OSTEOSARCOMA

DR RAJAT GUPTA

ORTHOPAEDIC ONCOLOGIST

BONE CANCER CLINIC

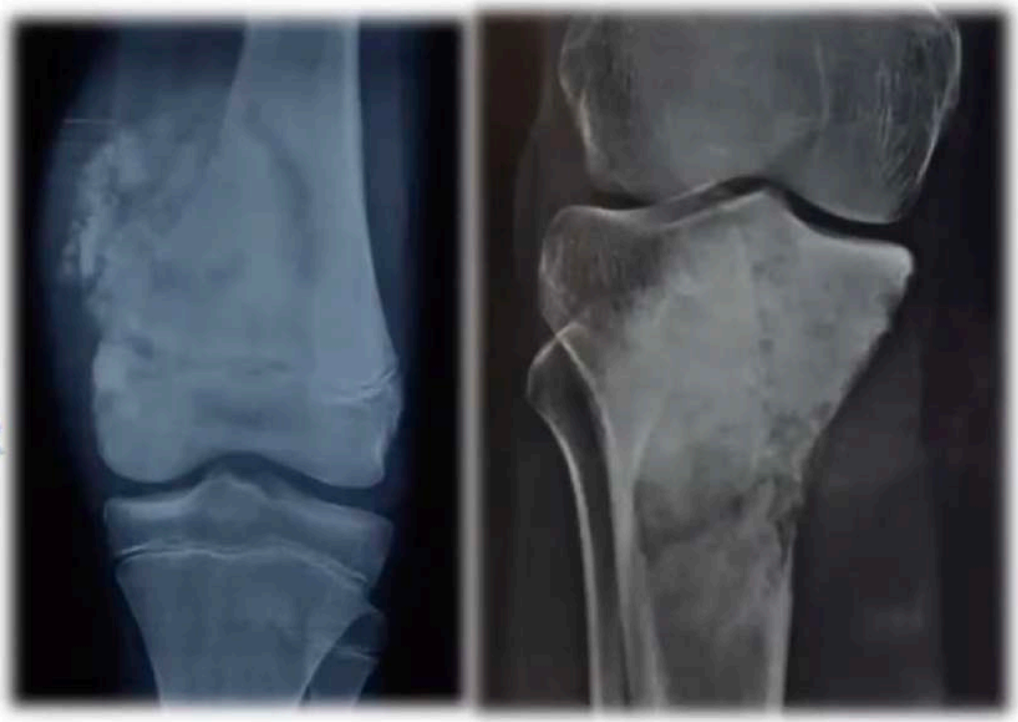
CHANDIGARH

www.curebonecancer.com

+91-9930372264

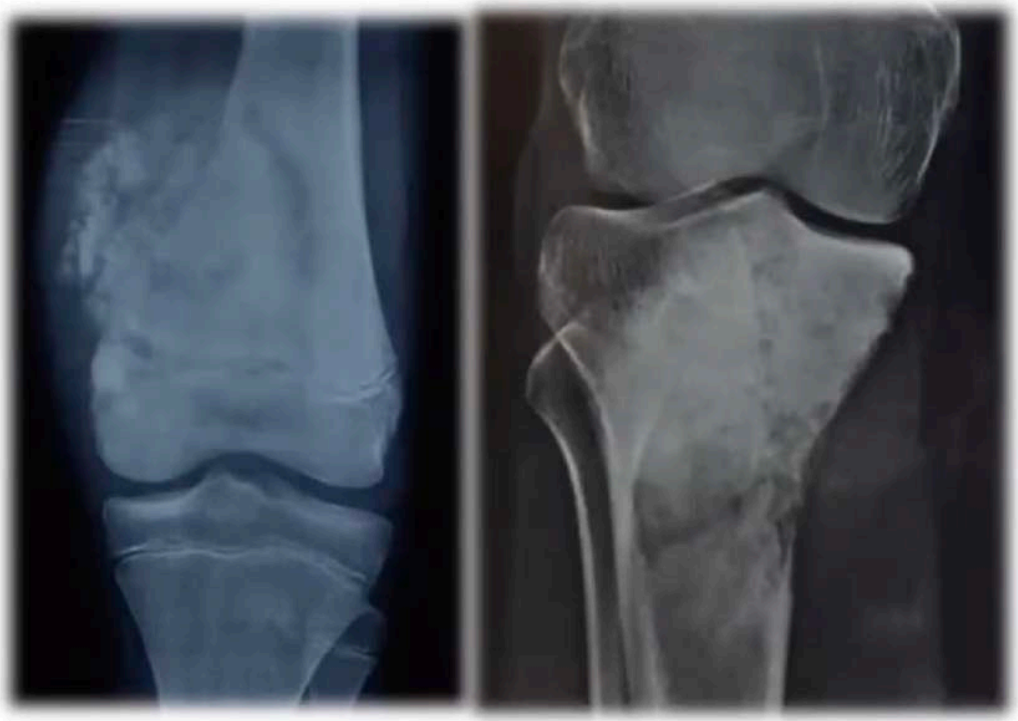
OSTEOSARCOMA

- MOST COMMON PRIMARY BONE CANCER OF CHILDREN & ADOLESCENTS
- 2ND MOST COMMON PRIMARY BONE MALIGNANCY
- INCIDENCE OF 1 PER MILLION PER YEAR
- USUALLY PRESENTS IN 2ND DECADE
- CHARACTERISED BY PRESENCE OF MALIGNANT OSTEOID



OSTEOSARCOMA

- CAN PRESENT IN ANY AGE
- HIGHER PREDISPOSITION IN PATIENTS WITH
  - HEREDITARY RETINOBLASTOMA
  - LI FRAUMENI SYNDROME
  - ROTHMUND THOMSON SYNDROME



