, $\times 80$).

size of the graft depends on the volume of the cavity to be filled (Figure 2).

The stumps of the gastroepiploic vessels are irrigated by a heparinized saline solution and the graft is wrapped in a moist pad, until it is placed in the gutter formed after debridement. The pedicle is then brought up through a sub-

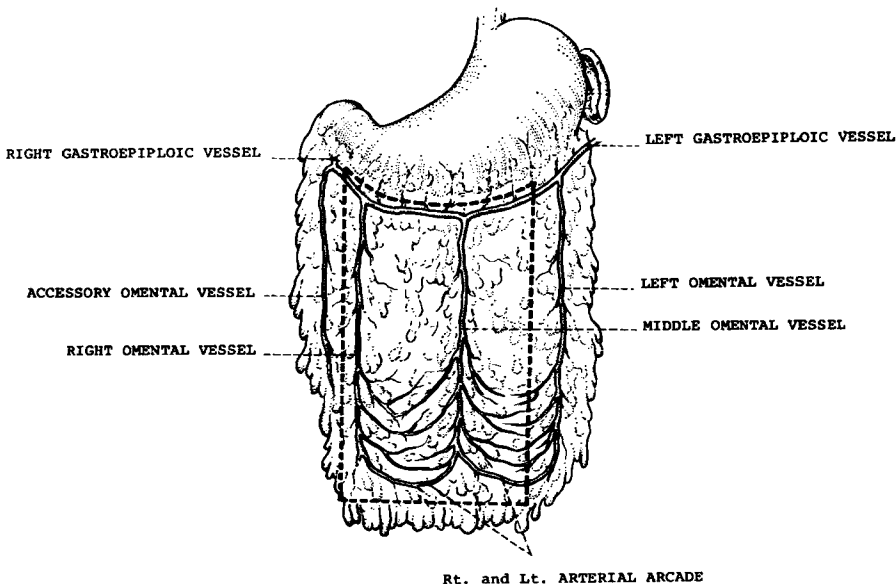


Figure 2. Blood supply of the omentum and an example of the extent of the excision.

cutaneous tunnel to be anastomosed with the recipient vessels. Following end-to-end anastomoses of the vessels, the graft is well packed in the gutter. In the event that there is a skin defect upon closure of the wound, a split-thickness skin graft is sewn into place over the omental graft with a tie-over dressing.

CASE REPORTS

Case 1. A 65-year-old female, with a history of four surgical operations for chronic osteomyelitis of the left femur from the age of 13, was referred to us with an acute exacerbation. A radiograph showed a thickened and sclerotic cortex at the junction of the middle and lower thirds of the femur and a lateral cortical surface which appeared irregular (Figure 3).

At operation, the affected portion was well curetted and an omental graft was placed in the gutter. A branch of the lateral circumflex artery and the greater saphenous vein were used as the recipient vessels (Figure 4).

The patient received antibiotics for about 1 month prior to admission, 45 days preoperatively after admission, and 60 days after operation.

Culture of the discharge and granulation tissue on admission and at surgery was negative for bacterial growth.

A femoral arteriogram obtained 5 weeks later revealed well preserved patency of the omental artery as indicated by the arrow (Figure 5).

Now 1 year and 5 months following surgery, the patient shows no systemic or local evidence of recurrent inflammation. There is no radiographical evidence of bony filling as yet.

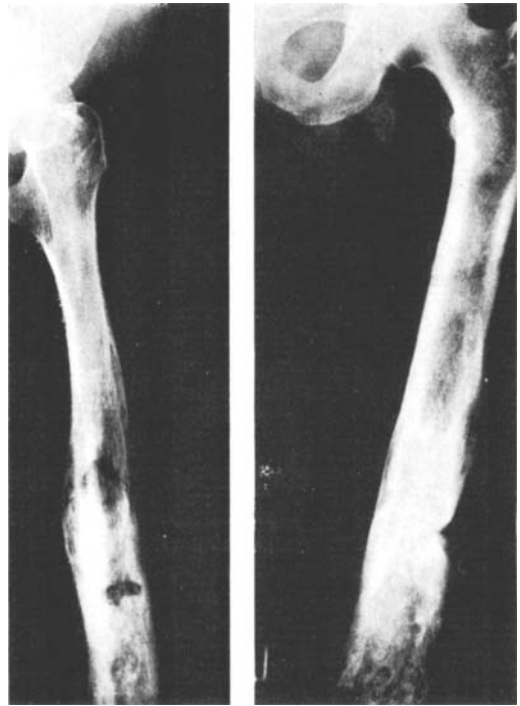


Figure 3. Case 1. A radiograph of the left femur.

Case 2. A 43-year-old male with chronic osteomyelitis of the left tibia from the age of 11 was admitted to our clinic for operation.

A radiograph indicated marked sclerosis with irregular margins of almost the entire tibia with an anterior convex deformity (Figure 6).



Figure 4. Case 1. The omental graft is in view being placed in the gutter.

