

Introduction

- Limb salvage surgery is the current standard of care for limb sarcomas.
- In 1999 Tsuchiya et al. presented a technique for limb biological reconstruction with autografts recycled in liquid nitrogen (LN).
- This technique has the advantages of low cost, easy access, perfect graft matching and does not require a bone bank, among others.
- In 2015 our team, in Montevideo, Uruguay, started treating limb sarcoma patients with this novel technique to our region.

Purpose

- To assess local recurrence rates, time to consolidation of the recycled autograft, function of the patients and to present the first Uruguayan cohort of sarcoma patients treated with this technique novel to our country.

Methods and Materials

- Retrospective study.
- Patients who underwent limb salvage procedure with LN recycled autografts at our institution between August/2015 and June/2019.
- Nineteen patients were enrolled, 6 patients with a follow up <6 months were excluded.
- Thirteen patients were included for statistical analysis.
- All patients were operated by the same surgical team.
- The technique included submerging the bone in LN at a temperature of -196°C for 20 minutes, subsequent warming of the bone followed by reimplantation and surgical fixation.
- Postoperative radiographic evaluation was performed at one month, 3 months, 6 months, one year and then annually.
- Postoperative function was assessed per the MSTS score.
- All tests were deemed significant if $p < 0.05$.

Results

- Thirteen patients were included in the study, 77% were male.
- The mean age was 28 years old (range 5-57, SD 17).
- The most common diagnosis was osteosarcoma (54%).
- The mean follow up was of 27 months (SD 17).
- No patient died and no patient was lost to follow up.
- Six patients had a reconstruction with an intercalary autograft, 3 were osteoarticular, 2 hemicortical and 2 were a composite with an arthroplasty implant.
- The majority were free autografts (92%) and one was a pedicle autograft (Figure 1).
- The mean length of the autografts was 15cm (range 5-28).
- The autograft union rate was 83% and the mean time to union was 6.7 months (range 4-9).
- No patient had a recurrence at the bone site. One patient developed at soft tissue local recurrence.
- Eleven patients had localized disease at the time of the procedure, none evolved to metastatic disease.
- The mean function by the MSTS score was 73.8% (range 13-100%).

Study	Tsuchiya (2005)	Rahman (2009)	Igarashi (2014)	Paholpak (2015)	Bianchi
Patients (n)	28	10	36	12	13
Follow Up (months)	28.1	54	101	32	27
Union Rate (%)	93	100	72	100	83
Union Time (months)	6.7	8.8	6.2	8.2	6.7
Local Recurrence	2	0	4	1	1
Autograft SV (%)	96.4	100	80.6	83.3	77
MSTS score	71.4	82.4	72.2	79	73.8

Discussion

- Several reconstruction methods currently exist for limb salvage procedures.
- Autografts frozen in LN have several advantages such as: low cost, easy access, complete tumor removal, preservation of bone morphogenic proteins, preservation of osteoconduction and osteoinduction properties, perfect graft matching, does not require a bone bank, allows for tendon and ligament reattachment, no disease transmission, no graft rejection
- Safe regarding local recurrences.
- High percentage of union rates.
- Good long-term graft survival.



Proximal femur pedicle autograft in a 28 y.o. male with epithelioid sarcoma metastasis.

Conclusions

- No patient with localized disease at the time of the limb salvage procedure progressed to metastatic disease.
- No patient presented with recurrence at the bone site.
- Our study showed results similar to other international cohorts for autograft consolidation rates (83%) and functional score (73.8%).
- LN recycled autograft is a validated surgical reconstruction option and particularly useful in countries with limited resources.

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