

# **Radical Resection of the Distal Humerus and Prosthetic Reconstruction**

**James C. Wittig, MD**

**Associate Professor of Orthopedic Surgery**

**Chief, Orthopedic Oncology**

**Mount Sinai Medical Center**

# Purpose

- To describe the indications, surgical technique, and short term oncological and functional results for radical resection of the distal humerus and prosthetic reconstruction
- Small series of 3 patients

# Indications for this Procedure

- Primary bone sarcoma of the distal humerus
- Primary soft tissue sarcoma surrounding or invading the distal humerus
- Palliation for advanced metastatic carcinoma with severe bony destruction
- Complications related to conservative treatment for pathological fractures (nonunion or progression following radiation)

# Cases

- 52 year old male with a 9 cm high grade synovial sarcoma arising from the proximal flexor-pronator mass, surrounding the distal humerus
- 54 year old female with advanced metastatic renal cell carcinoma involving the distal humerus and a useless, painful arm/elbow; treated one year prior with intramedullary rods at another institution
- 55 year old male with myeloma and a pathological fracture of the distal humerus who failed treatment with radiation and had a persistent nonunion treated conservatively for 4 months

# Surgical Procedure--Steps

## ■ Tumor resection

- Dissection and mobilization of brachial vessels
- Dissection and Preservation of median, radial and ulnar nerves
- Preservation of biceps
- Preservation of sufficient forearm flexors and extensors while still maintaining an adequate margin

## ■ Prosthetic reconstruction with Modular Segmental Distal Humerus and Total Elbow

## ■ Soft tissue reconstruction

- Proximal transfer/rotation of forearm flexors and extensors with elbow flexed 60-90 degrees (Flexorplasty)
- Biceps tensioned appropriately; Side sutured to triceps for full closure
- Entire prosthesis must be covered with soft tissue

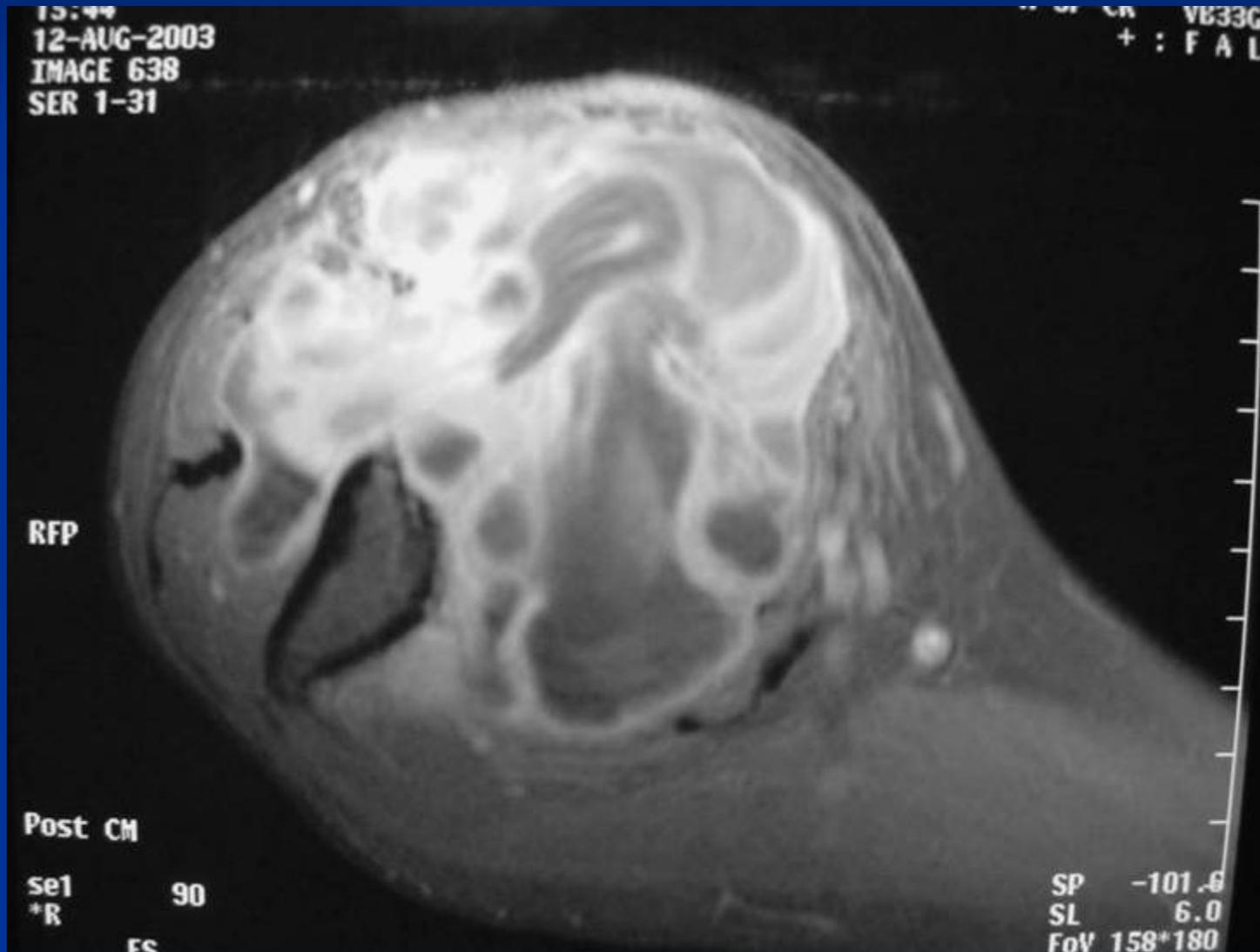
# Case 1

- 52 year old male with high grade synovial sarcoma arising in the elbow region
- Large incisional biopsy in another country
- Preoperative chemotherapy
- Postop radiation





# MRI—Large Mass Surrounding Distal Humerus



# Arteriogram to Visualize blood Vessels



## Case 2

- 54 year old female with advanced metastatic renal cell carcinoma involving the distal humerus
- Failed previous intramedullary fixation and radiation
- Presented with a 10 cm mass



**Distal Humerus  
Destroyed by  
Tumor**



1811692BH

Kontrast:

