

# Phoco-reduction (Surgical Phocomelia) as a method of reconstruction after resection of sarcoma of the humerus: a suitable option for reconstruction in cases of extensive involvement of the bone

Limb Salvage: The Standard Treatment

Wide Resection of Tumor

Reconstruction with one of several methods of reconstruction available



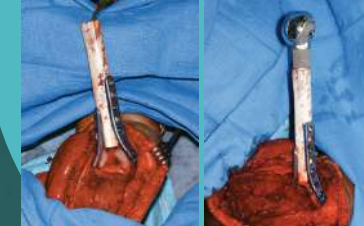
Endoprosthesis Reconstruction



Tumor Sterilization and Fixation<sup>2</sup>



K-Nail Bone Cement Spacer

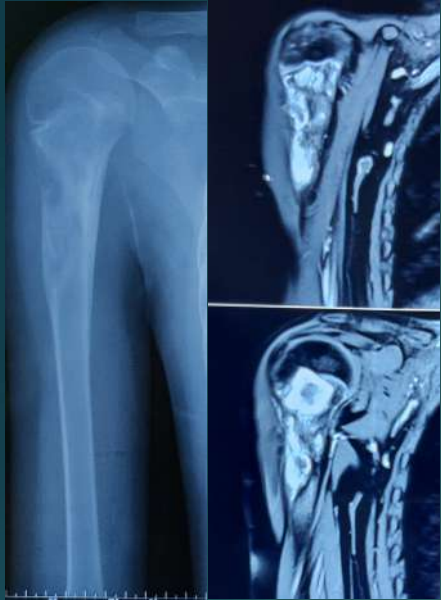


Allograft-Endoprosthesis Composite<sup>3</sup>



ECRT(Extracorporeal Radiotherapy) - Endoprosthesis Composite

More extensive involvement of humerus: options of reconstruction expanded



The humerus: one of the frequent sites for occurrence of bone sarcoma in pediatric patients<sup>1</sup>

**What if the humerus is even more extensively involved and none of these reconstruction methods are feasible ? ???**

Amputation



Limb salvage: Phoco-reduction (Surgical Phocomelia)

1. Serlo J, Tarkkanen M, Sampo M, Vettenranta K, Riikonen P, Helenius I. Incidence, treatment and survival of paediatric patients with bone sarcomas in Finland from 1991 to 2005. *Acta Paediatr.* 2015 Jul;104(7):738-45. doi: 10.1111/apa.12986. Epub 2015 Apr 6. PMID: 25721807.
2. Garg SK, Aggarwal P, Virk J, Punia RPS, Dimri K, Jindal R. Limb Salvage Using Liquid Nitrogen-Treated Tumour-Bearing Autograft: A Single Institutional Experience of 10 Patients. *Indian J Orthop.* 2020 Jan 13;54(2):200-207. doi: 10.1007/s43465-019-00001-9. PMID: 32257038; PMCID: PMC7096595.
3. Campbell's Operative Orthopaedics, 12<sup>th</sup> Edition

# Phoco-reduction (Surgical Phocomelia) as a method of reconstruction after resection of sarcoma of the humerus: a suitable option for reconstruction in cases of extensive involvement of the bone

## Segmental Resection and Replantation A viable option for advanced sarcomas in the upper limb<sup>1</sup>

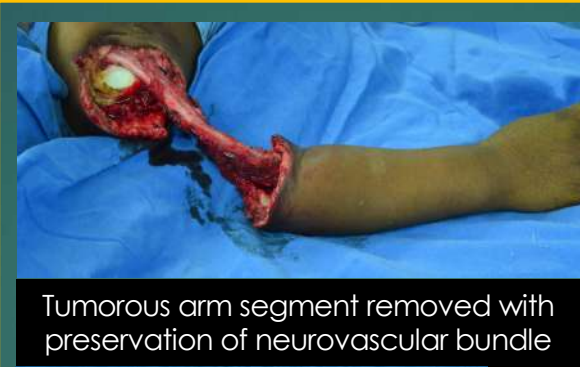
Surgical Phocomelia or Phoco-reduction:

- a. Shortening of the upper limb – patient acceptance level is satisfactory
- b. Salvaged upper limb can be used by the patient to perform certain activities of daily living
- c. Avoidance of amputation

