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# Use of warm Ringer's lactate solution in the management of locally advanced giant cell tumor of bone

**Research of the month**

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**Clinical research**

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ORIGINAL ARTICLE

## Use of warm Ringer's lactate solution in the management of locally advanced giant cell tumor of bone

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**Abstract**
*Background* This study was conducted to discover the effectiveness and safety of using warm Ringer's lactate solution (RLS) as a local treatment in the management of locally advanced giant cell tumor of bone with marked soft tissue invasion, including nearby neurovascular bundles.
*Patients and methods* This was a longitudinal cohort study with an average follow-up period of 4.6 ± 0.3 years, ranging from 4.2 to 5.9 years. There were 21 patients (9 male and 12 female), with the ages of subjects ranging from 12 to 64 years. Eight patients (38 %) were tumor recurrence cases. Pathological fracture was found in 15 patients (71 %). After extended curettage, warm RLS (50 °C) was locally applied for 20 min. Bone stabilization and reconstruction were then performed.
*Results* All patients survived the operation. No additional neurovascular injury resulting from the use of warm RLS was found. Patients who had neurological deficit before the operation experienced significant improvement in motor and sensory function during the follow-up period. Complication was found in one patient (5 %). Two patients (9.5 %), had tumor recurrence and 19 patients (90.5 %) were tumor-free with good to acceptable function.
*Conclusion* Use of warm Ringer's lactate solution as an adjunctive local treatment during intra-lesional curettage of giant cell tumor with locally soft tissue extension was found to be safe with relatively low recurrence rate. However, additional studies to identify the optimum thermoablation dose at each part of the body should be undertaken before this technique can be used as a standard treatment.

**Keywords** Giant cell tumor · Benign bone tumor · Thermoablation · Heat shock proteins

### Introduction

Giant cell tumor of bone is one of the most common aggressive benign bone tumors, especially among Asian population [1–3]. Intra lesional curettage with local treatment, including bone cement, and phenol or liquid nitrogen, usually delivers good results in the management of this tumor in the patients who had an early diagnosis [4–6]. However, in patients who received a delayed diagnosis, this tumor is capable of producing pathological fracture and may invade adjacent soft tissues, either or both of which will result in an locally advanced tumor lesion. Delayed diagnostic patients usually present with large tumor masses. Conventional local treatments in these locally advanced giant cell tumors may not be clinically appropriate in all cases. Recurrence rate after intra-lesional curettage and local treatment in these patients is high. Radical surgery, such as wide resection or amputation, may have to be performed in some cases [7–9].

In order to preserve patients' organs and functions, a new local treatment technique needs to be identified and

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Table 1 : Patients' biographic data and the results of treatment.