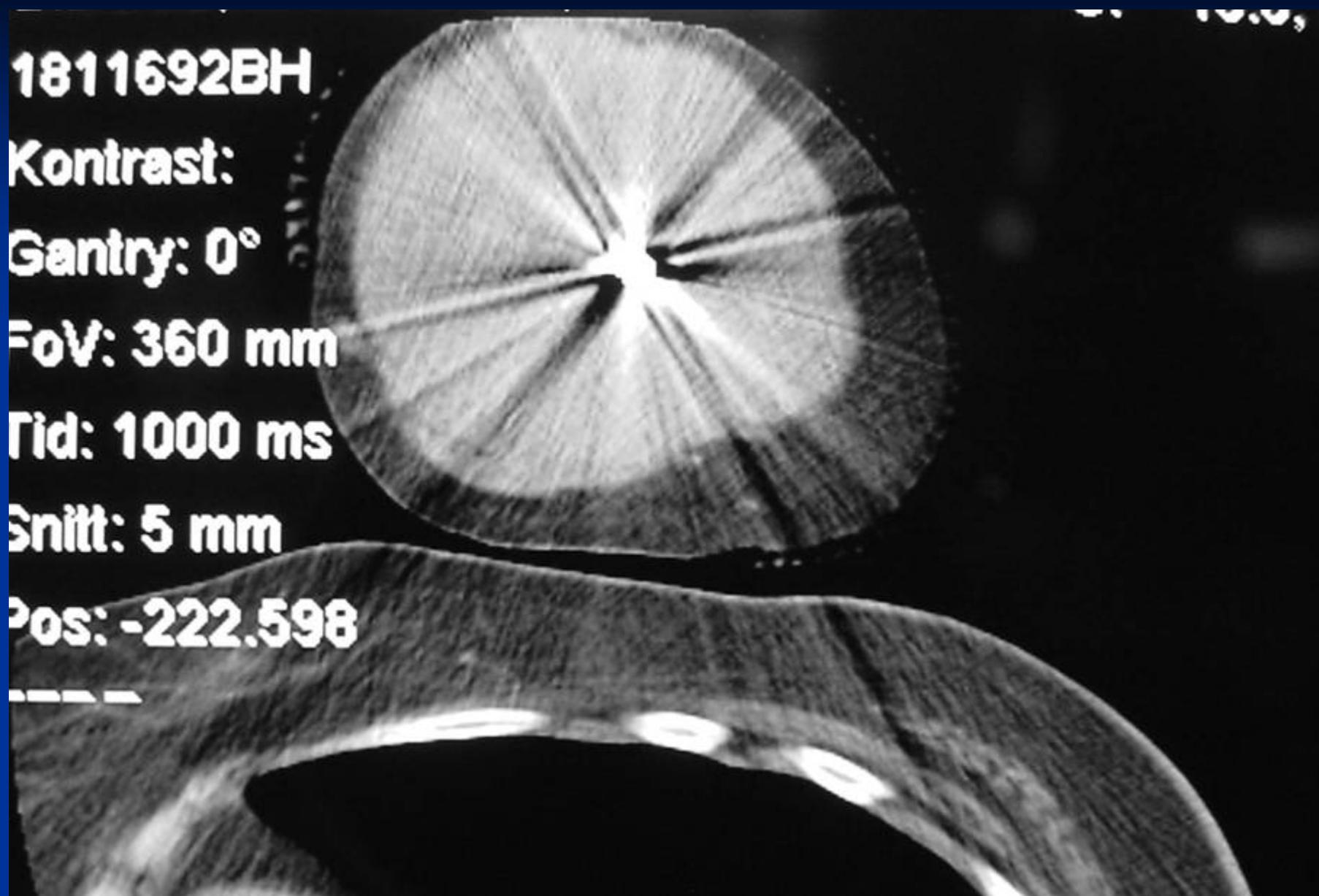
Gantry: 0°

FoV: 360 mm

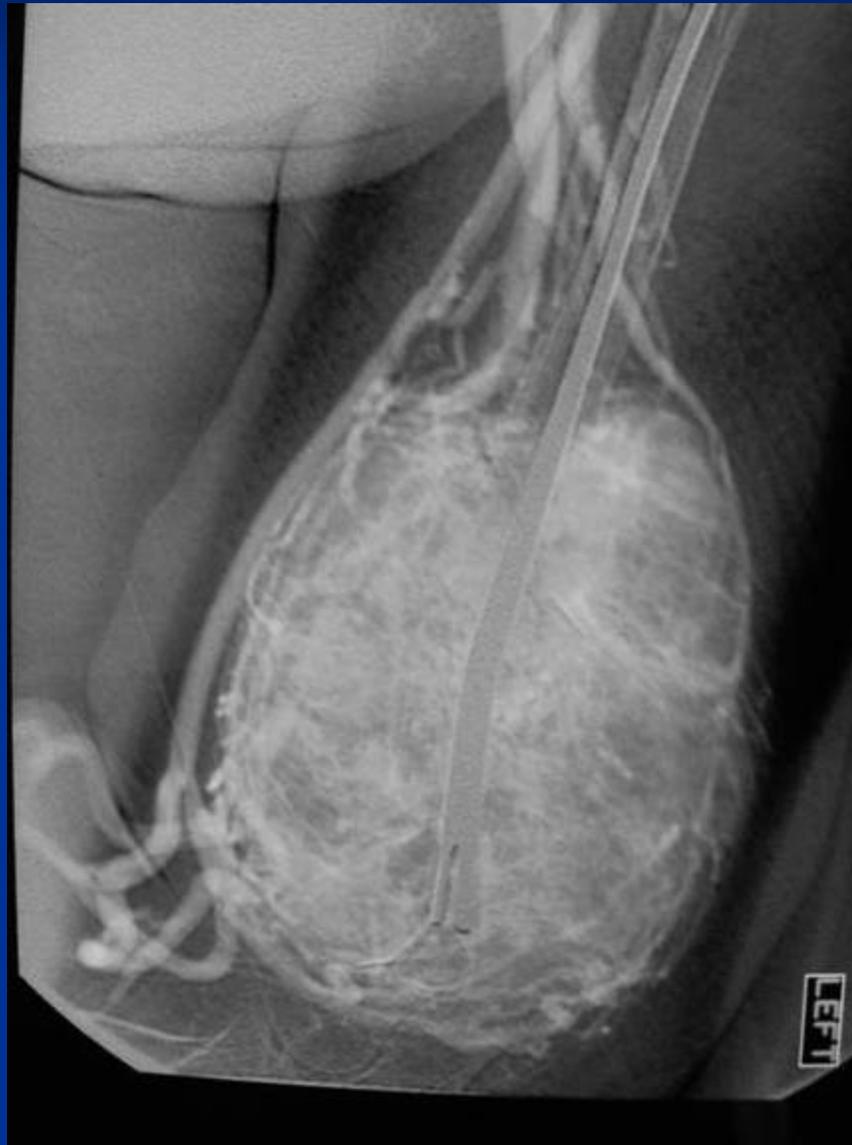
Tid: 1000 ms

Snitt: 5 mm

Pos: -222.598



# Arteriogram Showed a Hypervascular Mass



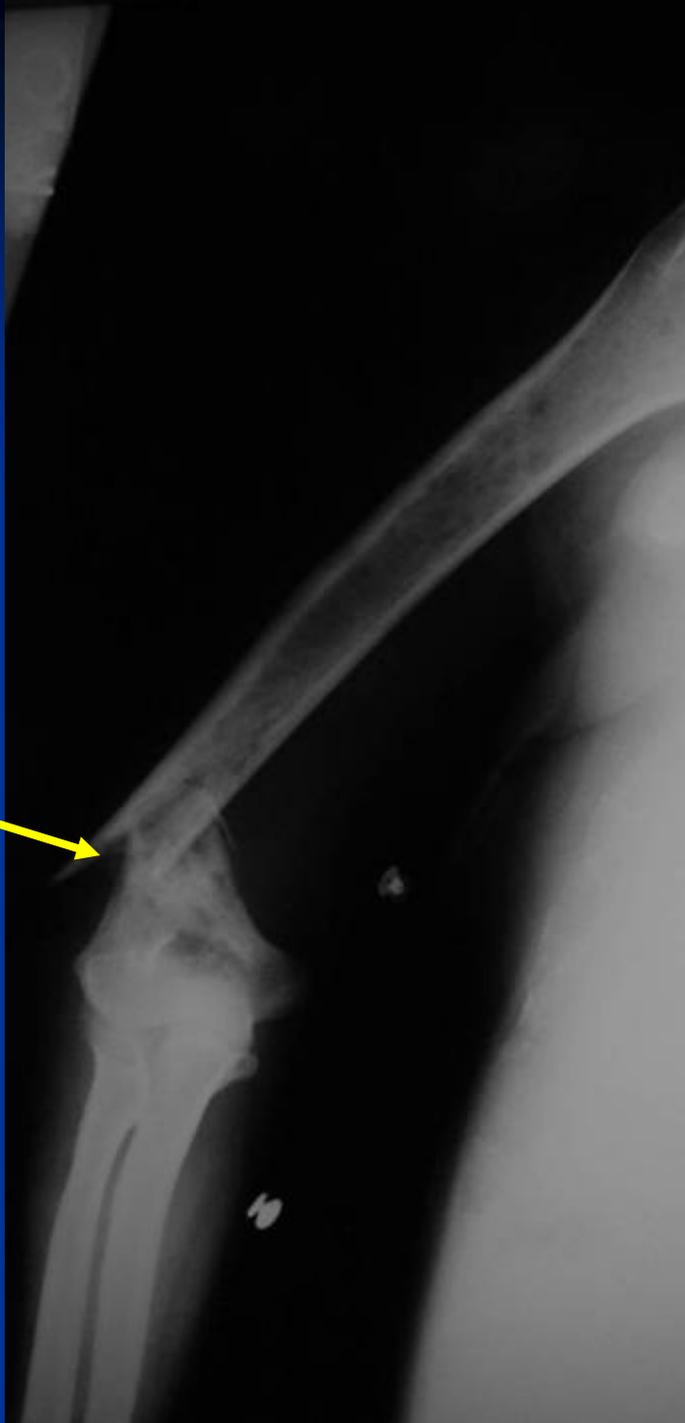
# Preoperative Embolization to Cut Off Blood Supply to Tumor



## Case 3

- 55 year old male with a nonunion of a pathological fracture of the distal humerus for 4 months
- Failed previous radiation
- Poor quality bone at time of surgery—not appropriate for internal fixation

