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Case report

Case report on metastatic pelvic bone tumor treated with frozen autograft by liquid nitrogen

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ABSTRACT

Introduction and importance: Frozen autograft recycling has been used for biological reconstruction of bone defects following tumor excision, more commonly in extremities. We report on the histological outcome of a pelvic recycled frozen autograft.
Case presentation: We investigated the pelvic frozen autograft removed in 2 years and 8 months after surgery because of soft tissue recurrence in pelvic floor. The autograft bone showed no evidence of revitalization and was non-viable with patchy inflammation, and no residual tumor. There was only fibrous union but the autograft bone remained mechanically stable.
Clinical discussion: We confirmed the clearance of tumor cells with the treatment with liquid nitrogen. The union at the host-graft junction might be affected by the previous radiotherapy, the presence of infection, the small contact area limited by the anatomy, and the inadequate compression across the osteotomy interface with the fixation.
Conclusion: Frozen autograft treated by liquid nitrogen can be used safely for biological reconstructions after pelvic tumor excision.

1. Introduction

Frozen autograft recycling was advocated for biological limb reconstruction of bone defects following tumor excision. There were reports confirming no residual tumor cells in the graft with good revitalization, and good bone fusion during the operation both macroscopically and radiographically [1,2]. We report a patient with pelvic reconstruction by recycled frozen autograft after surgery for recurrence of squamous cell carcinoma of the cervix. The graft was removed at 2 years and 8 months after implantation because of soft tissue recurrence in the pelvic floor and infection. We investigated the clearance of the tumor cells, the viability of the autograft and the union at the host-graft junction. This work has been reported in line with the SCARE criteria [3].

2. Presentation of case

The patient is a 33 years old woman who had pelvic recurrence of squamous cell carcinoma of the cervix. She had good past health and no family history of gynecological malignancies. She presented with cervical mass first detected right before labor in July 2015. The cervical mass was not present in previous gynecological examination. She had the delivery by lower segment Caesarean section (LSCS). Blood tests showed elevated tumor markers, including CEA, CA 125 and CA 19.9. Colposcopy and biopsy confirmed the diagnosis of moderately differentiated invasive squamous cell carcinoma. CT and MRI scans showed cervical carcinoma involving uterus and vagina. She was treated with robotic radical hysterectomy and pelvic lymph nodes dissection in December 2015 by a surgical team of gynaeoncologist in a university hospital. No adjuvant treatment was required after reviewed in multi-disciplinary team meeting. At 8 months after the index operation, there were serial elevation of tumor markers. CT, MRI and PET-CT scans confirmed local recurrence with right ilium and acetabulum involvement. She was given a course of chemotherapy and radiation therapy, followed by tumor resection and reconstruction, and resection of right sciatic nerve. Adjuvant immunotherapy was given after.

The partial ostectomy of pelvis involved resection of the right ischial tuberosity, the right acetabulum Enneking and Dunham [4] type II/III resection and the proximal right femur. The resected acetabulum was treated by liquid nitrogen and was used as recycled autograft in the reconstruction with right total hip replacement. The surgery was performed by a team of subspecialized orthopaedics oncology surgeons,

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Fig. 1. Host-graft junction.

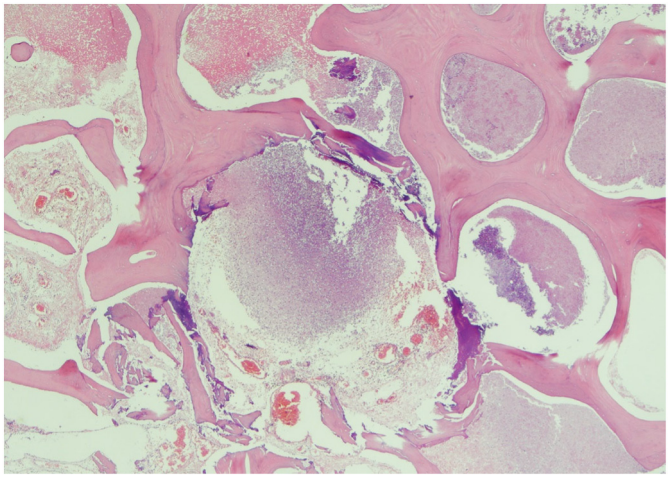

Fig. 3. Clusters of necrotic debris and neutrophils.

leaded by a consultant with more than 20 years experience in orthopaedics oncology in a university-affiliated tertiary referral center. Post operatively she received rehabilitation physiotherapy and was able to have full weight bearing walking with a pair of elbow crutches for 10 min, and with a frame independently with no limitations.