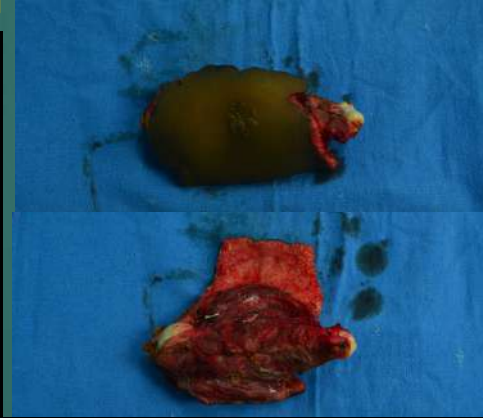
### Case 1

4 years female with Ewing sarcoma humerus with extensive involvement

None of the usual methods of resection feasible after resection of the tumor



Tumorous arm segment removed with preservation of neurovascular bundle



Resected tumor which includes the skin – Resection of a segment of the arm



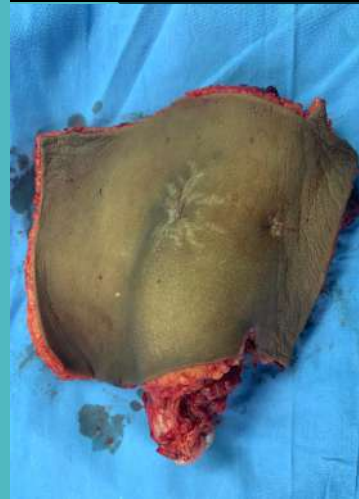
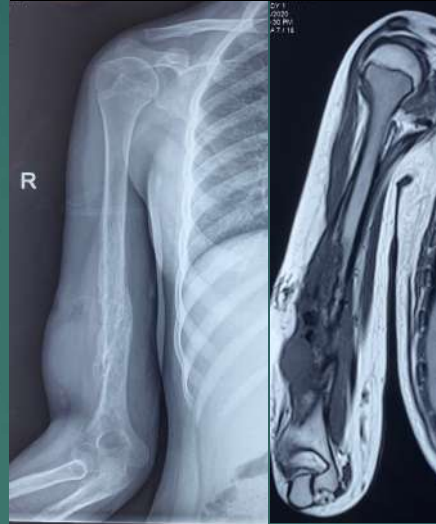
Carefully planned skin incision so that after removal of tumor along with skin (segment of arm) good wound closure is achieved

### Case 2

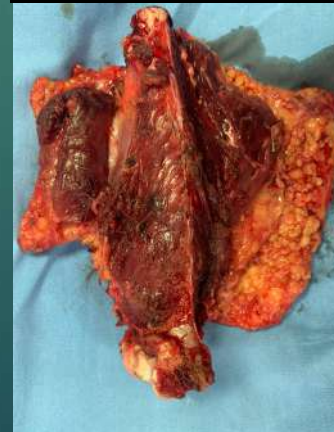
14 years female with Ewing sarcoma humerus with extensive involvement

None of the usual methods of resection feasible after resection of the tumor

Carefully planned incision to include the skin along with the resected tumor



Resected tumor which includes the skin – Resection of a segment of the arm



1. Hahn SB, Choi YR, Kang HJ, Shin KH. Segmental resection and replantation have a role for selected advanced sarcomas in the upper limb. *Clin Orthop Relat Res.* 2009 Nov;467(11):2918-24. doi: 10.1007/s11999-009-0872-0. Epub 2009 May 2. PMID: 19412644; PMCID: PMC2758978.



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Fungating malignant tumors: amputation is undertaken in almost all cases

However, if phoco-reduction is undertaken: Fungating portion of the tumor can be included in the resected tumor segment along with the skin

## Case 3

17 years male with Fungating Synovial Sarcoma of the Elbow



Tumorous arm segment removed along with the fungating portion with preservation of neurovascular bundle



Resected tumor which includes the skin along with the fungating portion – Resection of a segment of the arm



Follow-up at 5 months – union between humerus and ulna



Wound healed and patient able to position hand in space well

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## Results

All 3 patients disease-free at the latest follow-up

One patient had implant failure (broken plate) and wound dehiscence – managed with Implant removal and Debridement



Case 2: Recon plate broken and removed later at 2 months follow-up  
Distal humerus fused to ulna with two Steinmann pins and Recon plate with elbow in functional position at index surgery



Case 3: Patient at 5 months follow-up: able to position hand with ease for reaching objects

## Learning Points

Phoco-reduction can be an important option of reconstruction in cases of extensive involvement of the humerus in pediatric sarcomas

Shortened limb length is acceptable to most patients

Elbow arthrodesis is performed whenever feasible with the elbow in functional position

Patients are also able to carry out certain activities of daily living

Amputation can be avoided not only in extensive tumors but also in sarcomas with fungation