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**Title:** Lower Limb Reconstructions With Bone Massive Allograft In Pediatric Patients

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## BACKGROUND

In the growing child, more commonly affected by primary bone sarcoma, limb salvage procedures present unique challenges and are surgically demanding situations. Reconstructive issues include: the small size of pediatric skeleton with concern of anatomical matching; the growth potential of unaffected leg and eventually limb-length discrepancy; the concerns of prosthetic stem fixation in immature bone with the risk of cortical stress-shielding; the need for durable reconstruction. Different reconstructive options are available for limb salvage procedures in the skeletally immature patients and include expandable mega-prostheses, distraction osteogenesis, allografts, allograft-prosthetic composites or autologous grafts.

## QUESTIONS/PURPOSES

This study aims to highlight the oncological outcome and complications of lower limb reconstructions with bone massive allograft in pediatric age.

## PATIENTS AND METHODS

From the overall database of 365 Bone Massive Allograft reconstructions from June 1995 to May 2015 performed at our Institution, we have retrospectively reviewed 74 patients with 14 years of age or younger who underwent lower limb reconstruction after primary bone sarcoma resection. The diagnoses included 43 osteosarcomas, 29 Ewing's sarcomas, 1 chondrosarcoma and 1 fibrosarcoma. The mean age of the patients was 10 years (range 3- 14). There were 38 girls and 37 boys. Reconstruction included: 23 intercalary allograft + vascularized fibular graft-VFG (11 femur, 12 tibia); 21 osteoarticular allograft-OA (15 distal femur, 6 proximal tibia); 16 intercalary allograft alone (10 femur, 5 knee arthrodesis reconstruction, 1 fibula); 13 allograft-prosthetic composite-APC (8 proximal femur, 2 distal femur, 3 proximal tibia); 1 free vascularized growth plate transfer plus allograft of proximal femur.

## RESULTS

After a mean follow-up of 62 months (range: 3-174) 61 patients (82%) were continuously disease free, 6 patients were alive with metastasis and 2 patients showed no evidence of disease after treatment of local recurrence or metastatic lesion. Five patients died of disease and 1 died of another cause (leukemia). The overall allograft survival for revision for any reason or amputation was 86,8% at 5 years and 66% at 10 years.

We have observed 12 allografts failure (16,2%) at the average of 75 months (range: 18-142) resulting from 9 fractures, 2 articular deteriorations and one local recurrence.

A fracture of the allograft occurred in 15 patients (20,3%), most of them affected osteoarticular allograft (8 fractures) and intercalary allograft + VFG (4 fractures). Thirteen of them had to be surgically revised: in four patients the allograft had been replaced by modular prosthesis, in four replaced by expendable prosthesis, in one patient an APC was performed, in four patients were performed replacement of internal fixation with or without bone graft augmentation.

There were 10 non-unions and allograft resorptions (13,5%). Three occurred in OA around the knee (2 distal femur, 1 proximal tibia), three in femoral intercalary allograft, two in tibial intercalary allograft+VFG, one in APC of proximal femur and one in knee arthrodesis reconstruction. Nine were treated with replacement of internal fixation and autologous bone grafting.

In 3 of 21 osteoarticular allograft (14,2%) the joint surface showed important signs of deterioration with consequently allograft replacement in two patients.

Eight patients (10,8%) presented a wound dehiscence with superficial infection, treated with surgical revision with or without flap coverage in 7 cases and conservatively with an antibiotic suppression therapy in one case. We observed two deep infections (2,7%), one primary and one after revision surgery with a composite prosthesis, underwent a one-stage surgical debridement.

#### CONCLUSIONS

Reconstructions of large bone defects in pediatric age are always challenging situations. In growing children the use of bone massive allograft, possibly combined with VFG or prosthesis, is often crucial. Despite the high rate of possible complications, biological reconstructions with bone massive allograft still represent a viable option and should be consider by surgeons in pediatric patients with lower limb sarcoma.