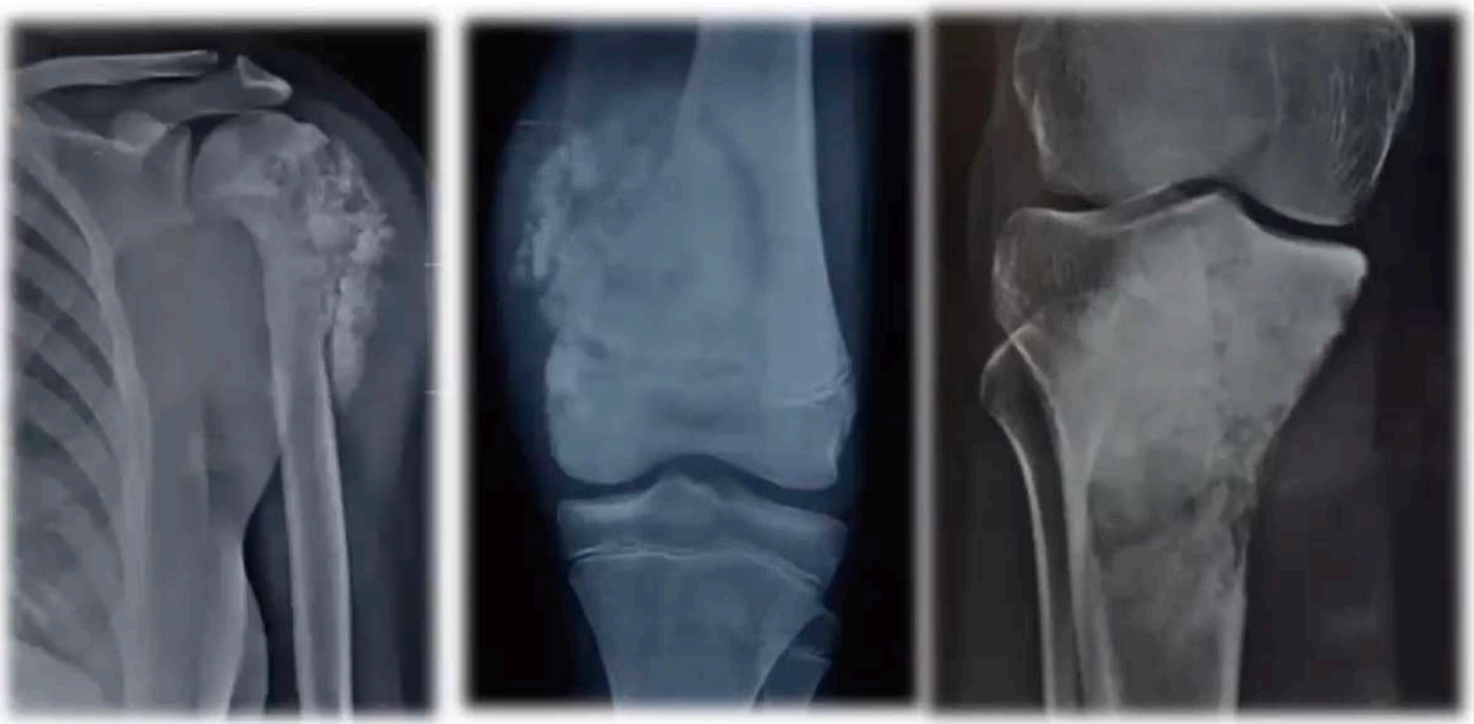
OSTEOSARCOMA

COMMONLY SEEN

AROUND KNEE

AND

PROXIMAL HUMERUS



OSTEOSARCOMA

CAN AFFECT ANY BONE

RADIOLOGICAL EVALUATION

- **AGE** *SKELETALLY IMMATURE*
- **LOCATION OF TUMOUR** *METAPHYSEAL*
- **TYPE OF LESION** *PERMEATIVE LYTIC*
- **MATRIX OF LESION** *SCLEROTIC BONE FORMING /SCLEROTIC*
- **ZONE OF TRANSITION** *WIDE*
- **TYPE OF PERIOSTEAL REACTION** *CODMAN'S + SUNBURST*
- **SOFT TISSUE COMPONENT** *YES*

OSTEOSARCOMA

CAN BE DIAPHYSEAL IN 7-9 % OF PATIENTS

OSTEOSARCOMA

PRIMARY

- CONVENTIONAL
- TELENGIECTATIC
- SMALL CELL
- HIGH GRADE SURFACE
- PERIOSTEAL
- LOW GRADE INTRA MEDULLARY
- PAROSTEAL

SECONDARY

- PAGET'S
- RADIATION INDUCED
- BONE INFARCT
- CHRONIC OSTEOMYELITIS
- FIBROUS DYSPLASIA

OSTEOSARCOMA

PRIMARY

- CONVENTIONAL

- ✓ **OSTEOBLASTIC**

OSTEOSARCOMA

PRIMARY

- CONVENTIONAL

NO DIFFERENCE IN PROGNOSIS

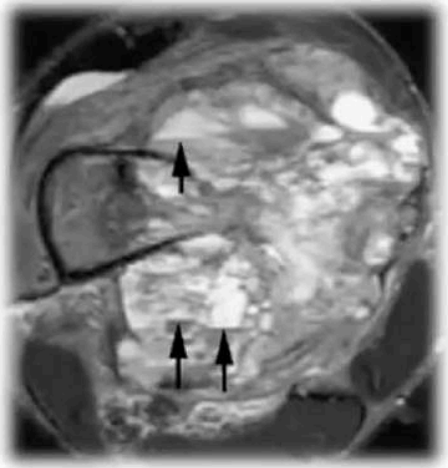
- ✓ OSTEOBLASTIC
- ✓ CHONDROBLASTIC
- ✓ FIBROBLASTIC
- ✓ HIGH GRADE
- ✓ INTRAMEDULLARY

CHONDROBLASTIC OGS RESPONDS LESSER TO CHEMOTHERAPY

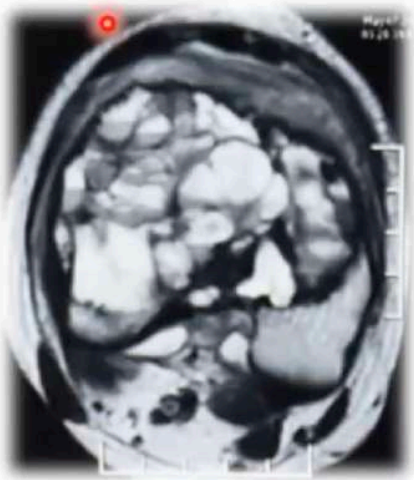
OSTEOSARCOMA

PRIMARY

- TELENGIECTATIC



OGS



ABC

- ✓ 3-10% of all Osteosarcomas
- ✓ Fluid levels on MRI
- ✓ Closest differential : ABC

OSTEOSARCOMA

PRIMARY

- SMALL CELL

✓ HIGH GRADE

✓ MIMICS 'EWING'S SARCOMA' ON HISTOLOGY – (ROUND BLUE CELLS)