At 11 months after the pelvic operation, she was complicated by intestinovesical fistula and rectovaginal fistula. Right hemicolectomy and partial small bowel resection with loop ileostomy and colonic conduit for fecal and urinary diversion were performed. There was residual pelvic collection which required multiple CT guided drainages. Serial imaging including MRI and PET-CT scans showed the enlarging pelvic mass with thick wall and septations, suggestive of an infected tumor with abscess formation.

At 2 years post implantation, the patient developed sore secondary to the prominent ilium screw. Screw removal and debridement of the unhealthy skin was performed, and the wound was closed primarily. Intraoperative X ray screening confirmed no motion at the host-graft junction after removal of the screw.

In view of the persistent pelvic collection and infected tumor mass, right abdominopelvic amputation was performed in September 2020, that was at 2 years and 8 months after the reconstruction with the frozen autograft. The surgery was performed by the same team of subspecialized orthopaedics oncology surgeons and surgeons who specialize in urology, colorectal surgery and vascular surgery. Intraoperatively, the host-graft junction had a 2 mm bone gap in most areas, but the fixation of the frozen autograft was stable, and there were soft tissues connecting the junction. The resected tumor was sent for histopathological and microbiological studies. The posterior ilium and the amputated right lower limb were sent for histopathological studies.

The posterior ilium specimen was evaluated with blocks taken at the host-graft junction. Macroscopically, there was a 2 mm gap at the host-graft junction (Fig. 1), with soft tissues connection. Histological examination showed the frozen autograft was non-viable and the marrow space was mostly replaced by dense fibrosis (Fig. 2). There were areas of dense neutrophilic infiltration (Fig. 3) with focal foreign body giant cell reaction. No residual tumor tissue was found within the treated autograft bone. Dense fibrous connective tissue was also noted at the host-graft junction (Fig. 4), suggesting fibrous union with no evidence of revitalization of the frozen autograft.

Post operatively, she received rehabilitation physiotherapy and was mobilizing well after wheelchair training upon discharge.

3. Discussion

Processed autografts had been used for reconstruction of large bone defects following tumor excision. The ideal treatment option should clear all the tumor cells, preserve adequate strength and allow revitalization of the grafted bone for permanent biological reconstruction. Autoclaved autograft was not used as the high temperature destroyed

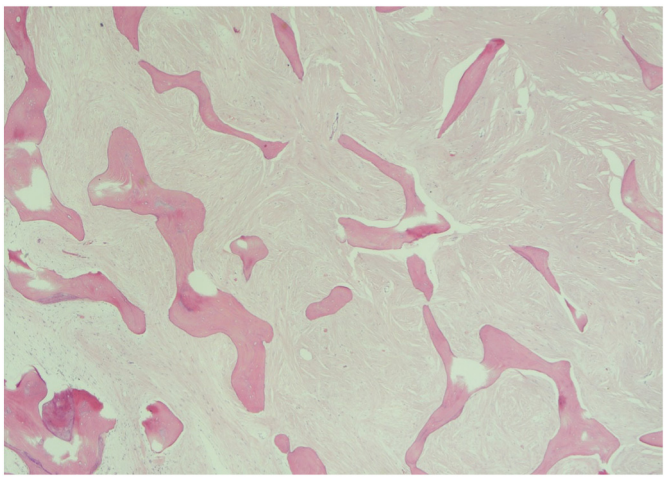

Fig. 2. Most of the treated bone was replaced by dense fibrosis.

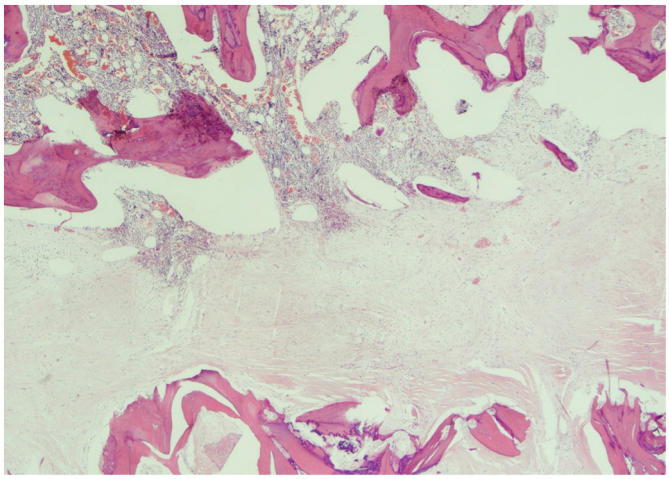

Fig. 4. Junction between native and treated bone.

the bone and its bone marrow, and significantly weakened its strength [5,6]. Other reported treating methods included irradiation [7,8] and pasteurization [9,10].