**Fracture  
Nonunion**



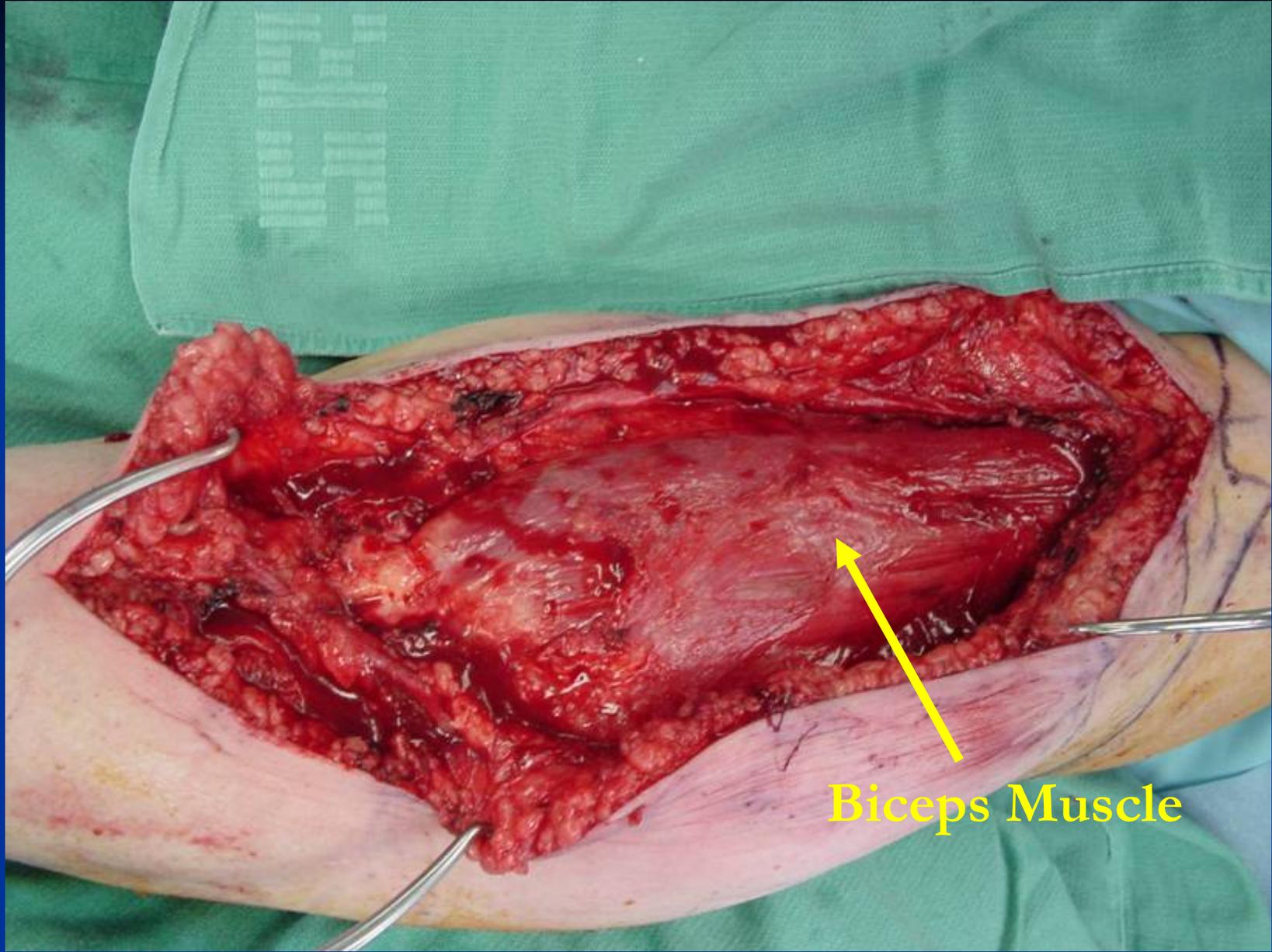


# Metastatic Renal Cell Carcinoma



# Incision--Anteromedial

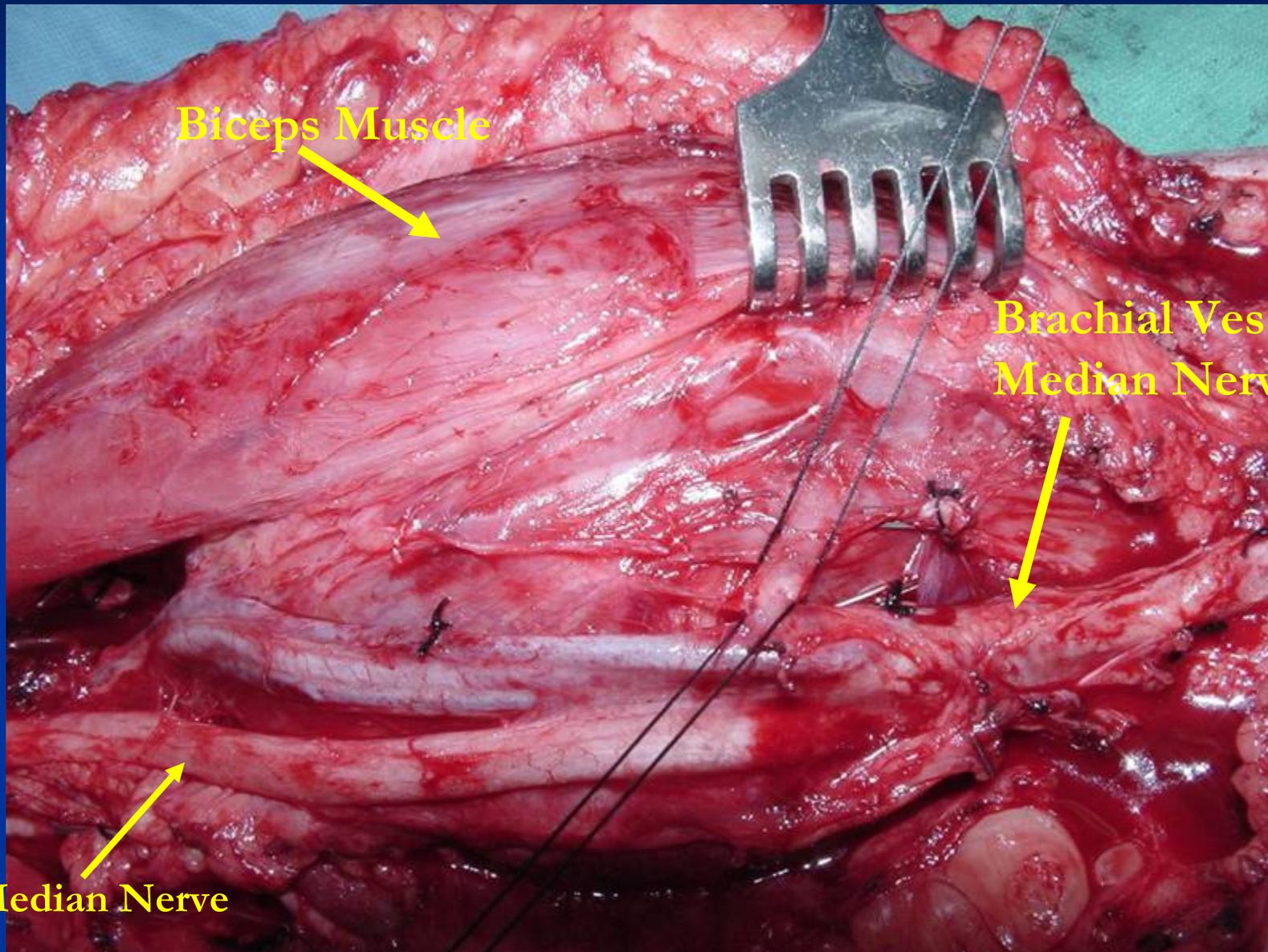




**Biceps Muscle**

# Neurovascular Dissection and Mobilization

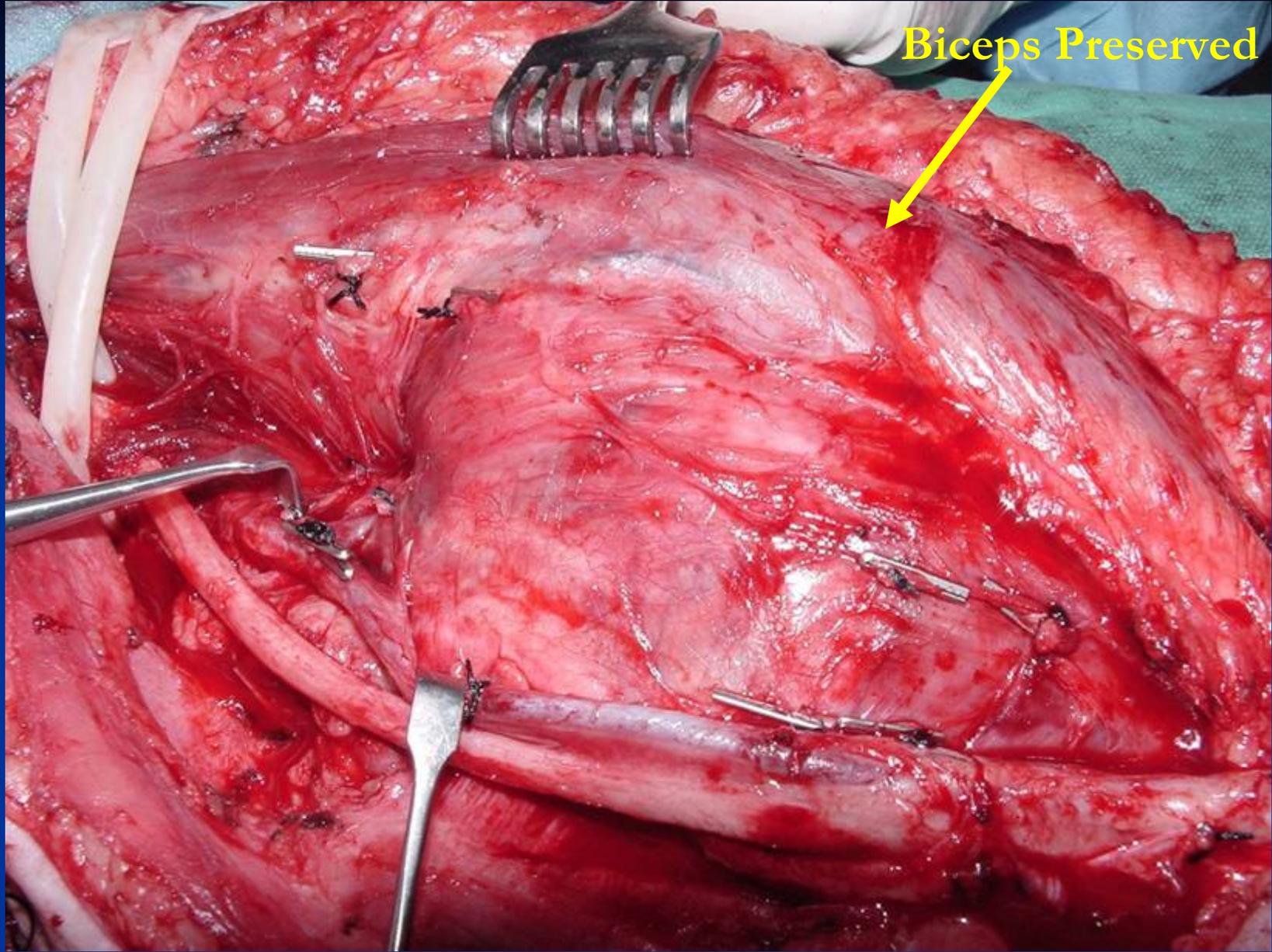
## Feeding Blood Vessels to Tumor are Tied Off



