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Hospital-based allogenic bone bank—10-year experience

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Summary Bone banking in a hospital provides resources of allogenic bone grafts. However, they may transmit infection from donor to recipient. We found few reports discussing the infection rate and monitoring processes associated with bone banks. The discard rate using the screening test was 18.5% (309/1674) in this series. The leading cause was hepatitis B antigen (HBsAg) positive donor serum (67%), followed by Venereal Disease Research Laboratory (VDRL) positive donor serum (15%), and anti-hepatitis C virus (HCV) positive donor serum (12%). The overall infection rate in the recipients was 1.3% (17/1365). Among 1353 implanted allografts, 22 cases (1.6%) had a positive swab culture result after thawing. Only four out of these 22 cases (18.2%) developed infection. However, the wound cultures of the infected recipients were different from the swab culture of thawing allografts except in one case. Among the 1331 recipients with sterile allograft bones, 13 (1%) were found to have infection. In conclusion, our bone bank operates under a strict monitoring system which results in a low infection rate. The recipient's status, the aseptic technique and environment during operation is likely to be more critical in prevention of allograft-related infection.

Introduction

Musculoskeletal allografts are useful in treating a wide variety of disorders. In particular, osseous and osteochondral tissues have been successfully used to repair or replace parts lost or damaged after injury, disease, degenerative procedures, and treatment modalities.[1] Procedures with allograft increased 14-fold between 1985 and 1996, and recently account for approximately one-third of bone grafts performed in United State of America.[2] One of the most potentially disabling complications of musculoskeletal allograft use is the transmission of diseases, especially infection, from donor to recipient.[3]

However, we found few documents discussing the infection rate and monitoring processes associated with bone banks in Taiwan. The present study

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investigates the performance of a hospital-based bone bank over past 10 years.

Methods

In 1989 we established a hospital-based bone bank at the Orthopaedic Department of National Taiwan University Hospital. The regulation of its operation is performed following guidelines of the Centers for Disease Control and Prevention (CDC) in USA. The bone bank became a well-run unit one and a half years later, when a full-time employee was responsible for this work. Thus we retrospectively reviewed 1365 allografts used in 1353 recipients from this bone bank from July 1991 to June 2001. The detailed booking-in system used for the bone bank included the source, the results of all screening tests, the date of harvesting, the date of implantation, and the recipient of each allograft. With the help of the nosocomial infection control group at the hospital, information was gathered on all surgically infected patients in the orthopaedic department during this period. Two databases were cross-linked to track every infection that followed allogenic bone graft surgery.

Most (98%) of the allografts were taken from femoral heads, which were harvested during total or hemi-hip arthroplasty under strictly aseptic technique. Other sites included the femoral and tibial condyle, proximal humerus, etc. More than 95% of the stored allografts were used within three months after procuration. All allografts were frozen at $-70\,^{\circ}C$ for two weeks to one year before implantation.

Each freshly harvested allograft was packed immediately with at least three sterile layers whilst inside the operation theatre. The inner layer was a sterile surgical glove and a piece of sterile sheet. The other two outer layers were both sterile plastic bags. The freezer of the bone bank was located next to the operating rooms and hence the packed allografts were frozen within minutes to hours.

Once an allograft was harvested, the donor's medical history was screened. If the donor had had local bone infection, infection of other organs (e.g. pneumonia), autoimmune disease (such as rheumatoid arthritis), or malignancy (not necessarily bone involvement), the allograft was discarded immediately and was not stored in the refrigerator. The remaining allografts were kept in the freezer and were not used until all laboratory screening tests proved the graft to be sterile.

The laboratory screening procedures became more comprehensive pregressively: when our bone banking began functioning fully in 1991, only hepatitis B virus surface antigen (HBsAg) and Venereal Disease Research Laboratory (VDRL) screening of donor serum was undertaken. From July 1993 onwards, a bacterial swab culture was also performed immediately after the bone graft was harvested, achieved by rubbing the surface of the allograft with a sterile culture stick. This procedure was performed by the surgeons or assistants immediately after harvesting whilst inside the operation theatre. The swabbed culture stick was preserved in a dry sterile tubular container thus preserving an adequate environment for transportation. It was then plated on aerobic and anaerobic blood agar without enrichment broth, and subsequently bathed in a semisolid broth tube that enabled aerobic micro-organisms to grow in the upper layer and anaerobic in the lower layer. The aerobic agar was incubated at 35 °C for three days in a 5% CO_2 environment. The anaerobic agar was incubated at 35 °C for three days in an anaerobic environment. The broth was incubated at 35 °C for seven days in 5% CO_2 environment. This bacterial culture method was not changed over the 10 years of the study. If the results of either swab culture or serological tests were positive, the bone graft was discarded. Then in May 1999, serum anti-hepatitis C virus antibody (anti-HCV) and anti-human immunodeficiency virus (anti-HIV) positive patients were excluded as candidates for allogenic bone graft donor (Table I).

Gamma-radiation was not used for disinfection. Another swab culture of allograft was performed after thawing. It was undertaken by surgeons or assistants inside the operation theatre during the implantation. The swab culture method, culture sticks, the culture medium, the microbiology laboratory were the same as those used during harvesting. All allografts were then washed with copious sterile normal saline and bathed with gentamicin solution (80 mg in 200–300 mL normal saline) before the graft was used in the recipient's body. The recipients received an intravenous injection of prophylactic first-generation cephalosporin within 30 min of the operation.

Results

According to the bone bank booking system, 62 (4.1%) allografts were used in tumour patients, 649 (47.8%) allografts used in spine surgeries, 648 (47.7%) allografts used in primary or revisional total hip arthroplasty, 54 (4%) allografts used in total knee arthroplasty, 73 (5.4%) allografts used in