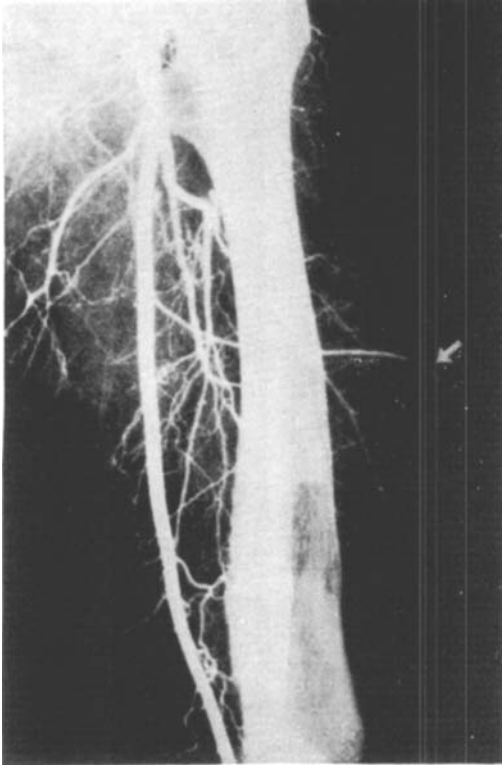


Figure 5. Case 1. A femoral arteriogram at 5 weeks after surgery. The omental artery remains patent (arrow).

The middle and lower thirds of the tibia were curetted following sufficient excision of the involved bone, and the gutter was filled with an omental graft with the anterior tibial vessels being used as the recipients. The skin defect over the omentum was covered by a split-thickness skin graft.

The patient received antibiotics for about 2 months before admission, and for 20 days prior to and about 2 months after surgery in our clinic, respectively. Culture of the discharge on admission showed *Escherichia cloacae*, and the culture at surgery was negative.

An arteriogram carried out 5 weeks post-operatively showed patency of the omental vessel.

One year and three months later, the patient was doing well with no evidence of recurrence. X-ray findings are still unchanged from the postoperative pictures.

Case 3. This 27-year-old male with chronic osteomyelitis of the femur from the age of 13 was transferred to our clinic because of a recent aggravation.

A radiograph on admission showed sclerotic

cortex extending from the middle portion to the distal metaphysis of the femur.

The external pudendal artery and the greater saphenous vein were used as the recipients for the omental grafting in this case.

Antibiotics were administered 16 days prior to admission, and for 15 days before and about 3 months after surgery in our clinic, respectively. Bacterial cultures were negative both on admission and at surgery.

A femoral arteriogram 5 weeks after surgery failed to reveal the vessels of the omental graft, though the clinical results had been favourable. After 12 months, the patient is in good condition without any signs of recurrent inflammation.

DISCUSSION

The omentum has the characteristic that it readily develops vascular anastomoses with adjacent tissues, and this quality has been used for the revascularization of ischaemic myocardium (Vineberg et al. 1965), and chronic arterial obstruction of the leg (Nishimura et al. 1974),



Figure 6. Case 2. A radiograph of the left tibia.

etc. However, reports of free omental transplantation by microsurgical techniques are still limited to only a few papers and our method of applying this technique in the treatment of chronic osteomyelitis is an entirely new attempt.

One of the advantages of this method is that it is suitable for eliminating a dead space regardless of the size, shape, or site. The second advantage, as elicited by our animal experiments, is that the transplanted omentum forms abundant vascular anastomoses with the surrounding bone and, therefore, it is expected that the bone tissue will receive a sufficient supply of blood.

The patency of anastomosis was confirmed in two out of three clinical cases by femoral arteriographs performed 5 weeks postoperatively. In our series of animal experiments, the patency was studied at autopsy by microscopic inspection and/or by angiography via the saphenous artery, and the results were found to be excellent with the success rate being as high as 81 per cent (13 dogs out of 16).

It is likely that patent anastomosis is not always demonstrable by femoral arteriography if resistance to the blood flow is relatively high at the anastomosis site. This is possibly the explanation in case 3.

The disadvantages of our method are its technical difficulty and the necessity for abdominal exploration.

The recipient arteries sacrificed for end-to-end anastomosis were a branch of the lateral circumflex artery in case 1, the anterior tibial in case 2, and the external pudendal in case 3. The objection may be raised that sacrificing the anterior tibial artery might cause some degree of ischaemia of the pretibial mus-

cle group. Harii et al., however, demonstrated that no ischaemia has ever occurred following the transplantation of a groin flap, a procedure which also uses the anterior tibial artery. In addition, the postoperative arteriograph in case 2 revealed the contrast material filling the anterior tibial artery distal to the sectioned point via collateral circulation.

Furthermore, performing a popliteal arteriography (with a 50 per cent suspension of barium sulphate in 3 per cent gelatin) in an amputated leg after cutting the anterior tibial artery, in the same way as carried out in case 2, a relatively good distribution of the radio-opaque material in the pretibial muscles was shown on a cross section radiogram. It is likely, therefore, that the transection and ligation of several branches of the anterior tibial artery in preparation for grafting does not result in significant ischaemia in any part of the pretibial muscles.

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