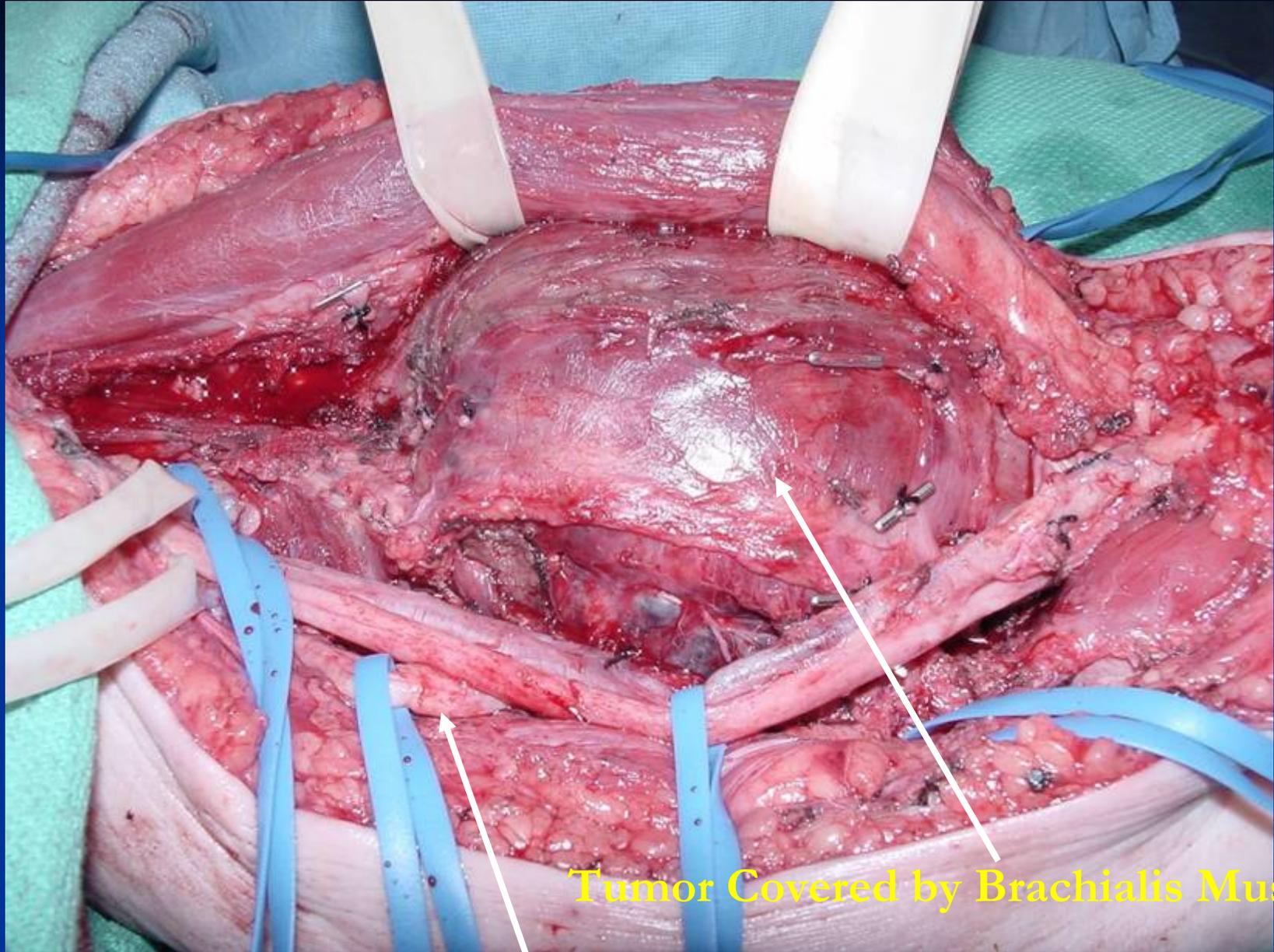
Biceps Muscle

Brachial Vessels  
Median Nerve

Median Nerve

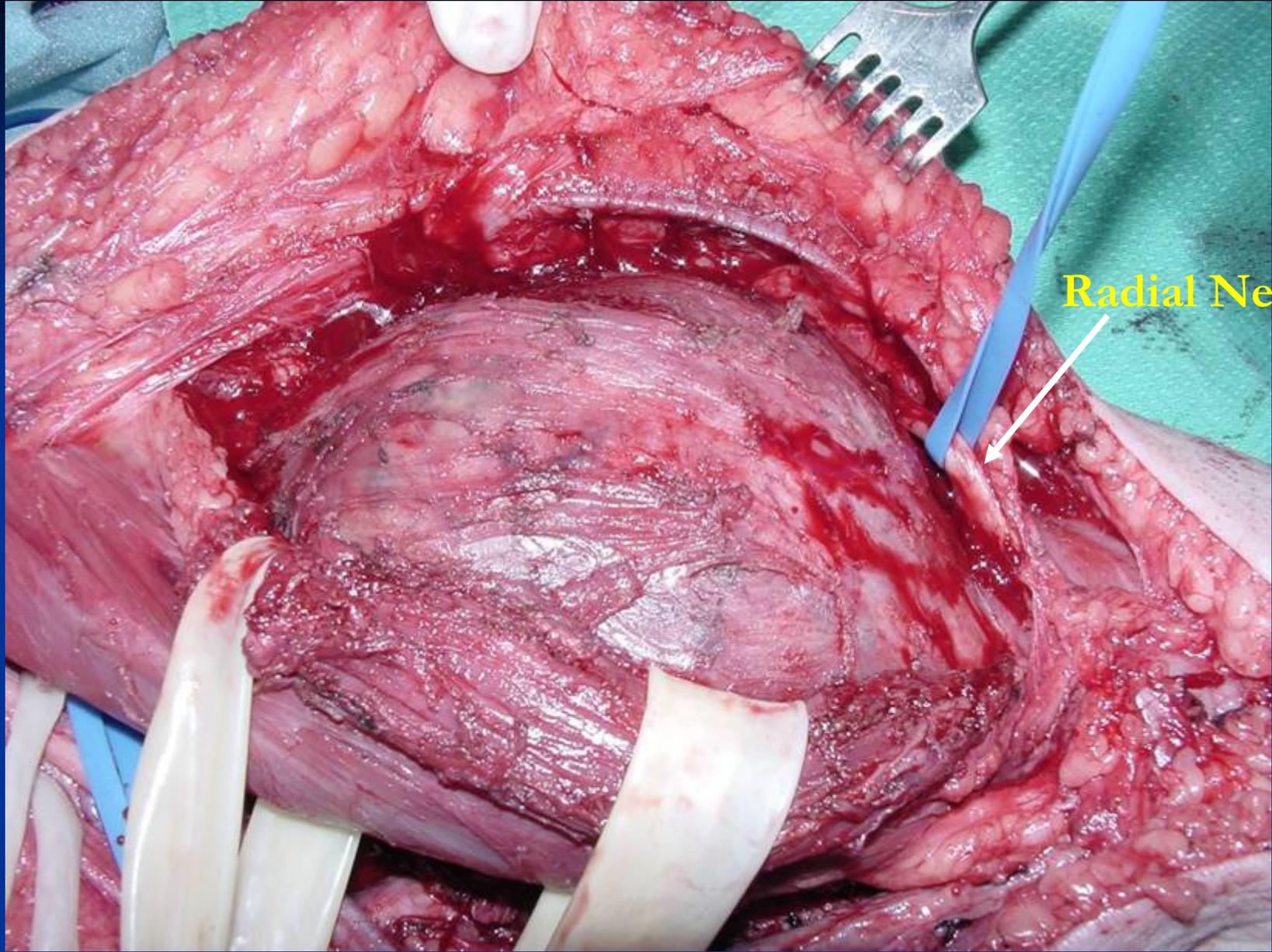


Biceps Preserved

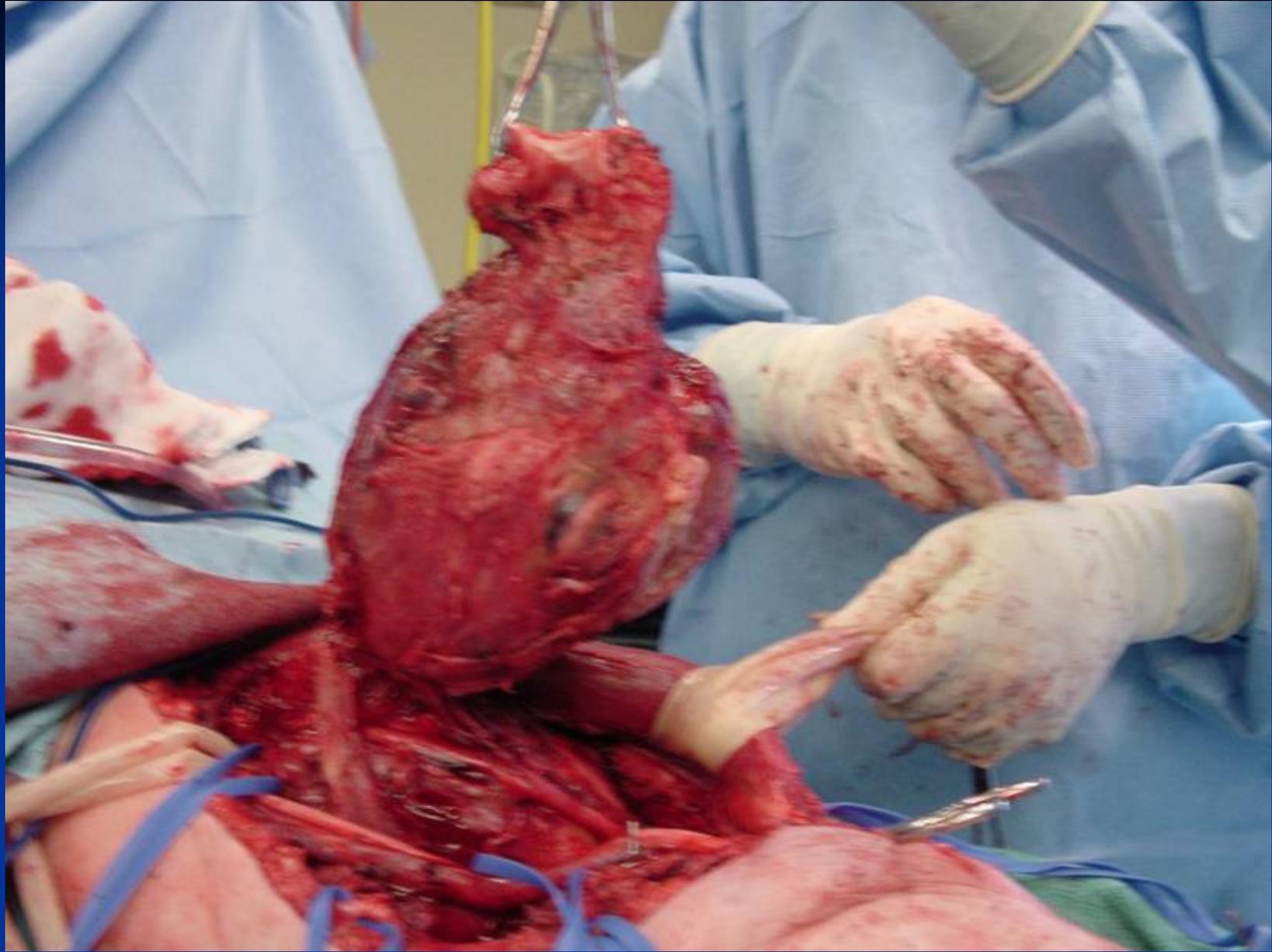


**Tumor Covered by Brachialis Muscle**

**Ulnar Nerve**



Radial Nerve

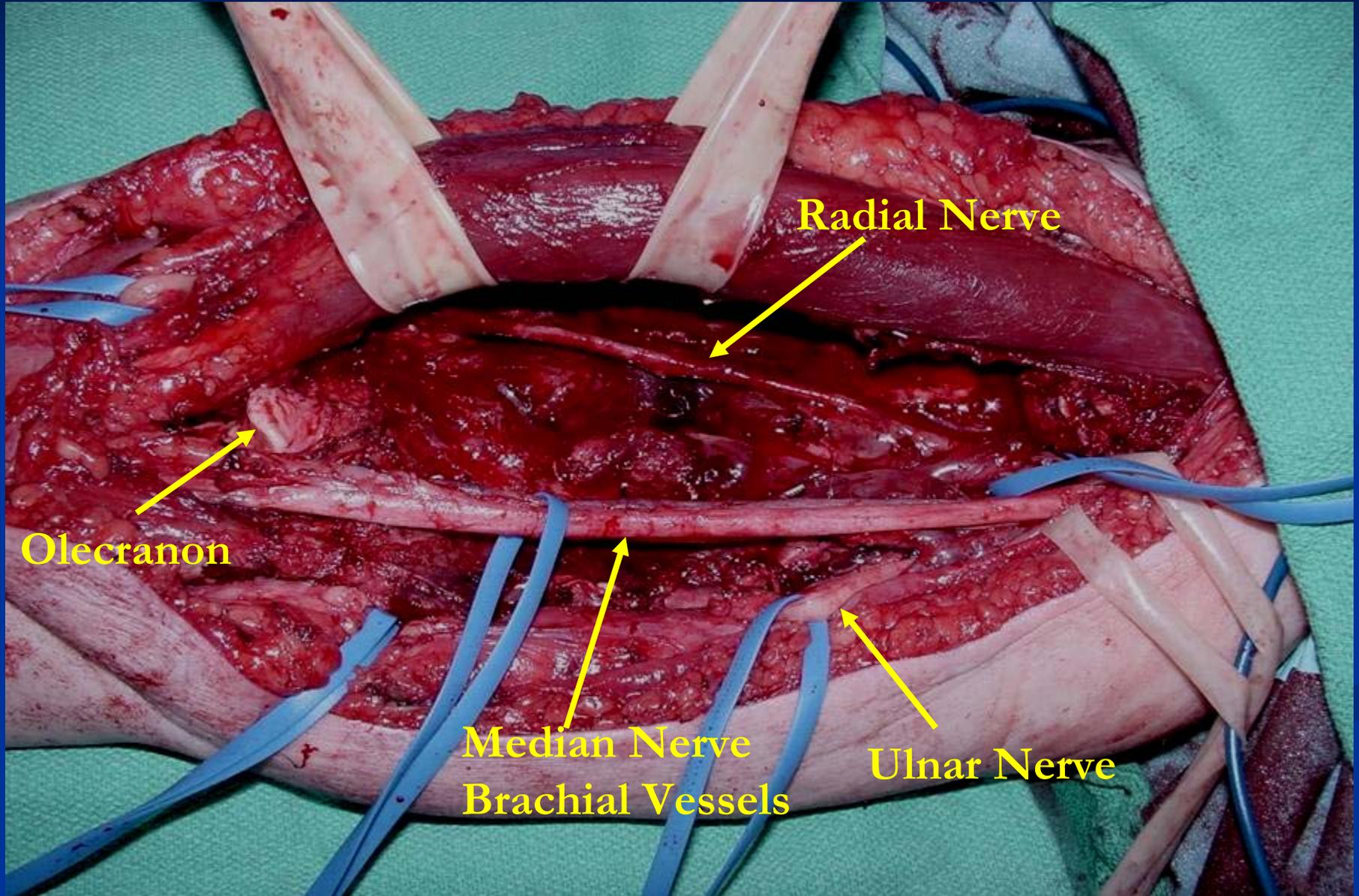