Reimplantation of frozen autografts treated with liquid nitrogen has been reported [1,2,11,12]. The proposed advantages include simplicity and short treatment time, eradication of the tumor cells, osteoinduction and osteoconduction properties of the autograft, preservation of the cartilage matrix, perfect fitting of the graft, adequate biomechanical strength, easy attachment of tendons and ligaments, and no concerns about infection and availabilities of allografts. In 2006, Sakayama et al. [11] reported pathological findings of a frozen autograft treated with liquid nitrogen retrieved from a patient who died from lung metastases 2 years after implantation. There was complete bone union and no local recurrence. Neovascularization was seen in cortical bone. In 2008, Tanzawa et al. [1] reported histological findings of retrieved frozen autografts from a live patient 6 years after implantation. It showed complete eradication of tumor cells, with osteocytes and microvessels in all portions of the bone. There was newly formed bone in most portions and osteogenesis was seen next to fibrovascular tissue. There was no histological proof of bone union at the host-graft junction, despite there was good bone fusion macroscopically and radiologically. In 2009, Tanzawa et al. [2] further reported 6 frozen autografts treated by liquid nitrogen which showed similar findings, with incorporation along with continuity of bone trabeculae at the host-graft junctions. The author suggested the osteogenesis in frozen bone should complete within 6 years of implantation.

Our report consisted of a retrieved frozen graft treated by liquid nitrogen from a live patient 32 months after implantation. The autograft bone showed no evidence of revitalization and was non-viable with patchy inflammation. There was no residual tumor in the autograft bone. While there was only fibrous union between the host bone and the autograft bone, the autograft bone remained mechanically stable.

There were areas of dense neutrophilic infiltration and foreign body giant cell reaction in the frozen graft, which could be the result of the ongoing infection in the pelvis. We were unable to confirm if the bone necrosis was part of the healing and remodeling process. Frozen grafts of long bone, with larger contact surfaces for healing compared to the pelvic frozen graft in our patient, were included in previous reports [1,2]. The reported revitalization of the frozen graft could take up to 6 years to complete. Moreover, our patient received radiotherapy to the pelvis which might slow down the union or lower the healing potential after the implantation of the frozen autograft.

4. Conclusion

We presented a patient with pelvic recurrence of squamous cell carcinoma of the cervix. Recycled frozen autograft was used for biological reconstruction after tumor resection. The recycled frozen autograft was removed in 2 years and 8 months after the implantation due to surgical treatment for pelvic collection and infected tumor mass.

We suggest that frozen autograft treated by liquid nitrogen can be used safely for biological reconstructions of bone defects following pelvic tumor excision. The union and revitalization of the frozen graft may take a long time. Even though there was no bony union, the reconstruction was stable enough for walking. Adequate compression at the host-graft junction should been achieved to improve the bone healing.

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Ethical approval

Ethical approval was not required in the treatment of the patient in this report.

Consent

Verbal informed consent was obtained from the patient for publication of this case report and accompanying images because the patient returned to her home country upon discharge from our hospital and defaulted follow-up. All the documentations were logged in the computerized clinical management system of the hospital.

Registration of research studies

Not applicable

Guarantor

Anderson SM Leung.

Provenance and peer review

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CRediT authorship contribution statement

Anderson SM Leung – participated in the surgeries, reviewed patient's record, wrote the paper.

Maximus CF Yeung – reported on pathology study, reviewed the paper.

Raymond CH Yau – participated in the surgeries, reviewed the paper.

Kenneth WY Ho – participated in the surgeries, reviewed the paper.

Tony WH Shek – reported on pathology study, reviewed the paper.

Albert YL Lam – led the orthopaedic oncology surgery team, participated in the surgeries, contributed to the study concept and design, reviewed the paper.

All authors read and approved the final version of the manuscript.

Declaration of competing interest

The authors report no declarations of interest.

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