OSTEOSARCOMA

PRIMARY

- LOW GRADE INTRAMEDULLARY

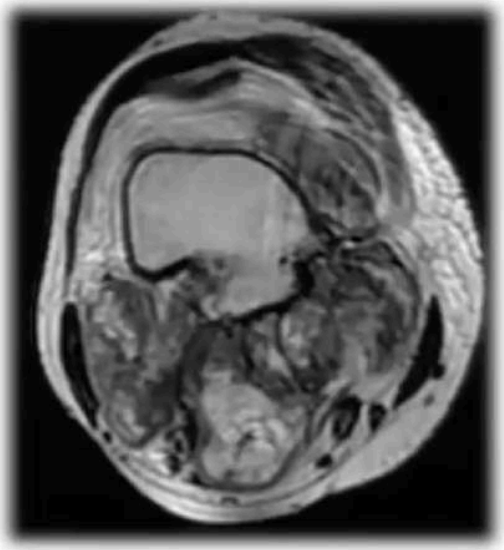
✓ LOW GRADE

✓ INDOLENT COURSE

✓ **CAN MIMIC FIBROUS DYSPLASIA**

✓ **MDM2 & CDK4 HELPS TO DIFFRENTIATE**

OSTEOSARCOMA



PRIMARY

- PAROSTEAL

- ✓ LOW GRADE
- ✓ FEMALE PREPONDERANCE
- ✓ NO ROLE OF CHEMOTHERAPY
- ✓ MIDDLE AGE
- ✓ **POSTERIOR ASPECT DISTAL FEMUR**

OSTEOSARCOMA

SECONDARY

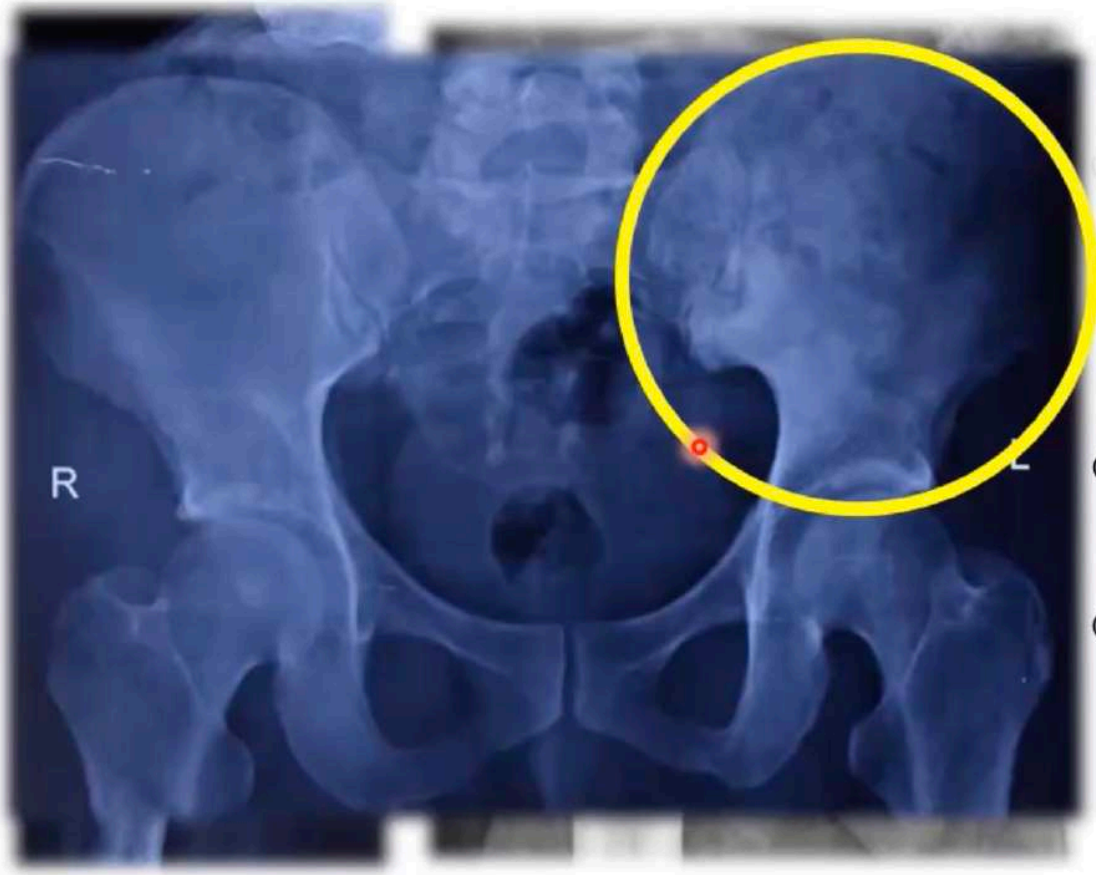
- Elderly Population

OSTEOSARCOMA

SECONDARY

- Elderly Population
- Commonly due Paget's Disease

OSTEOSARCOMA



SECONDARY

- Elderly Population
- Commonly due Paget's Disease
- Post Radiation
- Worse prognosis than conventional osteosarcoma

RADIATION-INDUCED SARCOMA OF BONE

MYRON ARLEN, MD, NORMAN L. HIGINBOTHAM, MD, ANDREW G. HUVOS, MD,
RALPH C. MARCOVE, MD, THEODORE MILLER, MD, AND I. C. SHAH, MD

Cancer 1971;28:1087-99

- **MICROSCOPIC/ RADIOLOGIC EVIDENCE OF NON MALIGNANCY / MALIGNANCY OF DIFFERENT HISTOLOGY BEFORE RADIATION**
- **SARCOMA DEVELOPING IN THE PATH OF RADIATION BEAM**
- **LONG ASYMPTOMATIC PERIOD BETWEEN RT AND DIAGNOSIS OF SECONDARY SARCOMA**
- **HISTOLOGICAL PROOF OF DIAGNOSIS OF SECONDARY SARCOMA**

OSTEOSARCOMA

PROGNOSTIC FACTORS

- ✓ STAGE OF TUMOUR
- ✓ GRADE OF TUMOUR
- ✓ SIZE OF TUMOUR
- ✓ LOCATION OF TUMOUR
- ✓ PRESENCE OF PATHOLOGICAL FRACTURE
- ✓ RESPONSE TO CHEMOTHERAPY
- ✓ MARGINS OF RESECTED SPECIMEN
- ✓ **SERUM ALKALINE PHOSPHATASE LEVELS**

OSTEOSARCOMA

PROGNOSTIC FACTORS

- ✓ **STAGE OF TUMOUR**

Metastatic disease at presentation – worse prognosis

Bone metastasis has worse prognosis than lung metastasis

OSTEOSARCOMA

PROGNOSTIC FACTORS

- ✓ **GRADE OF TUMOUR**

Higher the grade – worse is the prognosis

OSTEOSARCOMA

PROGNOSTIC FACTORS

- ✓ **SIZE OF TUMOUR**

More the tumour volume – worse is the prognosis

OSTEOSARCOMA

PROGNOSTIC FACTORS

Tumour in axial skeleton has worse prognosis than appendicular skeleton

- ✓ **LOCATION OF TUMOUR**

OSTEOSARCOMA

PROGNOSTIC FACTORS

Pathological fracture at presentation carries worse prognosis than patients without fracture.

- ✓ **PRESENCE OF PATHOLOGICAL FRACTURE**

OSTEOSARCOMA

PROGNOSTIC FACTORS

Tumour progressing on chemotherapy or having poor response to chemotherapy has a worse prognosis

- ✓ **RESPONSE TO CHEMOTHERAPY**

OSTEOSARCOMA

PROGNOSTIC FACTORS

HUVOS GRADING

POOR	GRADE 1 : LITTLE OR NO EVIDENCE OF NECROSIS	>50% VIABLE CELLS
POOR	GRADE 2 : NECROSIS OF 50%-90%	10-50% VIABLE CELLS
GOOD	GRADE 3 : NECROSIS OF 90%-99%	1-10% VIABLE CELLS
GOOD	GRADE 4 : NECROSIS OF 100%	NO VIABLE CELLS