| No. | Sex | Age (years) | New or recurrent case | Site | Tumor presenting time before operation (weeks) | Tumor mass ($cm^3$) | Pain, NRS | Present of pathological fracture | Bone stabilization | Complications | Pathological grading | Operative time (h) | Blood transfusion (unit) | At the 4th year follow up |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Female | 23 | Recurrent | Clavicle Rt. | 52 | 30 | 8 | No | – | – | I | 2.5 | 2 | Recurrent |
| 2 | Female | 28 | New | Distal femur Lt. | 32 | 350 | 8 | Yes | IF, bone cement | – | I | 3.0 | 4 | |
| 3 | Male | 43 | Recurrent | Distal femur Lt. | 24 | 580 | 6 | Yes | IF, bone cement | – | II | 3.5 | 4 | |
| 4 | Female | 27 | New | Distal femur Rt. | 52 | 500 | 10 | Yes | IF, bone cement | – | II | 3.5 | 3 | |
| 5 | Female | 22 | New | Distal tibia Lt. | 12 | 40 | 3 | No | EF | – | I | 3.5 | 3 | |
| 6 | Female | 12 | Recurrent | Distal tibia Rt. | 52 | 500 | 6 | Yes | EF | Ankle stiffness | I | 3.5 | 2 | |
| 7 | Female | 64 | New | Distal ulna Lt. | 20 | 150 | 7 | No | | – | II | 2.5 | – | |
| 8 | Male | 25 | New | Distal ulna Rt. | 26 | 75 | 8 | No | | – | I | 2.5 | – | |
| 9 | Female | 34 | New | Humeral condyle Lt. | 100 | 50 | 5 | No | | – | II | 2.5 | – | |
| 10 | Male | 50 | Recurrent | PP of middle finger Rt. | 20 | 8 | 6 | Yes | | – | I | 3.0 | – | Recurrent |
| 11 | Male | 50 | New | Proximal humerus Rt. | 150 | 1,500 | 9 | Yes | Bone cement | Haematoma, delayed wound healing, BPI and neuropathic pain | II | 3.5 | 10 | |
| 12 | Male | 27 | New | Proximal tibia Lt. | 20 | 500 | 2 | No | IF | – | I | 3.5 | 4 | |
| 13 | Male | 22 | New | Radius Lt. | 25 | 100 | 8 | Yes | EF | – | II | 2.5 | 1 | |
| 14 | Female | 40 | New | Radius Lt. | 25 | 250 | 4 | Yes | EF | – | I | 2.5 | – | |
| 15 | Male | 19 | Recurrent | Radius Rt. | 52 | 300 | 10 | Yes | EF | – | I | 2.5 | – | |
| 16 | Female | 16 | New | Radius Rt. | 52 | 16 | 6 | Yes | EF | – | I | 2.5 | 1 | |
| 17 | Female | 28 | Recurrent 2 times | Radius Rt. | 26 | 150 | 6 | Yes | EF | – | II | 3.0 | – | |
| 18 | Female | 23 | Recurrent | Sacrum | 52 | 400 | 10 | Yes | | Neurological deficit and neuropathic pain | III | 3.5 | 14 | |
| 19 | Male | 26 | Recurrent | Sacrum | 104 | 560 | 10 | Yes | | Neurological deficit and neuropathic pain | III | 3.5 | 10 | |
| 20 | Female | 23 | New | Proximal humerus Lt. | 52 | 480 | 9 | Yes | | BPI and neuropathic pain | I | 3.5 | 10 | |
| 21 | Male | 24 | New | Proximal tibia Lt. | 25 | 400 | 10 | Yes | IF, bone cement | – | II | 3.0 | 3 | |

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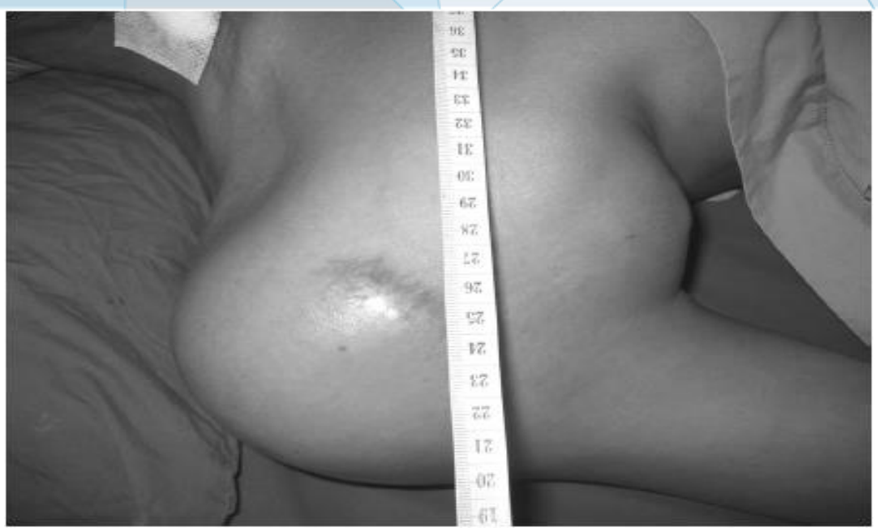

Fig.1: A 50 year-old male (patient 11) presented with a large soft tissue tumor mass at his right shoulder.

