

Outcomes of Cryosurgery Utilizing an Argon Cryoprobe: 24 years of Institutional Experience.



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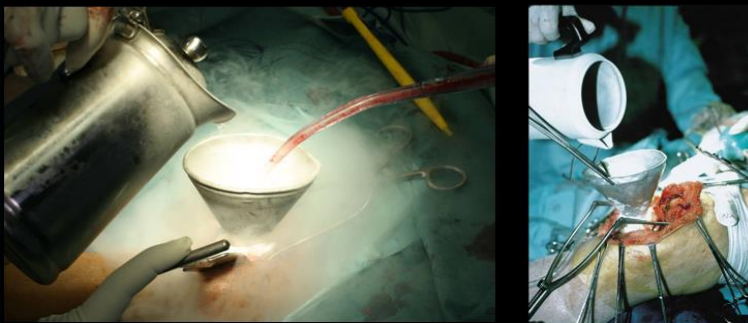
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Introduction

Cryosurgery in orthopaedics began in 1969 when Marcove and Miller initially utilized a liquid nitrogen pour technique. In 1996, cryoprobes were designed utilizing the Joule-Thompson expansion to gain freezing temperatures in probes. We began utilizing cryoprobes in the late 1990s and present our last 13 years of data cryoprobes for aggressive bone lesions.

Pour Technique with Liquid Nitrogen by Marcove

Liquid Nitrogen Poured into a metal Funnel



Argon Cryoprobe System

Probes placed systematically covering all regions of the lesion filled with saline



Methods

Following IRB approval, the institutional database at our facility was queried from 2005 through 2017. 115 patients were identified with 105 records available. We collected data including follow up, histologic diagnosis, and type of secondary fixation when applicable. We utilized a primary endpoint of recurrence, fracture, or infection to identify failures. We also calculated modified MSTS scores based on the clinical chart review.

Age	Average (Years)	Range
	35.3	1 to 86
Location	Bone	Amount
	Femur	27
	Tibia	15
	Humerus	15
	Carpals / Hands	9
	Radius / Ulna	11
	Pelvis / Sacrum	9
	Tarsals/ Feet	14
	Scapula / Clavicle	3
	Patella	1

Cryosurgery Type	Type	Amount
	Cryoprobe	93
	Marcove Pour	11
MSTS Scores	Average	Range
	27.7	14 to 30

Diagnosis	Histology	Amount
	Chondrosarcoma	24
	Aneurysmal Bone Cyst	16
	Giant Cell Tumor of Bone	15
	Enchondroma	15
	Chondroblastoma	12
	Osteoblastoma	3
	Chondromyxoid Fibroma	3
	Metastatic Disease (thyroid and renal cell)	3
	Desmoid Tumor	2
	Nonossifying Fibroma	2
	Other*	9

* 1 each of adamantinoma, eosinophilic granuloma, epitheloid sarcoma, Ewings Sarcoma, Hemangioendothelioma, Osteosarcoma, Parachordoma, patellar cyst, and sarcoma not otherwise specified.

Table 2 Complications		
Recurrences	Histology	Amount
	Chondrosarcoma	2
	Enchondroma	1
	Chondroblastoma	1
Complications	Type	Amount
	Implant Complications requiring removal	3
	Pathologic Fracture	1
	Non-union	1
	Infection	0

Endocare Cryoprobe Case Example for an Aneurysmal Bone Cyst in the distal tibia



Results

Of the 105 identified patients with charts available for review: 93 were treated with cryoprobe, 11 were treated with Marcove pour, and in 1 the type wasn't listed. Average follow-up was 2.8 years. 54 patients had greater than 2 years of follow up and 22 had greater than 5. Most cases were low-grade chondrosarcoma, aneurysmal bone cysts, giant cell tumors, enchondromas, and chondroblastomas. Complications included one fracture (0.95%), one non-union (0.95%), 4 recurrences (3.8%), and no infections. Recurrences were in 2 chondrosarcomas, a chondroblastoma, and a finger phalangeal enchondroma. Average MSTS score was 27.7.

Discussion

Our rate of recurrence and fracture compares well with historical controls. Marcove's initial series had fracture rates of 7-39% from 1969-1977. Though more recently in 2017, a 5% rate of recurrence and 1 fracture was reported in a large series. The Marcove pour and the cryoprobe techniques for chondrosarcoma have been compared with a nonsignificant trend toward lower complications and better functional outcome with the cryoprobe. Cryosurgery with improved techniques has a high success rate with a low complication rate and high functional scores.

The Only Pathologic Fracture in the Series Treated with an Intramedullary Nail



Conclusions

Cryosurgery as an adjuvant treatment to initial curettage followed by debridement with a cortical burr is a safe and effective tool for decreasing the recurrence of benign aggressive lesions and low-grade chondrosarcoma. There was an acceptable complication rate of fracture (0.95%), recurrence (3.8%), and infections (0%). Patients have overall good functional outcomes with MSTS scores of greater than 27 on average.