- ✓ **RESPONSE TO CHEMOTHERAPY**

OSTEOSARCOMA

PROGNOSTIC FACTORS

PICCI GRADING

GRADE 1 : MACROSCOPIC VIABLE TUMOUR

GRADE 2 : MICROSCOPIC VIABLE TUMOUR

GOOD { GRADE 3 : NO VIABLE TUMOUR

- ✓ **RESPONSE TO CHEMOTHERAPY**

OSTEOSARCOMA

PROGNOSTIC FACTORS

POSITIVE MARGINS HAVE WORSE PROGNOSIS

- ✓ **MARGINS OF RESECTED SPECIMEN**

OSTEOSARCOMA

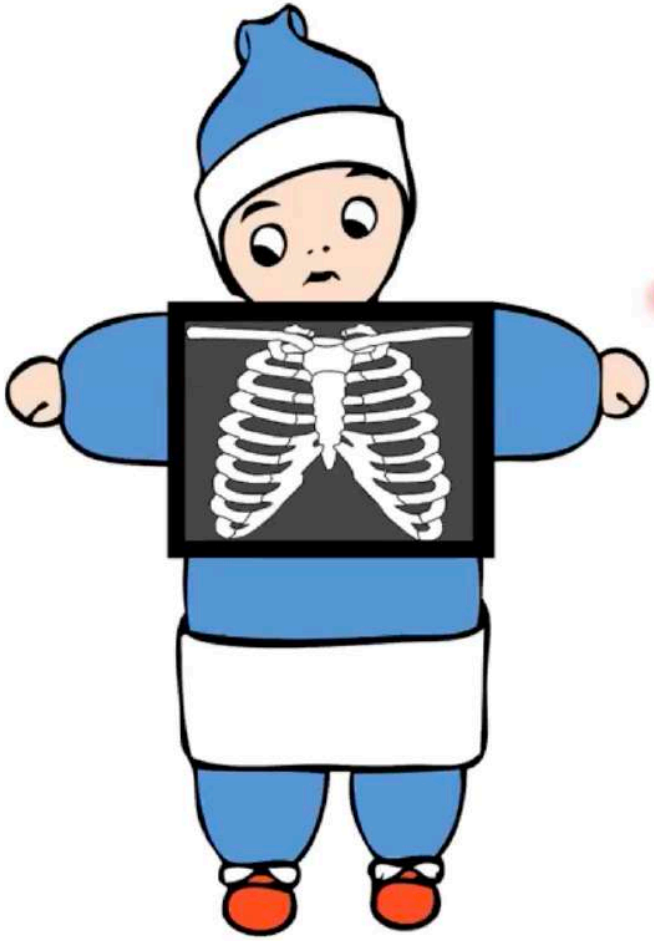
PROGNOSTIC FACTORS

HIGHER LEVELS ASSOCIATED WITH WORSE PROGNOSIS

- ✓ **SERUM ALKALINE PHOSPHATASE LEVELS**

OSTEOSARCOMA

X-RAY



BONE CANCER CLINIC

TARGET ORTHO

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X-RAY

- EXTENT OF BONY DESTRUCTION

BONE CANCER CLINIC

TARGET ORTHO

OSTEOSARCOMA

MRI

EXTENT OF THE LESION

INVOLVEMENT OF SURROUNDING MUSCLE ETC

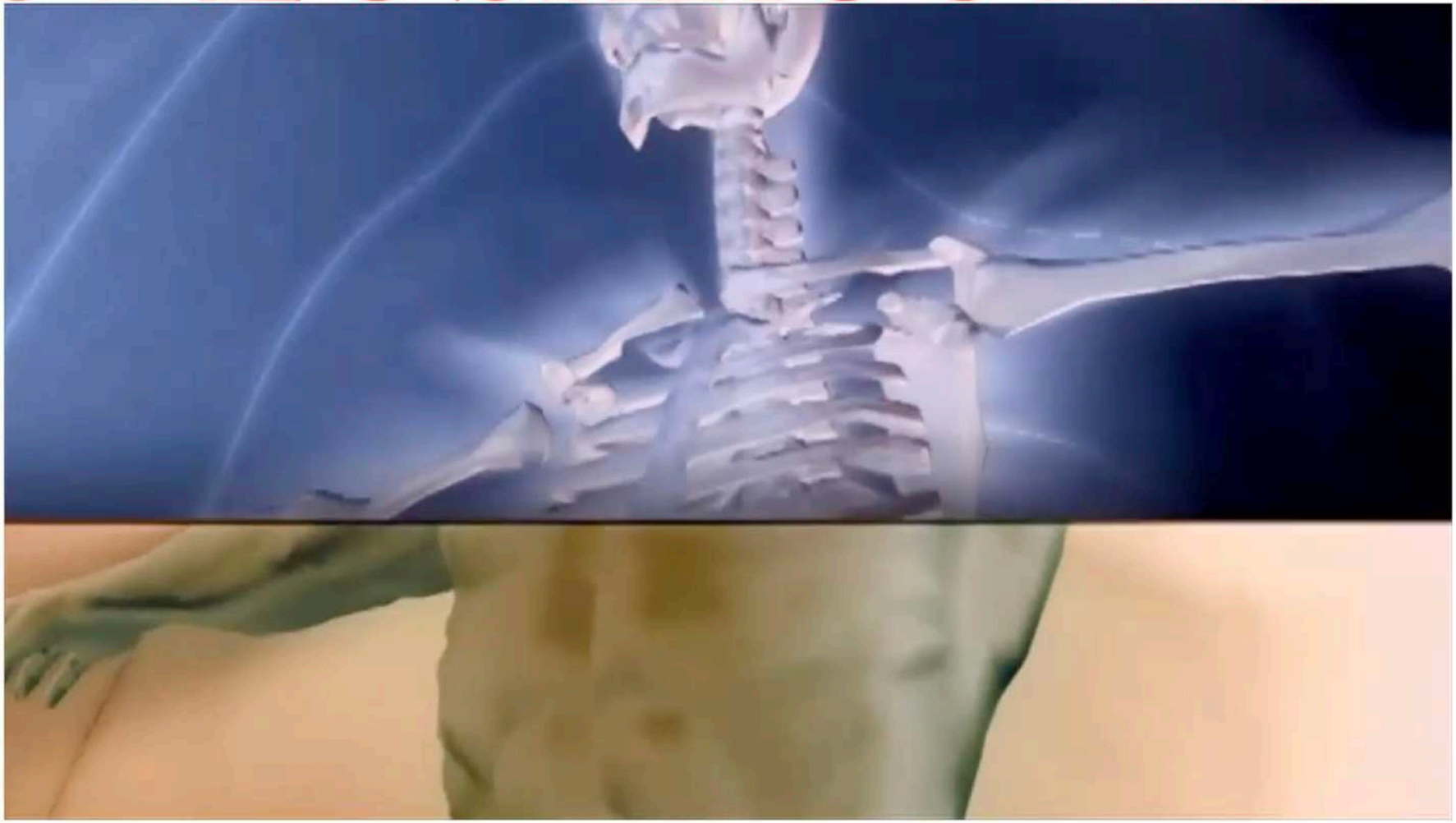
PLANNING BIOPSY / SURGERY

BONE CANCER CLINIC

TARGET ORTHO

OSTEOSARCOMA

PET CT



BONE CANCER CLINIC

TARGET ORTHO

OSTEOSARCOMA

PET CT

TO LOOK FOR DISEASE
ANYWHERE ELSE IN THE BODY