**Forearm Flexors and Extensors Released / Joint Capsule Released**

# Specimen Metastatic Renal Cell

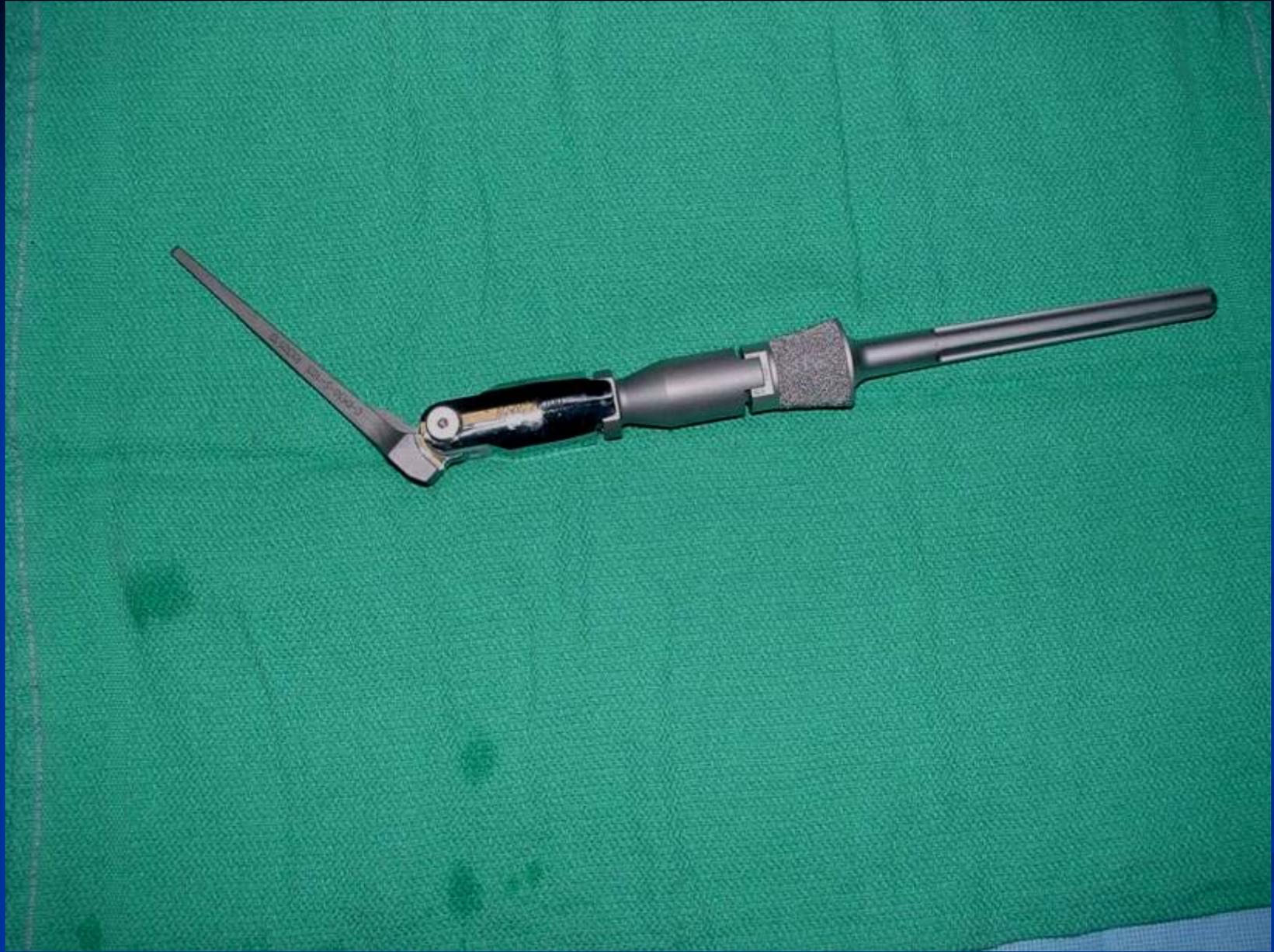


# Defect

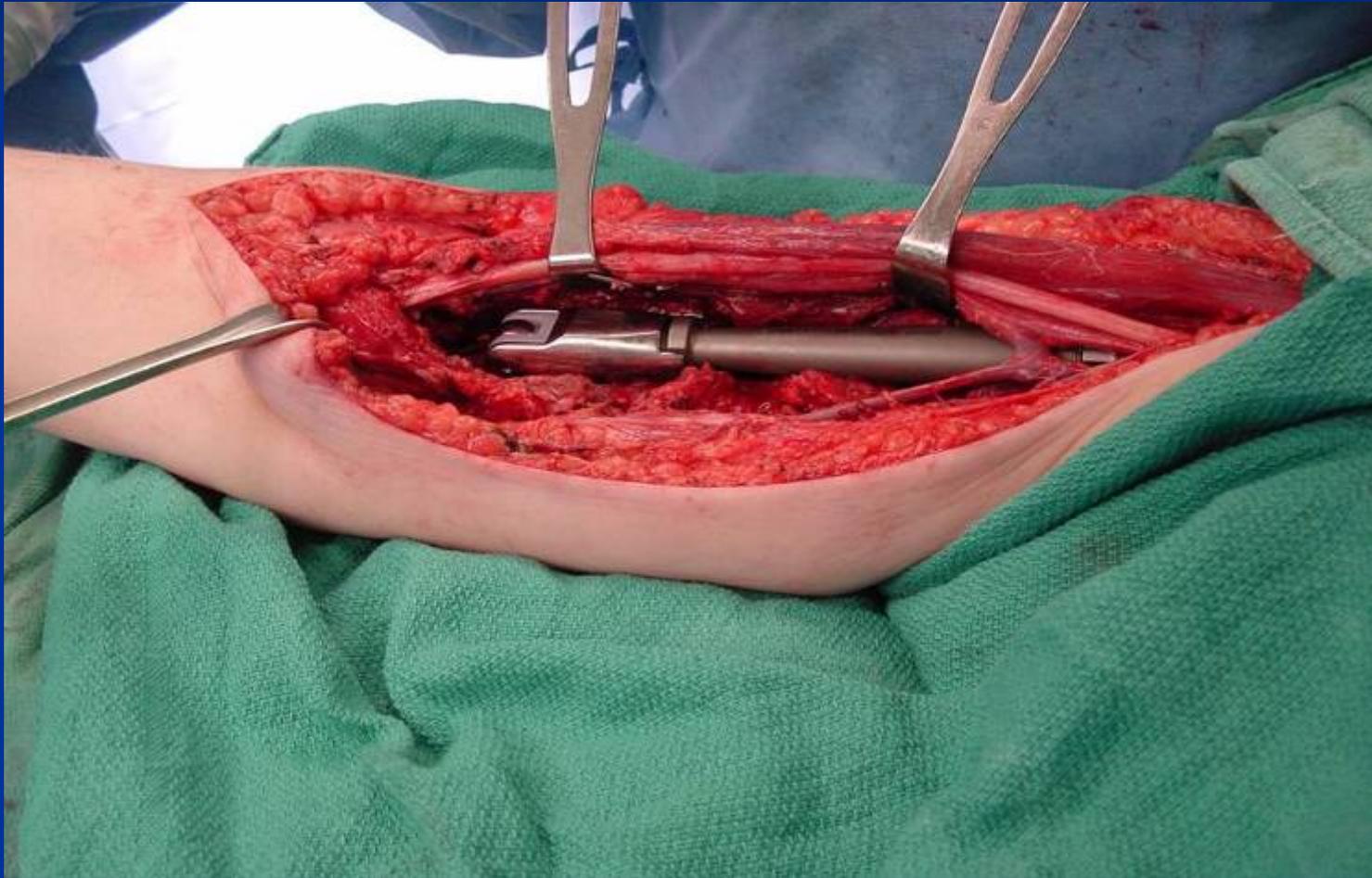


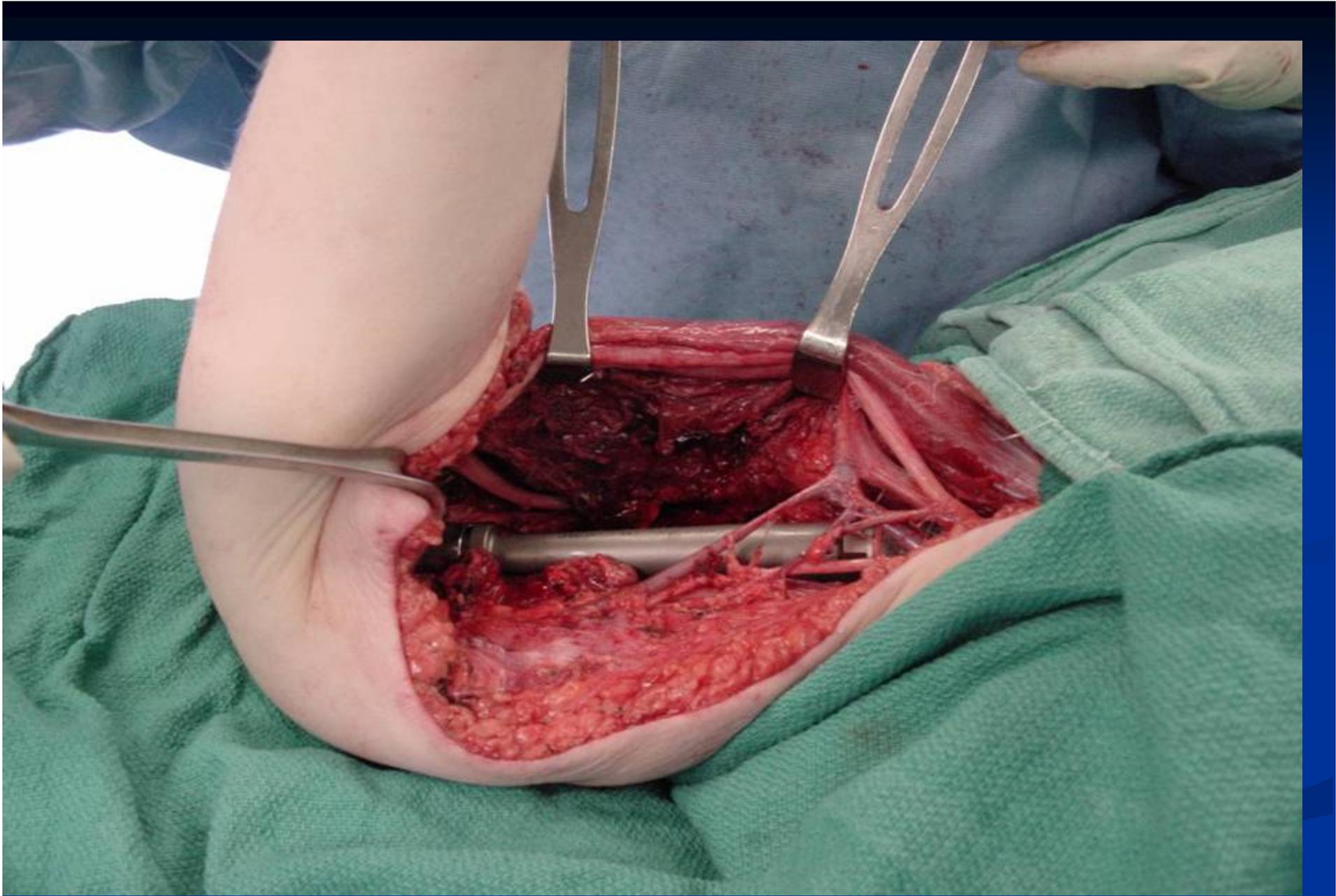
# Modular Segmental Replacement with Constrained Hinged Total Elbow





