Bone allograft banking in the United Kingdom

Morbidity at autograft donor sites and the lack of adequate quantities of bone to fill large defects have encouraged the use of preserved allografts. The steady increase in demand for graft material over the last decade has been largely due to the spiralling numbers of revision hip arthroplasties (BOA 1992; van Witzenberg et al 1992). These revision procedures now account for up to 30% of all elective hip operations in some British hospitals (Michaud, unpublished data), and often require substantial amounts of allograft. It is estimated that in 68% of UK hospitals this is the primary use of allograft; other hospitals also use such grafts in spinal, tumour and trauma surgery (Michaud, unpublished data).

These increased demands have encouraged the development of institutional bone banks, first in the United States and subsequently in other countries (Saies and Davidson 1990; Delloye et al 1991; Nather 1991; van Witzenberg et al 1992). The American Association of Tissue Banks (AATB) evolved both to advise on and to regulate this activity. The instruction manuals which were published (AATB 1991) have served as guides for bone-banking programmes in several other countries. More recently, the European Association of Musculoskeletal Transplantation has evolved to provide comparable guidance in Europe, whilst in the UK the embryonic British Association of Tissue Banks is bringing together those with an interest in the subject.

Several articles in the international literature have reviewed the guidelines for bone banking (Tomford, Starkweather and Goldman 1981; Buckham 1986; La Prairie and Gross 1991; Scarborough 1992), but some banks nevertheless continue to operate with inadequate levels of safety, as shown by Russell, Hu and Raso (1989) in their Canadian survey. The dangers of bone allografting are of increasing concern: even allografts screened to the best current standards carry a small but definite risk of HIV transmission (Buck, Malinin and Brown 1989; Simonds et al 1992). In seronegative cadaver donors delayed repeat HIV tests are not possible, but detection of HIV infection may be improved in future by the use of the recently introduced polymerase chain reaction.

In 1992 the British Orthopaedic Association set up a working party and the resulting publication (BOA 1992) expressed the view that the growing ‘cottage industry’ in bone banking was dangerous because of inadequate funding, staffing and regulation of small units. The report highlighted the clinical and medicolegal hazards and was in favour of centralised bone banks, possibly in tandem with regional blood-transfusion services, as had been successful in Scotland.

The recommendations for the processing of ‘small bone fragments’, such as femoral heads, included the exclusion of donors in high HIV-infection risk categories, clinical screening of donors for a range of transmissible conditions, routine donor testing for HIV-1 and 2 antibodies, hepatitis B surface antigen, hepatitis C antibody and syphilis, selective testing for cytomegalovirus and rhesus blood group, and a repeat HIV test of the donor after 180 days. Testing was also recommended for bacterial contamination of the graft at retrieval and advice was given on packaging and storage temperatures. Finally, it was suggested that a minimum quarantine period of 180 days be imposed for grafts from live donors. Users were reminded of the need to obtain informed consent both from the donors and the recipients.

In 1993 we surveyed 390 hospitals in the United Kingdom and found a graft-user rate of 39% and a graft-banker rate of 10% among the 164 hospitals which responded to our questionnaire. Almost 70% of those banks had been operating for less than five years; 76% of the new banks were in England; the efficient bone banks run by regional blood-transfusion centres in Scotland had made new hospital banks unnecessary there. Regional banks reported frequent enquiries from small hospitals wishing to set up their own banks, but financial limitations often made this impossible. The number of staff running banks was small, and in 88% of them there were less than five employees. Medical staff and nurses played the major role; technical staff had charge only in a few instances. Although 94% of banks had written protocols for donor screening and graft processing, the proportion of banks whose protocols met BOA recommended standards was lower. This problem existed principally in smaller in-house banks.

Most hospitals obtained their allografts from banks within their own region but 8% of hospitals in Scotland and more than 30% in both England and Wales supplemented this with purchases of allograft from elsewhere.

In the UK about 10 000 femoral heads are retrieved annually from patients undergoing arthroplasty for osteoarthritis or hemiarthroplasty for femoral neck fractures. Grafts from other anatomical sites were collected by few banks and fewer practised bone retrieval from cadavers, collecting an estimated 110 to 140 whole long bones annually. Half the banks discarded between 10% and 30% of retrieved grafts, a rate similar to that reported from several other countries (Tomford et al 1981; Kakaiya and...
Jackson 1990; Saies and Davidson 1990). The annual 
graft utilisation rate in the UK was calculated at about 
7800 femoral heads, 24 kg of morcelised bone, and 55 
whole bones. It seems, therefore, that when discarded 
allograft is taken into account, supply is barely meeting 
demand. Despite this, only 17% of hospitals reported case 
cancellations from lack of required graft. Numerous 
strategies to avoid this included stockpiling, purchase of 
graffs from elsewhere, and judicious scheduling of cases 
likely to need grafts. 

The clinical and serological screening of donors, 
bacteriological testing, secondary sterilisation of retrieved 
graffs and the use of recommended storage temperatures 
and graft quarantine periods were less than ideal in more 
than 30% of banks. There was also a low rate of AIDS 
counselling for donors, and of obtaining consent from 
graff recipients. These low standards were found mainly 
in small hospital banks; the regional banks and those run 
by the blood transfusion service generally followed 
recommended protocols. 

Between 30 000 and 40 000 elective total hip 
arthroplasties are performed annually in the UK (Williams 
et al 1992; Bulstrode et al 1993). There are also substantial 
numbers of hemiarthroplasties performed for fractures of 
the femoral neck. Thus, there is an abundant potential 
supply of bone allograft from living patients. At present, 
30% of the bone retrieved from this source is processed 
by small hospital banks, and 30% of these follow 
suboptimal practices. 

The expected rise in demand for safe allografts will 
require more intensive harvesting and more rigorous 
processing of the material. Transfusion centres have the 
staff and equipment to manage the similar requirements 
of blood banking (Atrah 1992) and they have established 
a good track record in bone banking. The cost of running 
a safe bone bank is high and co-operation between 
hospitals and local blood-transfusion services seems to be 
the best and least expensive solution, with a national 
regulatory body modelled on the American AATB, to 
maintain and update safety standards.

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