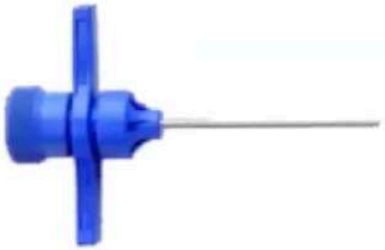
ASSESSMENT OF RESPONSE TO
TREATMENT

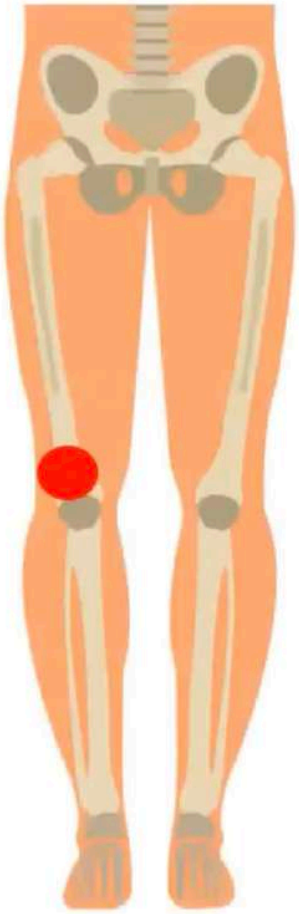
BONE
CANCER CLINIC

TARGET
ORTHO

OSTEOSARCOMA

BIOPSY





BONE CANCER CLINIC

TARGET ORTHO

OSTEOSARCOMA

PET CT

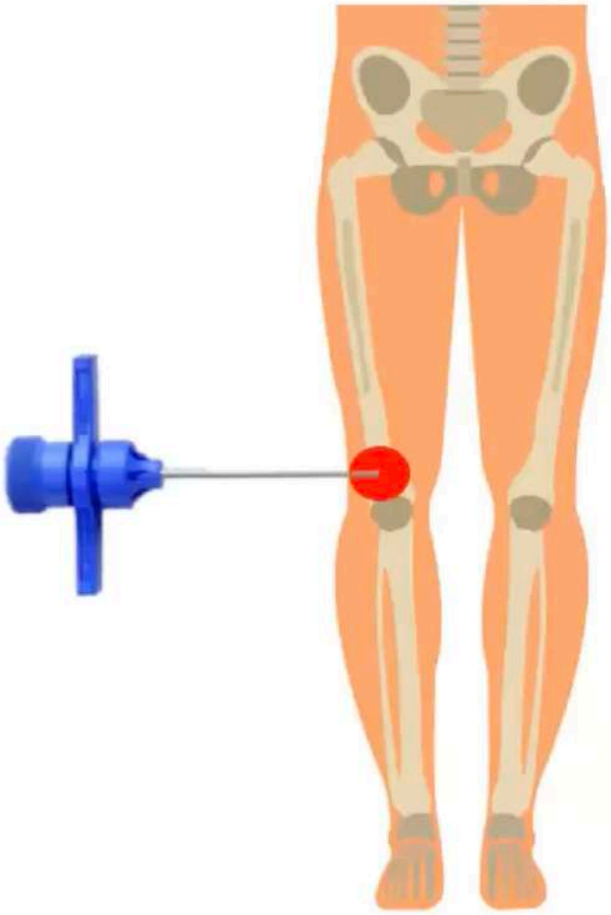
TO LOOK FOR DISEASE
ANYWHERE ELSE IN THE BODY

ASSESSMENT OF RESPONSE TO
TREATMENT

BONE
CANCER CLINIC

OSTEOSARCOMA

BIOPSY



BONE CANCER CLINIC

TARGET ORTHO

OSTEOSARCOMA

TREATMENT PLAN

NEOADJUVANT

2-3 CYCLES

LIMB SALVAGE

ADJUVANT

3-4 CYCLES

OSTEOSARCOMA

TREATMENT PLAN

LIMB SALVAGE

Parosteal osteosarcoma

OSTEOSARCOMA

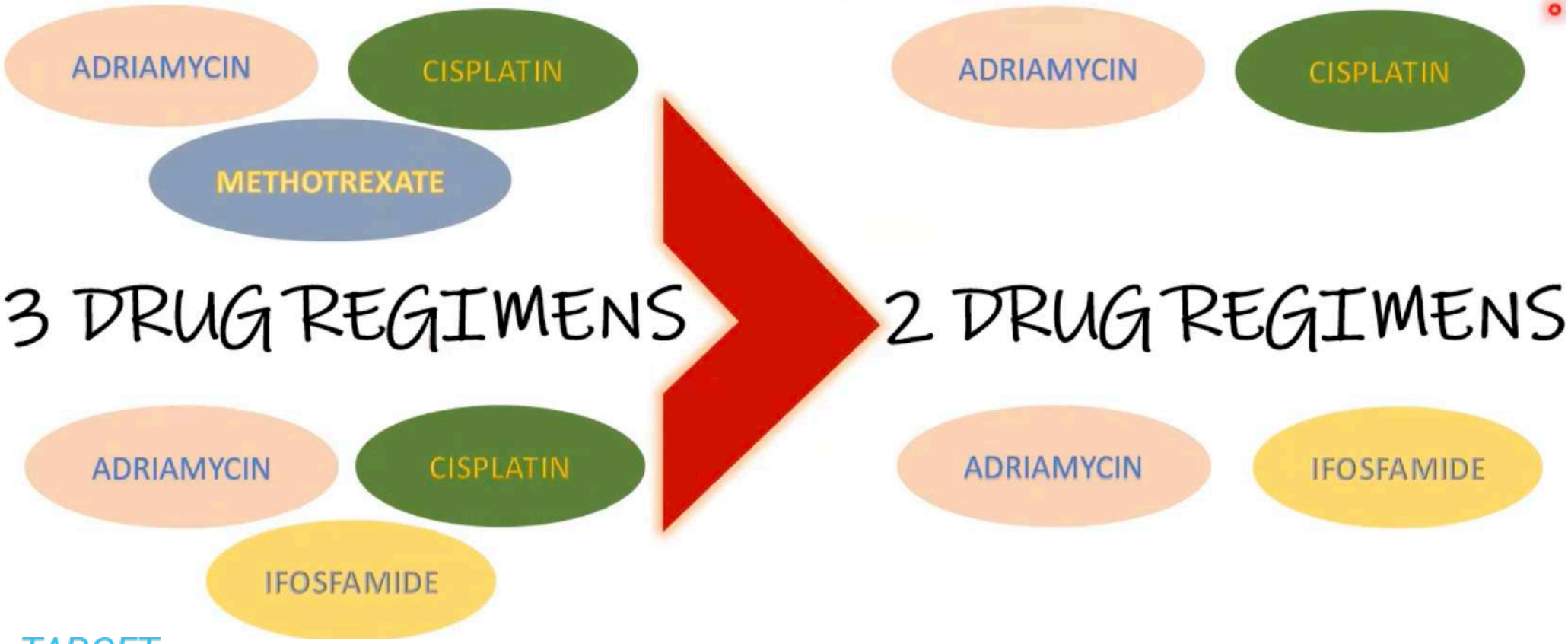
CHEMOTHERAPY

DRUGS

ADRIAMYCIN	75mg/m2 over 3 days
CISPLATIN	100mg/m2 over 2 days
METHOTREXATE	12gm/m2 over 4 hours
IFOSFAMIDE	9gm/m2 over 5 days

OSTEOSARCOMA

CHEMOTHERAPY



OSTEOSARCOMA

MAP PROTOCOL

Day 1-3 Adriamycin
Day 1-2 Cisplatin
Day 21 High dose Methotrexate
Day 28 High dose Methotrexate
Day 35 Next cycle