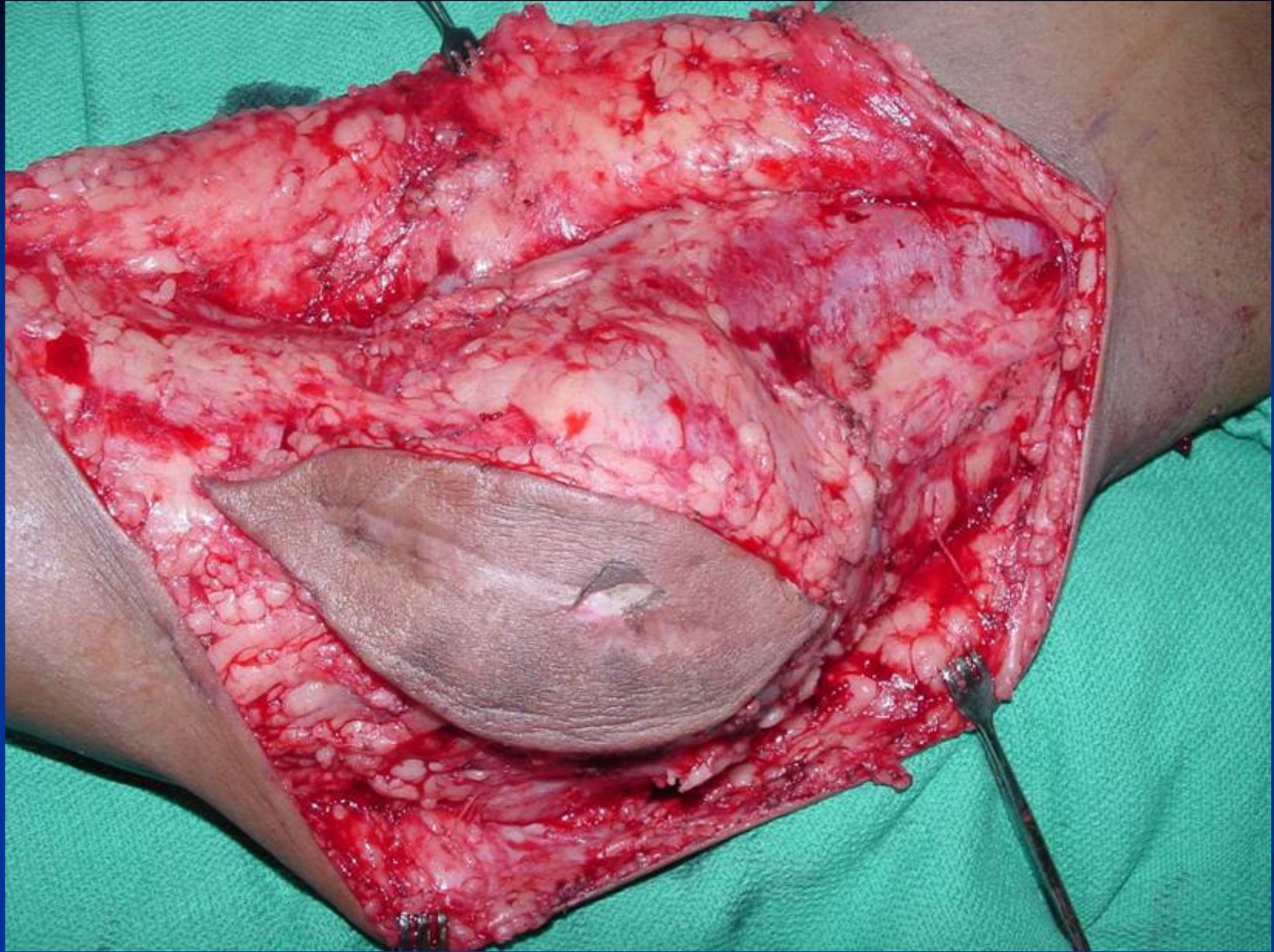
# Implantation of the Prosthesis

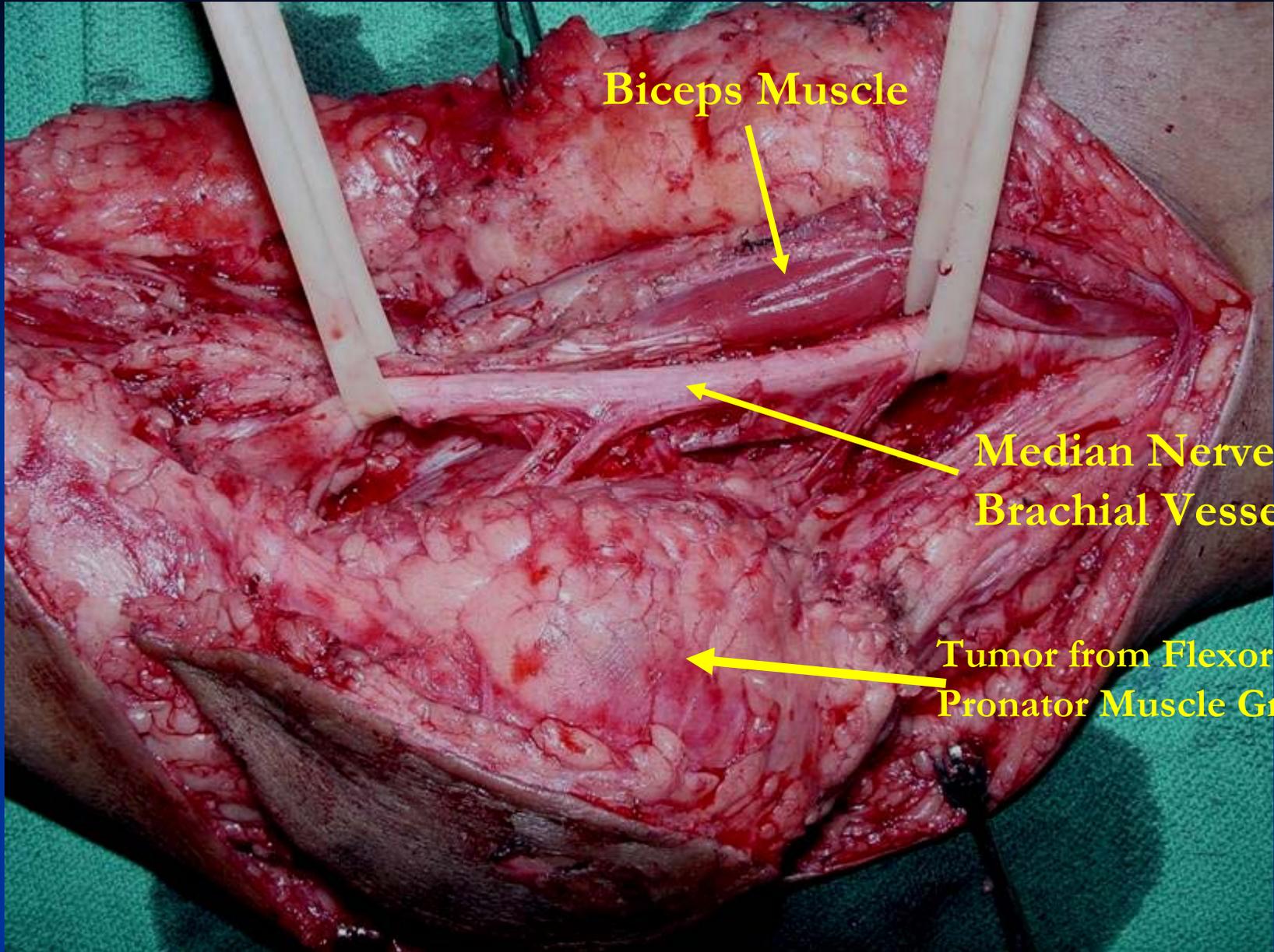




# Synovial Sarcoma of Elbow







**Biceps Muscle**

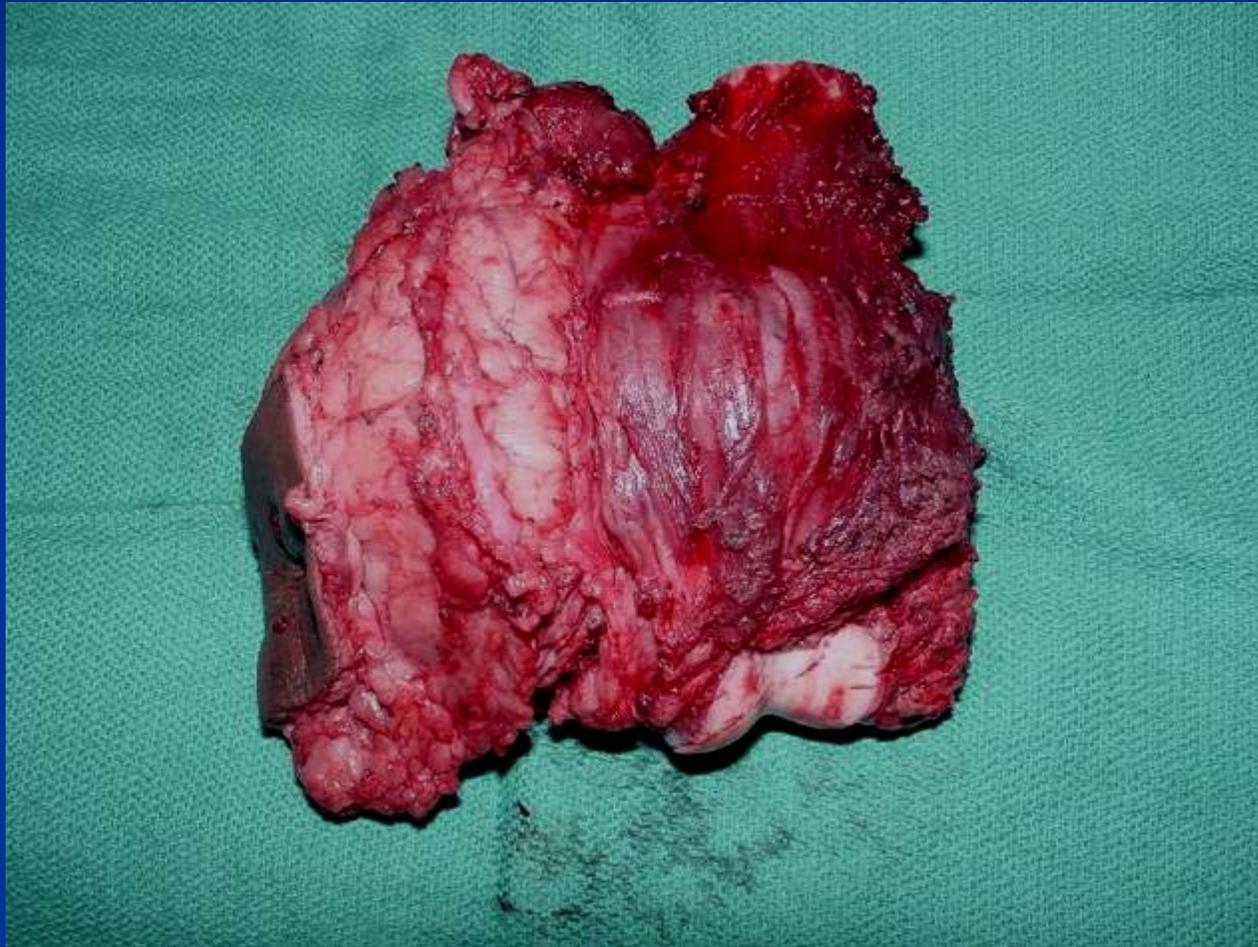
**Median Nerve  
Brachial Vessels**

**Tumor from Flexor –  
Pronator Muscle Group**

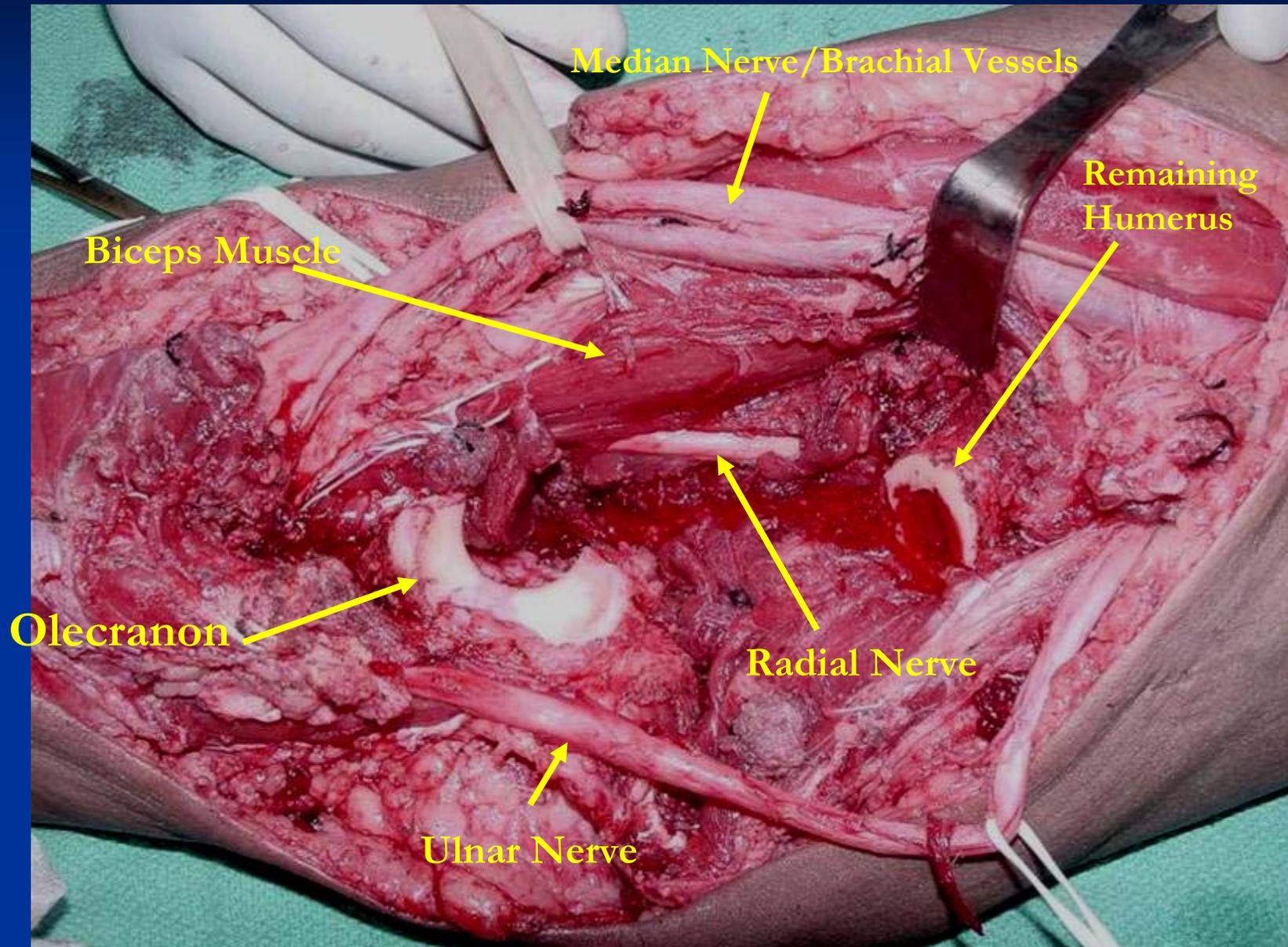
# Specimen



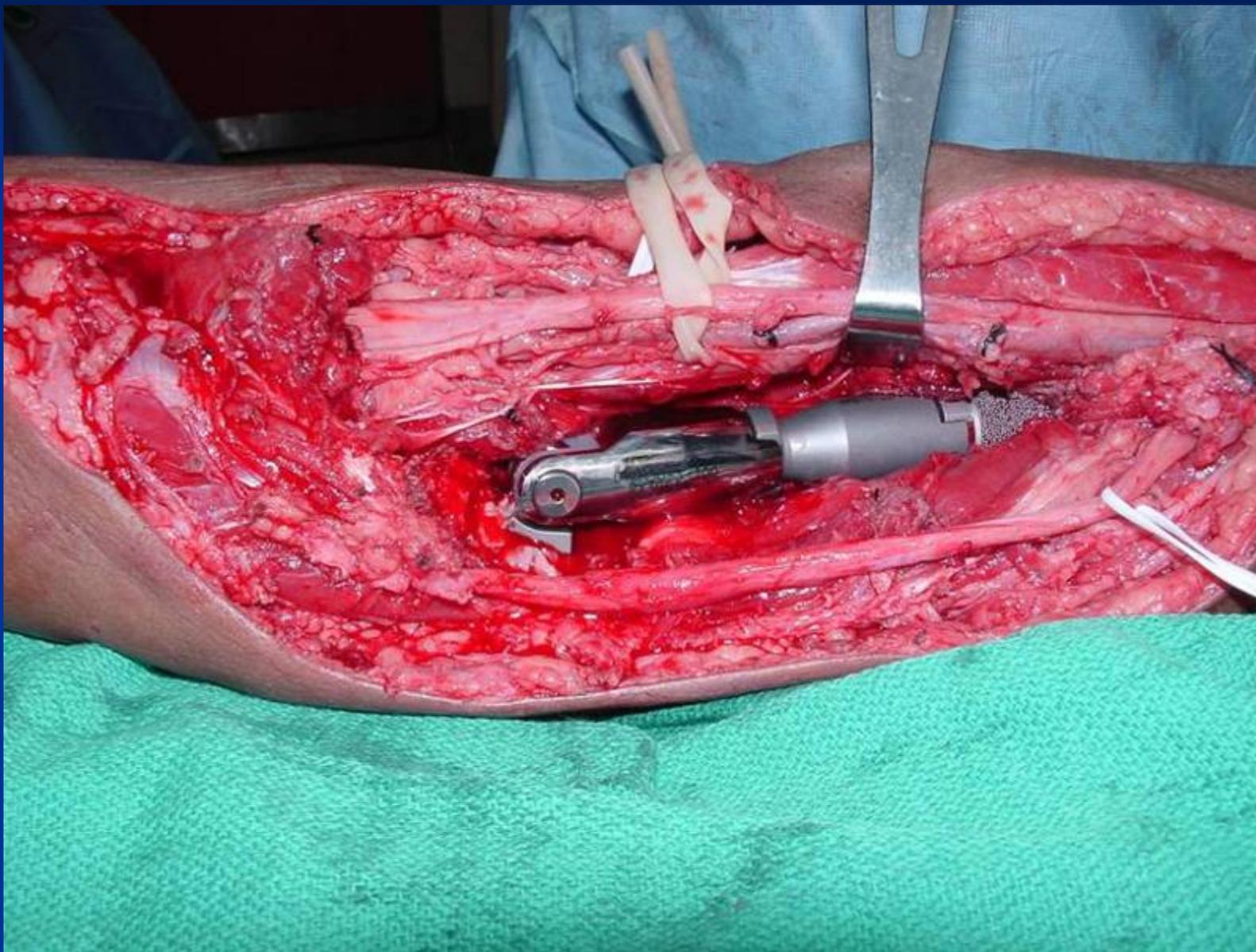
**Tumor Wrapped Around Distal Humerus  
Brachialis Muscle Involved by Tumor**