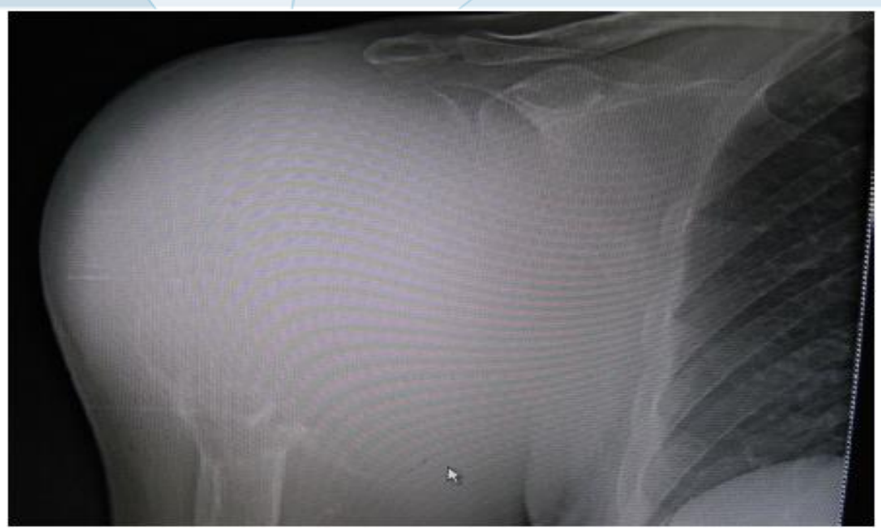

Fig.2: Plain radiograph revealed a large soft tissue tumor mass at his right upper humerus with ill-defined border.

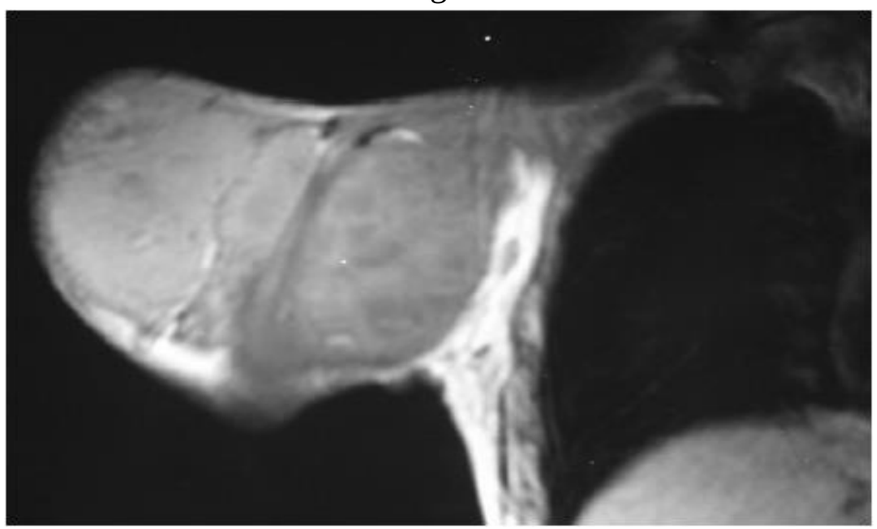

Fig.3: MRI of his right shoulder revealed large soft tissue tumor mass with neurovascular bundle lying in the tumor.

Fig.4: Intra-lesional curettage was carried out and the axillary vessels together with brachial plexus of the right upper limb could be preserved.

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Fig.5: Thermoablation by the use of 50 °C RLS for 20 min was performed. The warm RLS was passed into the lesion via sterile intravenous catheters.

Fig.6: Plain radiograph of the patient at the 4th-year follow-up revealed new bone formation without tumor recurrence.

Fig.7: The patient could flex his elbow and abduct his shoulder to a certain degrees.

Fig.8: He could flex his right fingers with motor power grade IV/0–V.