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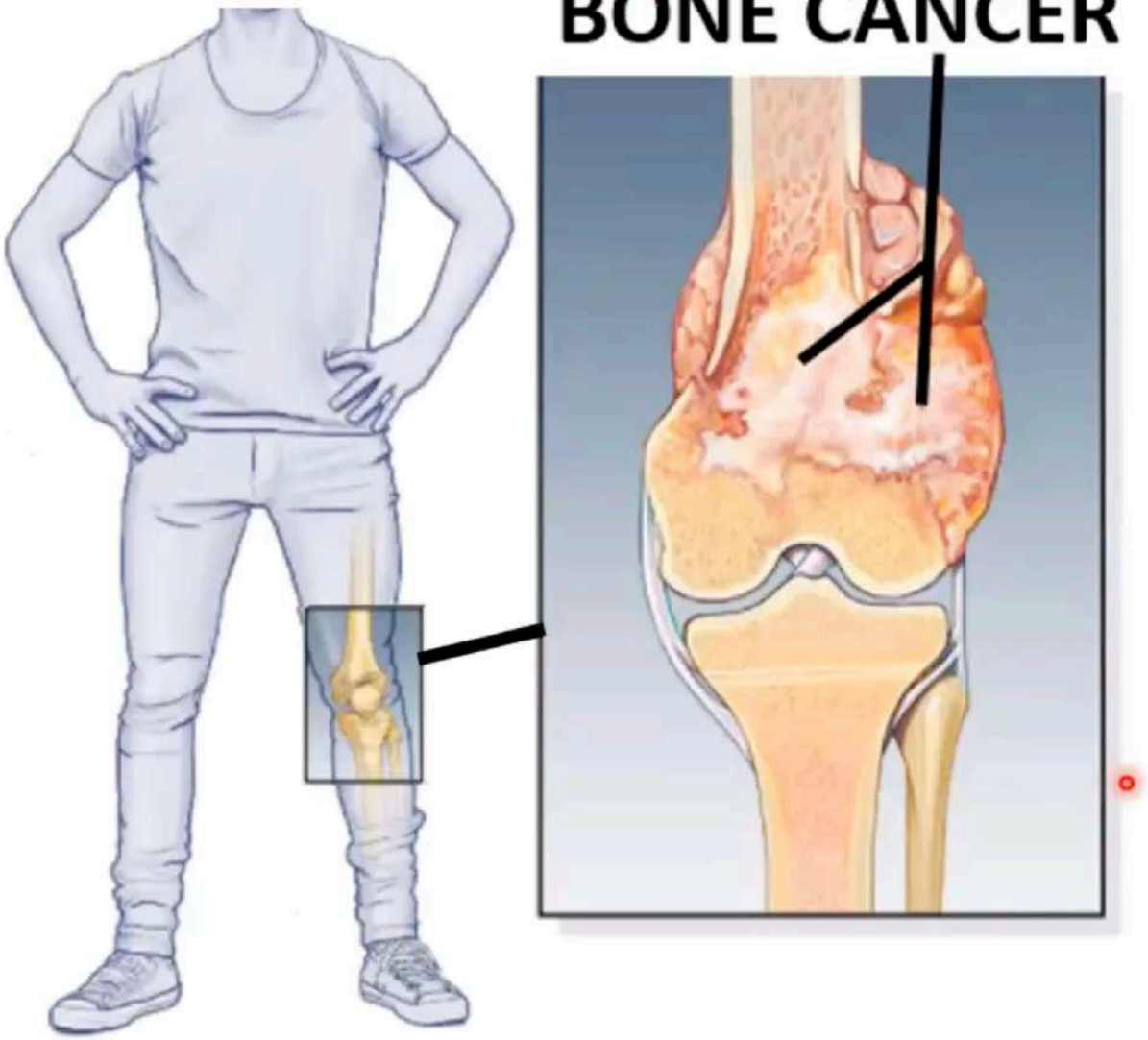
SURGERY ??

BONE CANCER

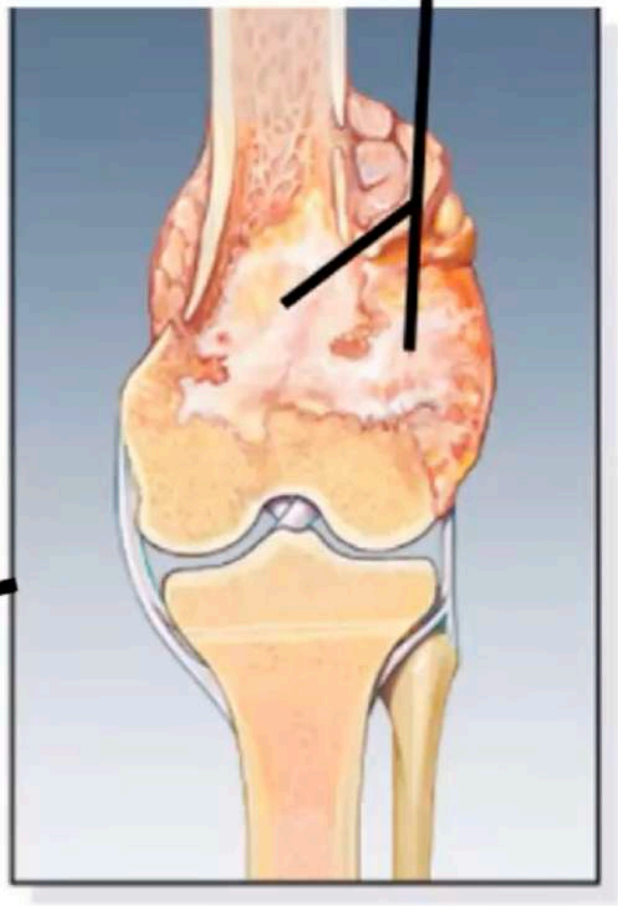


.....Today's era

.....Today's era

LIMB SALVAGE SURGERY

BONE CANCER



TARGET ORTHO

OSTEOSARCOMA

Barriers to Limb Salvage

- POORLY PLACED BIOPSY INCISIONS
- MAJOR VASCULAR INVOLVEMENT
- ENCASEMENT OF A MAJOR MOTOR NERVE
- PATHOLOGICAL FRACTURE OF THE INVOLVED BONE

These adverse factors should not be viewed as absolute contraindications.

3 STRIKE RULE OF LIMB SALVAGE

- Bone
- Nerve
- Vessel
- Soft tissue envelope

IF THREE OF THESE KEY COMPONENTS ARE INVOLVED, LIMB SALVAGE IS PROBABLY NOT WORTH CONSIDERING.

