Patella Cryo-free Method during Recycled Frozen Autograft Procedure in Treating Proximal Tibia Malignant Bone Tumors - a Comparative Study of 11 Cases

Chao-Ming Chen, MD, Po-Kuei Wu, MD, Cheng-Fong Chen, MD, Wei-Ming Chen, MD,

Department of Orthopaedics and Traumatology, Taipei Veterans General Hospital, Taipei, Taiwan
School of Medicine, National Yang-Ming University, Taipei, Taiwan

Background

Liquid nitrogen frozen recycled autograft prosthesis composite is a widely-used reconstructive modality after excision of malignant bone tumor of proximal tibia in Asia. However, restoration of extensor mechanism remains a concerned problem during the reconstruction. Patellar chevron osteotomy instead of patellar tendon detachment could preserve the integrity of extensor mechanism and remains a standard procedure. Nevertheless, tumor eradicating procedure by liquid nitrogen freezing would jeopardize both bone and cartilage components of the innocent lower pole of patella, which might cause non-union, bone resorption, and patella-femoral joint arthritis. Thus, we design a new cryo-free method to protect innocent patella from cryoinjury during liquid nitrogen freezing. The purpose of this study is to compare clinical outcome between patella cryo-free and traditional methods in treating proximal tibia bone malignancy.

Materials and Methods

We retrospectively reviewed 11 cases of proximal tibia bone malignancy (9 osteosarcoma, 1 undifferentiated high-grade sarcoma, and 1 malignant giant cell tumor) treated with wide excision and frozen autograft-prosthesis composite reconstruction. Five patients were treated with patella cryo-free method (group A) while the remained 6 patients were not (group B). Patella chevron osteotomy was performed in all cases. After tumor resection, the tumor-bearing proximal tibia with innocent patella and patella tendon were all immersed in liquid nitrogen for 20 minutes and followed by slow thawing in group B. In group A, we used a towel clip to hold the gauze-wrapped patella above liquid nitrogen level and rinsed with warm sterilized water. Great care was taken to prevent tumor contamination in both groups. After final seating of prosthesis composite on the tibia, the patella was fixed with cannulated screws and tension-band-wire. Medial gastrocnemius muscle flap was routinely used in all cases. All patients followed the protocol of partial-weight bearing for 3 months after operation and range-of-motion (ROM) training commenced right after the surgery. The mean follow-up time was 41.4 months (25-60) in group A and 57.1 months (26-74) in group B.

Results

At the last follow-up, both groups showed no local recurrence nor distant metastasis and all survived with disease free. Latest image study revealed better patella union in group A, while 4

patients in group B had malunion or nonunion of the patella (p = 0.029). The mean extension degrees were 1.0 (0-5) in group A and 11.3 (5-15) in group B (p = 0.006). The mean flexion degrees were 124.0 (115-130) in group A and 100.8 (90-115) in group B (p = 0.009). The mean of Musculoskeletal Tumor society (MSTS) score at the last follow-up were 92.7 (90.0-100.0) in group A and 83.3 (80.0-86.7) in group B (p = 0.005). Of the 11 patients, three patients had superficial wound infection (1 in group A and 2 in group B), but all healed well after surgical debridement with/without local flap treatment. There was no neurovascular injury, associated fracture, graft resorption and tibia nonunion in both groups.

Conclusion

Liquid-nitrogen freezing technique can achieve reliable local control in treating proximal tibia malignant bone tumors. Patella cryo-free technique could preserve biological properties of resected patella and enhanced junction healing. Patients treated with patella cryo-free technique had less nonunion or malunion rate of the patella, less extension lag, and higher MSTS score. Compared with other methods, such as tumor prosthesis and traditional biological reconstruction for proximal tibia malignancy, we believe the application of patella cryo-free technique in frozen recycled autograft could preserve innocent patella, reduce nonunion or malunion rate of the patella, and provide better clinical outcome.