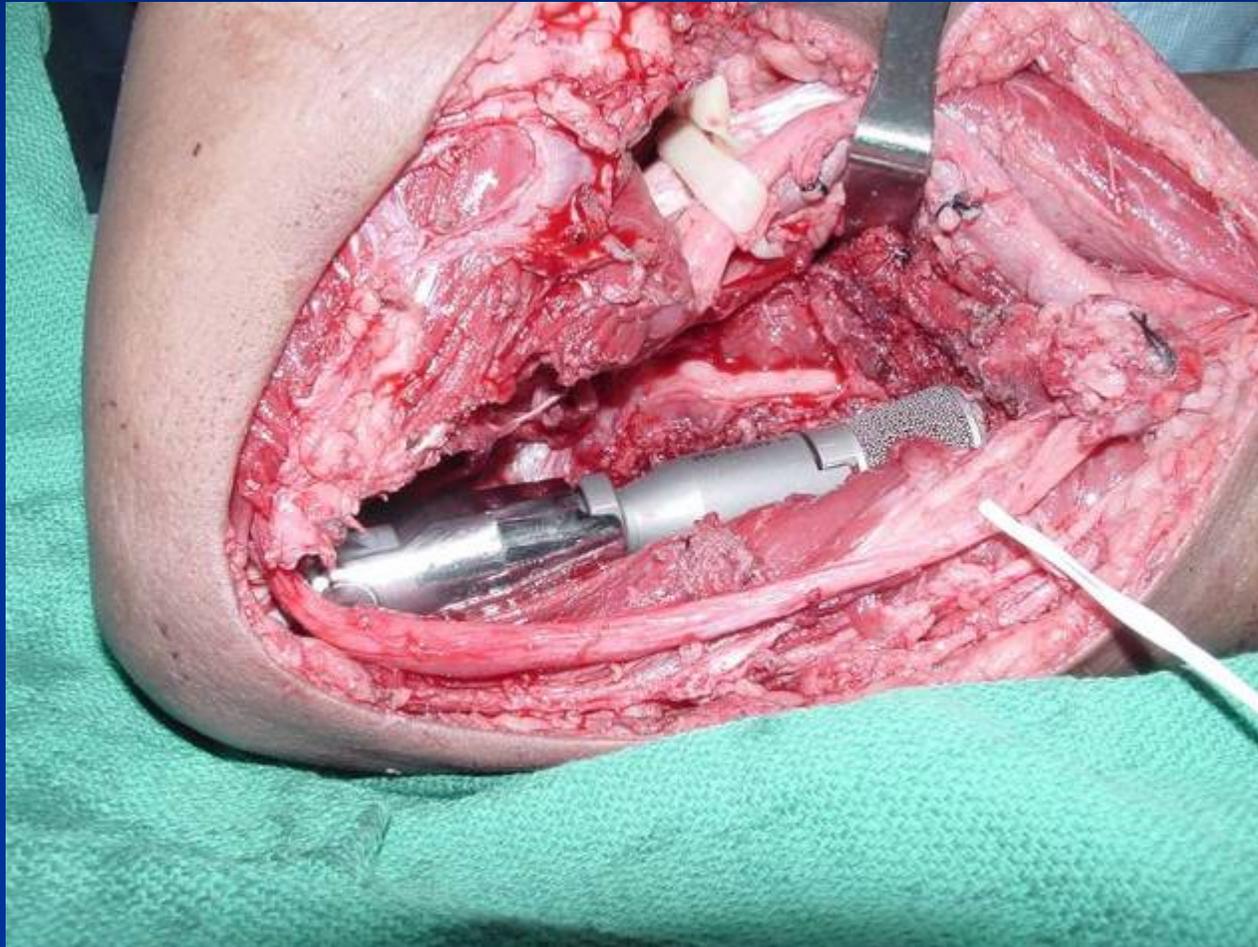
# Defect



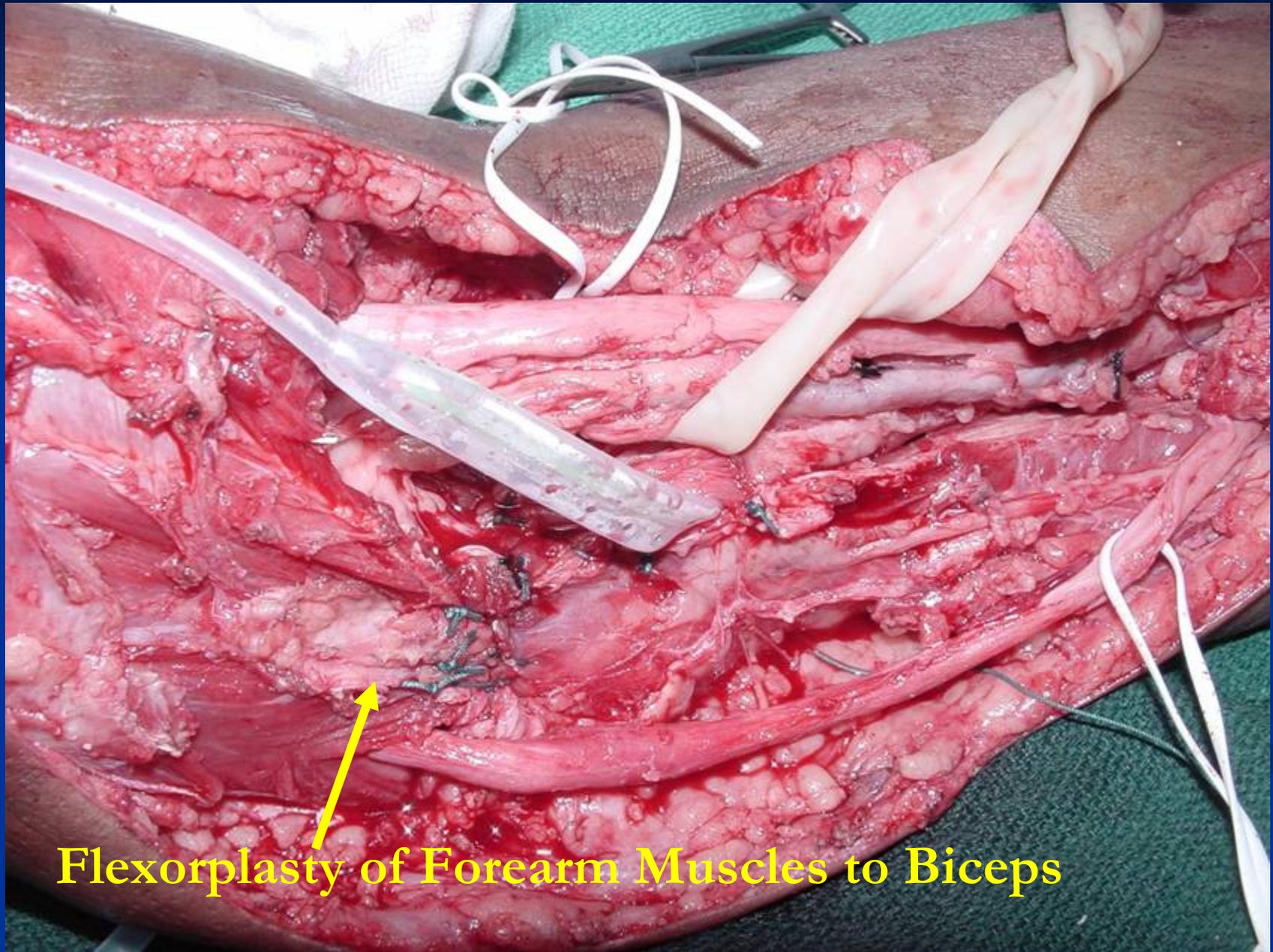
# Prosthesis Inserted



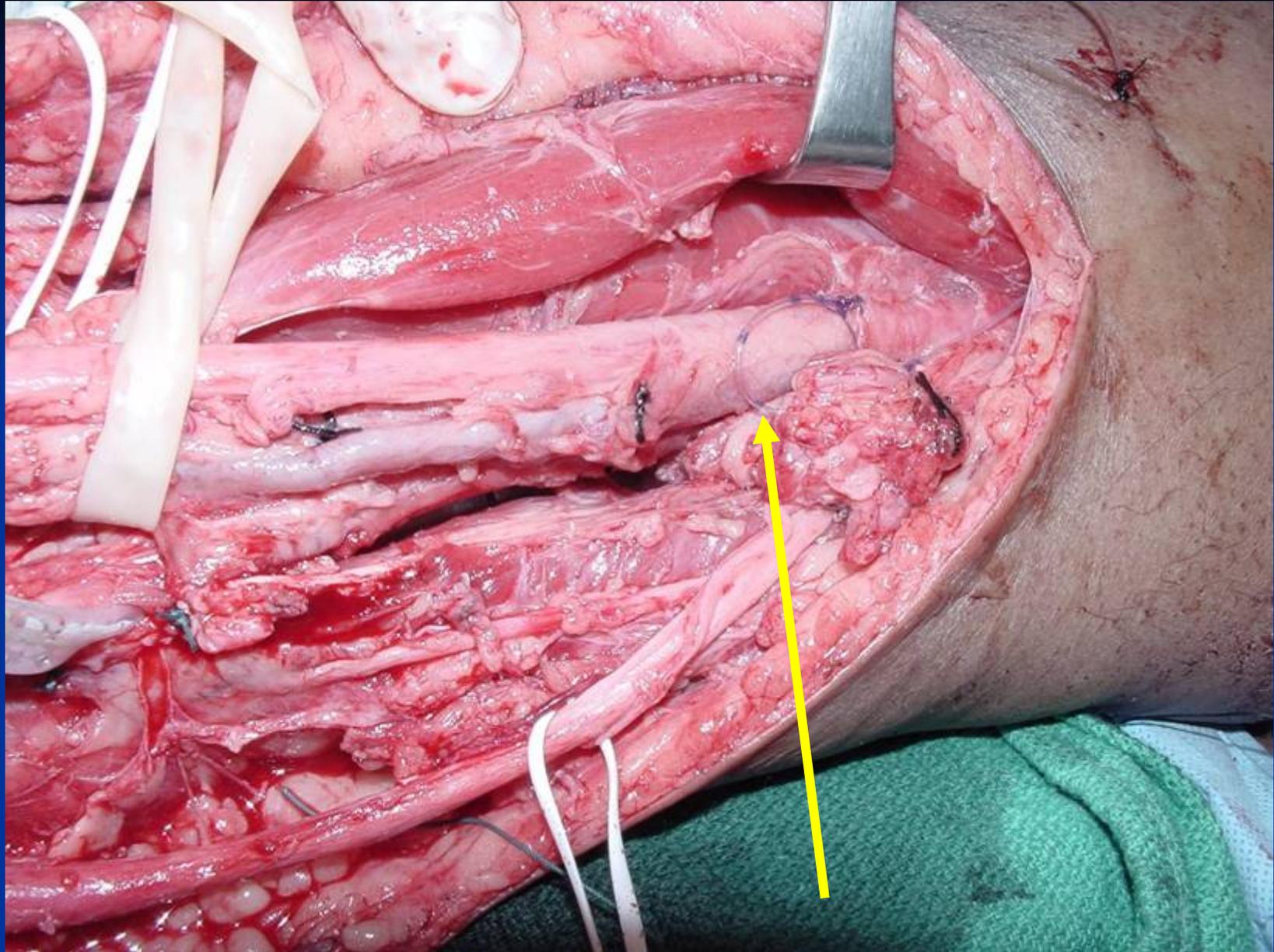
# Elbow Flexion



# Soft Tissue Reconstruction



Flexorplasty of Forearm Muscles to Biceps

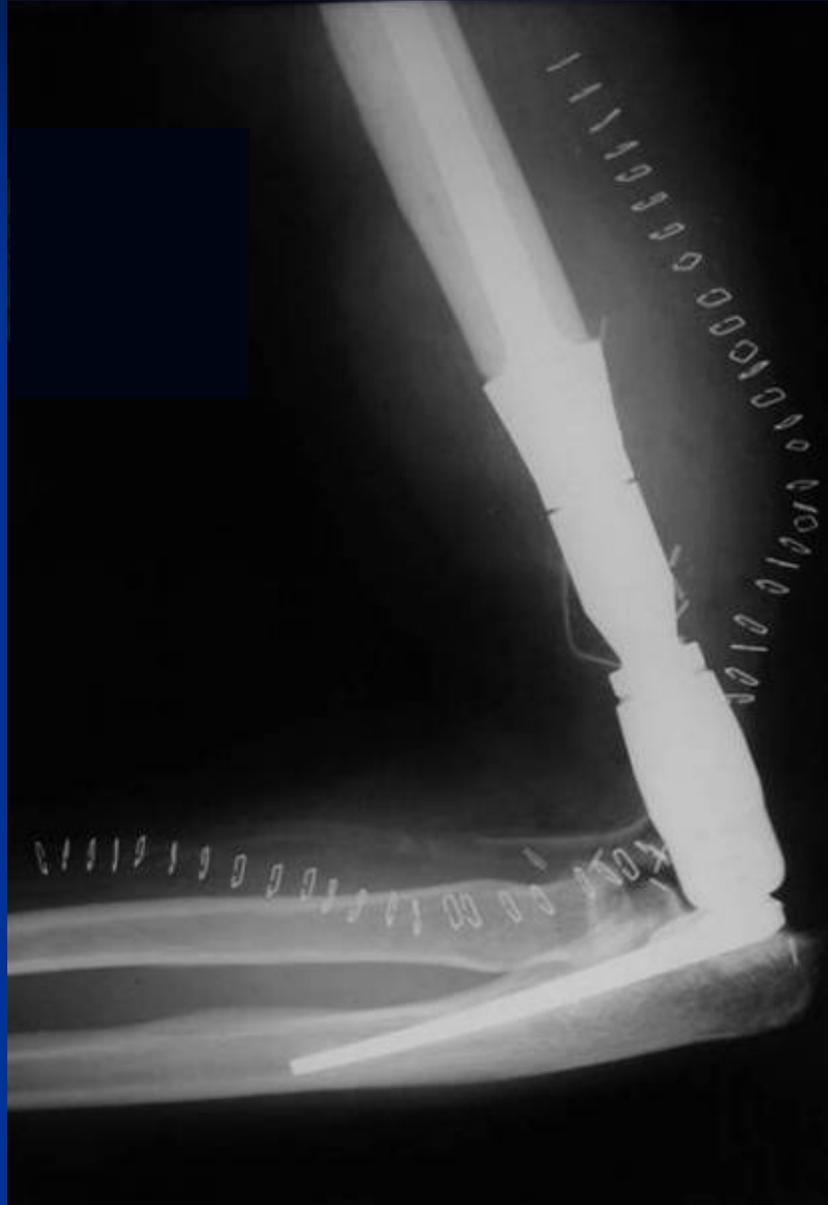


**Epidural Catheter into Brachial Plexus for Bupivacaine Infusion**

# X-Rays AP



# Lateral X-Ray



# Results

- Patients are maintained in a brace in flexion of 60 – 90 degrees for 6 weeks then active motion exercises are initiated
- Patients were followed for 6 months to 14 months
- No local recurrences
- All patients had functional use of their hands postoperatively
- Pain was relieved in all patients
- Active ROM of Elbow was 10-90 degrees by 16-20 weeks postoperatively
- No neuropraxias
- 1 minor wound dehiscence treated successfully with local dressing changes

# 12 Weeks Postop Metastatic Renal Cell

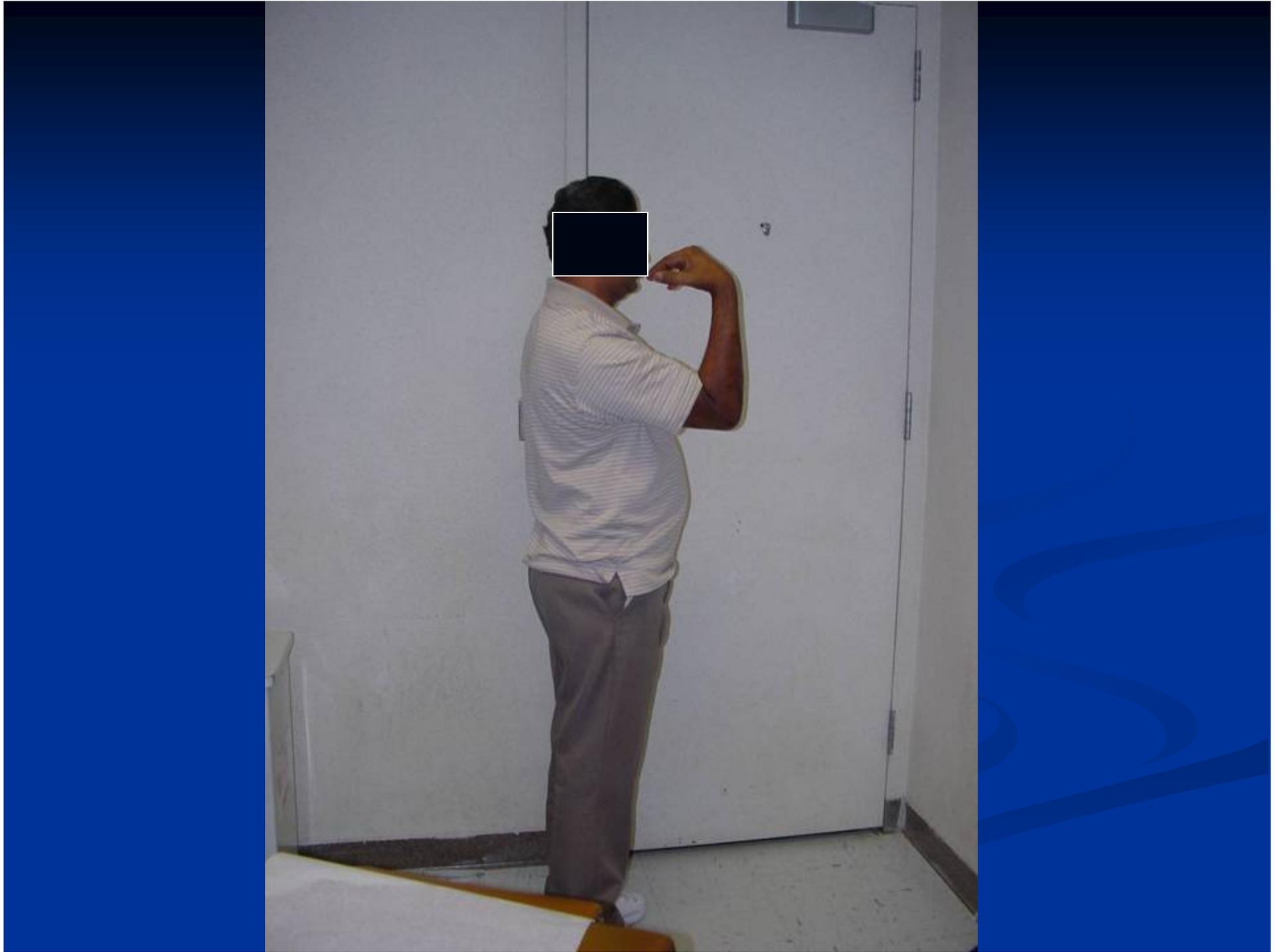