OSTEOSARCOMA

RECONSTRUCTION OPTIONS

NON BIOLOGICAL

- MEGAPROSTHESIS
- NAIL CEMENT SPACER

BIOLOGICAL

- ALLOGRAFT
- AUTOGRAFT
  - ECRT
  - CRYOTHERAPY
- ROTATIONPLASTY
- CANADELL'S PROCEDURE

OSTEOSARCOMA

25 YEAR LADY

OSTEOSARCOMA

THIGH BONE

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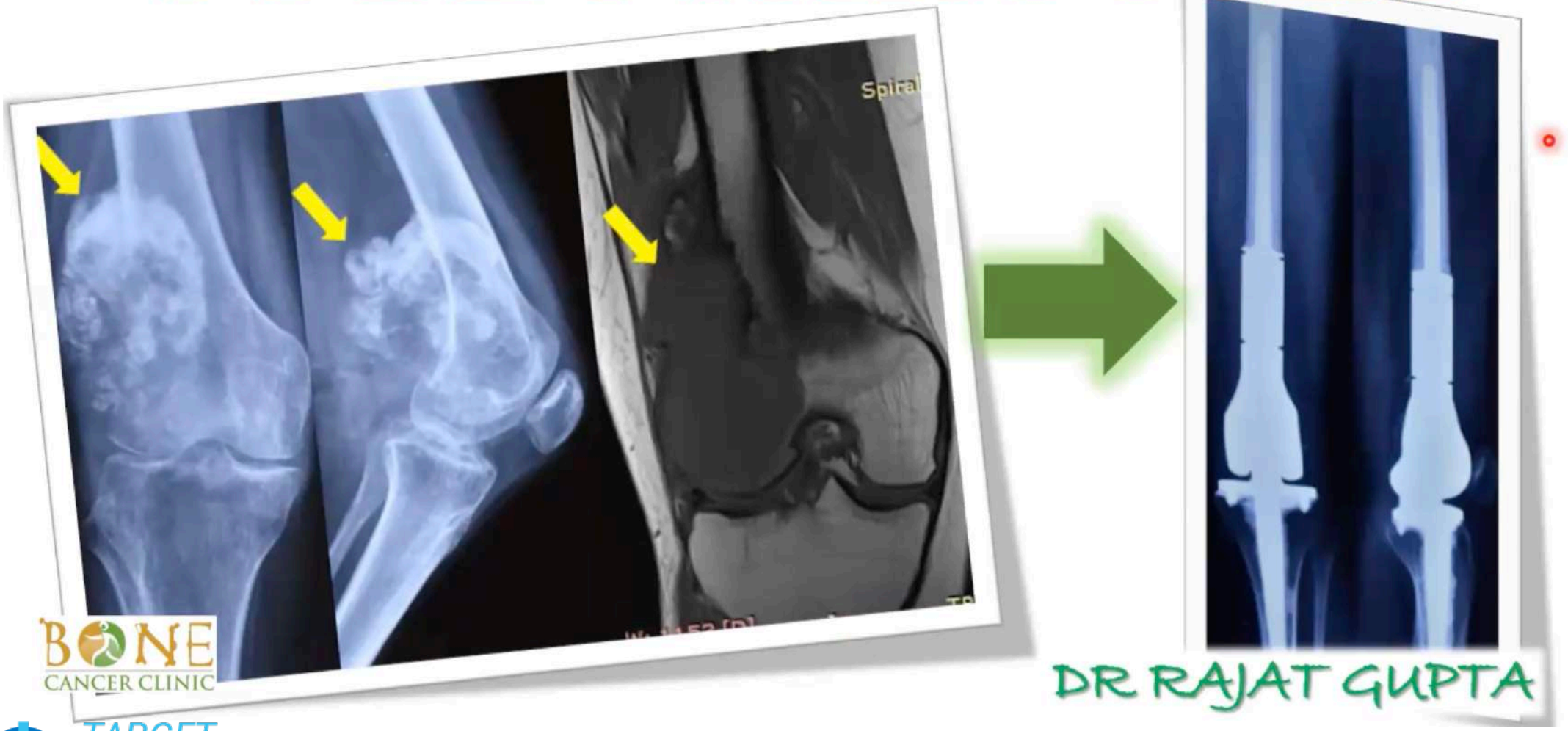
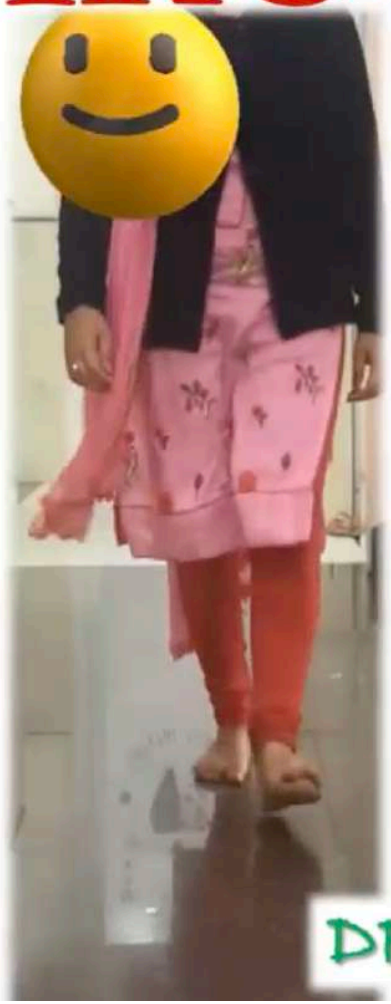
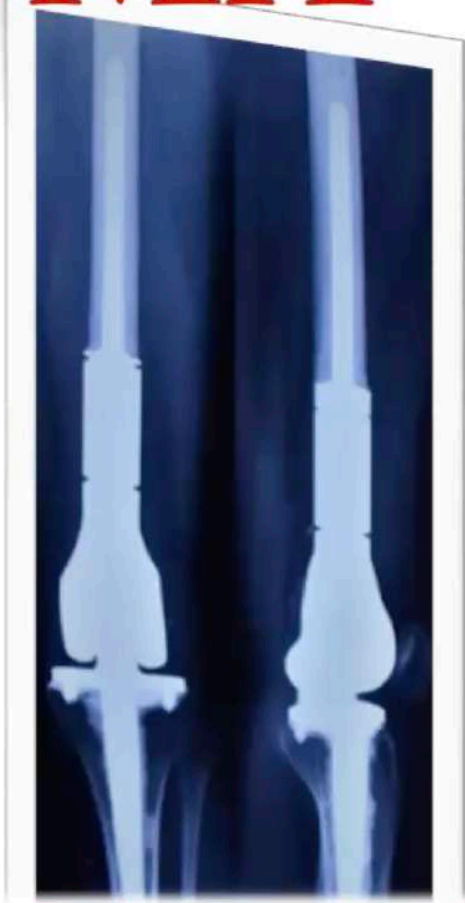
OSTEOSARCOMA



OSTEOSARCOMA





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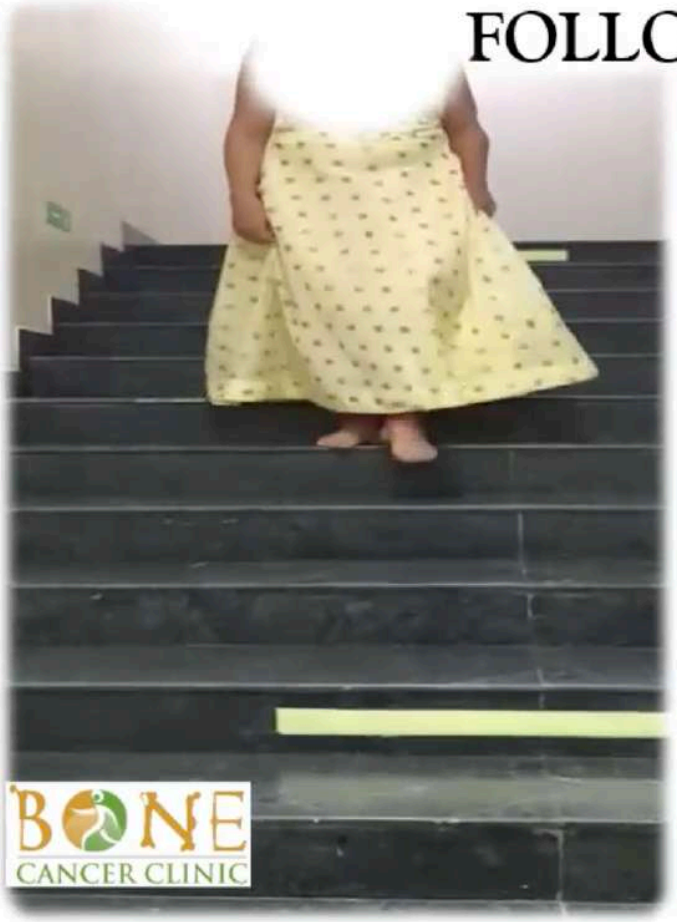
OSTEOSARCOMA