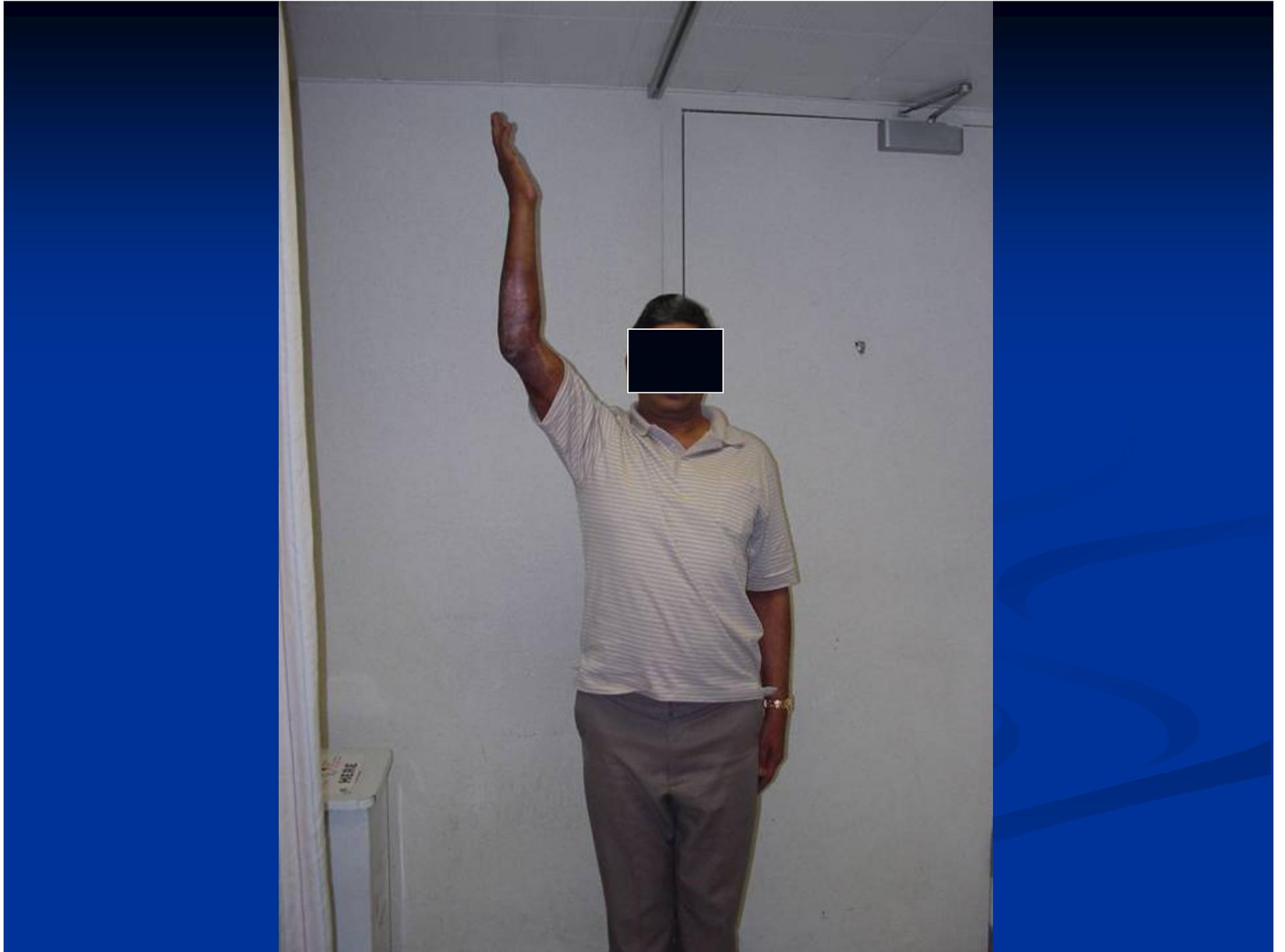




# 16 Weeks Postop Synovial Sarcoma











# Summary

- Reconstruction of the distal humerus with a cemented modular segmental distal humerus / constrained total elbow prosthesis is a safe and reliable method for reconstruction following radical resection of selected tumors for palliation or cure
- Function is optimized with soft tissue reconstruction and multiple muscle rotation flaps
- It is an acceptable alternative to an above elbow amputation or shoulder disarticulation
- Pain relief is reliable and a functional hand and elbow can be restored
- Complications can be minimized with careful attention to neurovascular dissection and soft tissue reconstruction
- The survival of the prosthesis awaits long term results

**Thank You!!**

# Nonunion of Pathological Fracture of Distal Humerus after Radiation Treatment