FOLLOW UP AT 1 YEAR



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FOLLOW UP AT 9 MONTHS

BONE CANCER CLINIC

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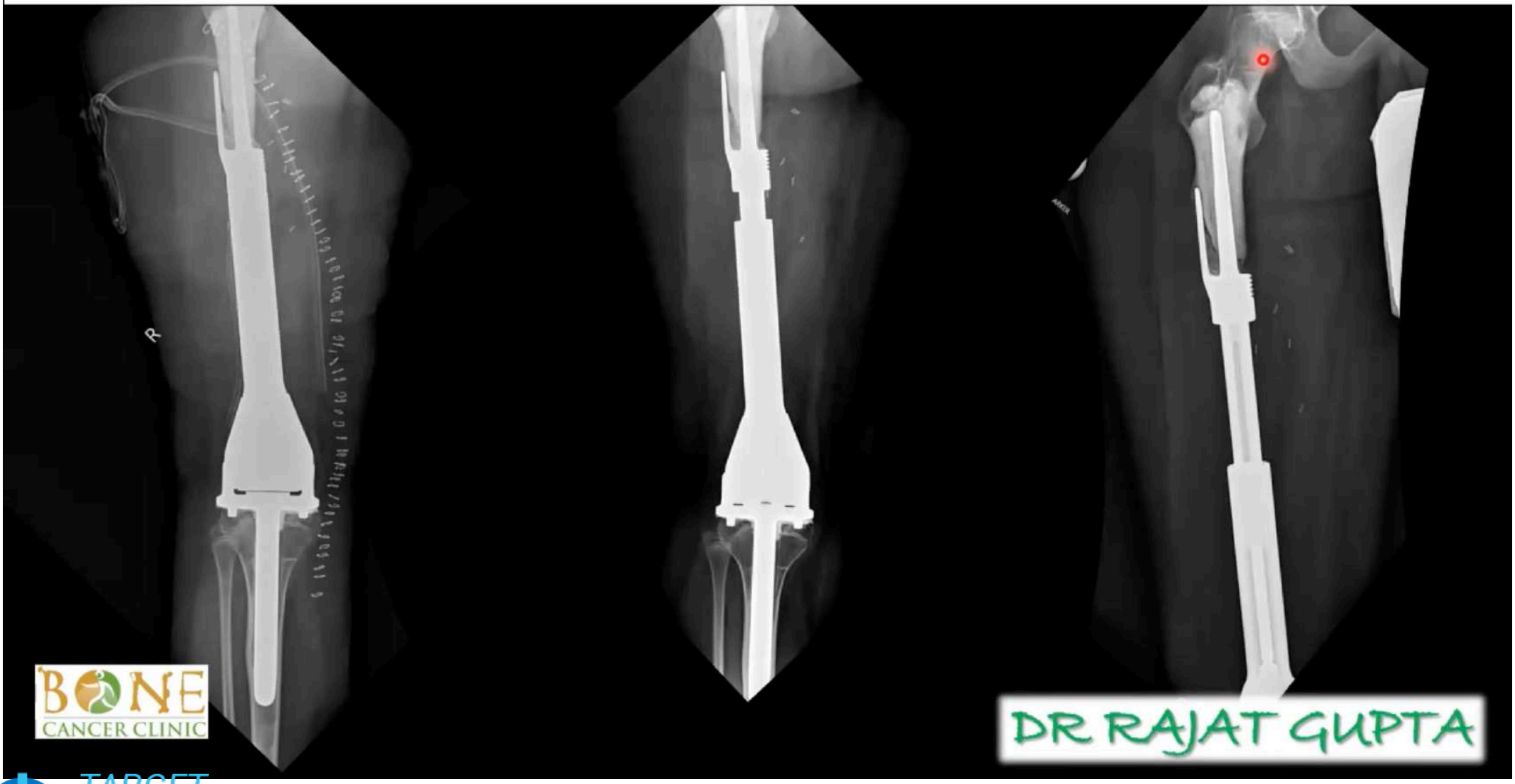
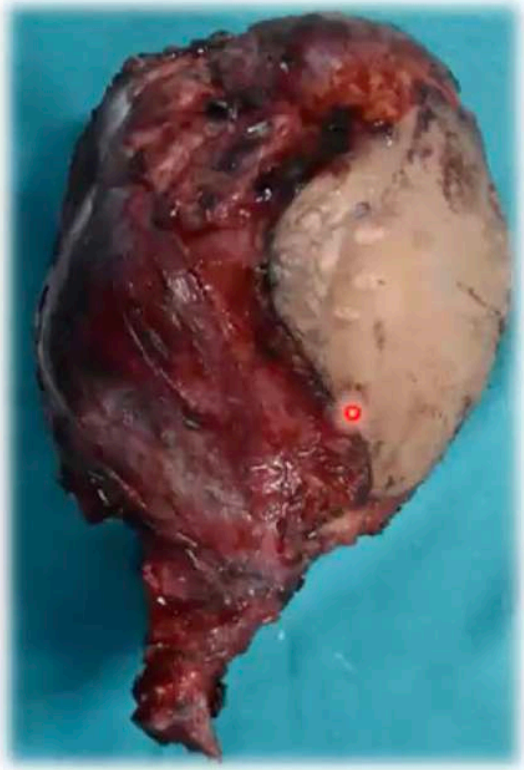
EXPANDABLE MEGAPROSTHESIS



NAIL CEMENT SPACER



BONE CANCER CLINIC

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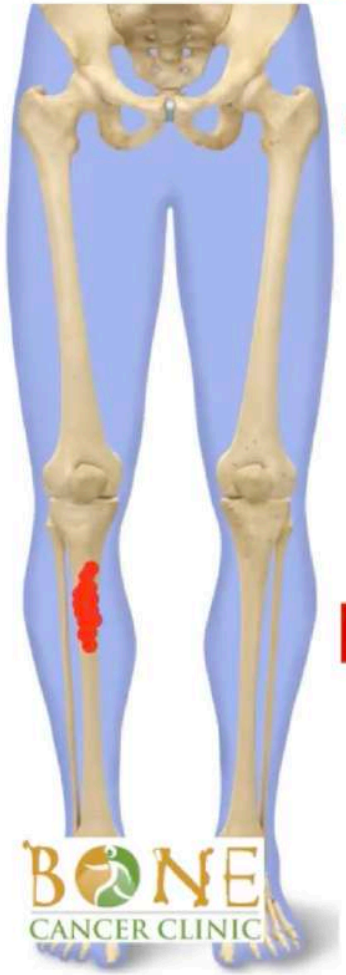
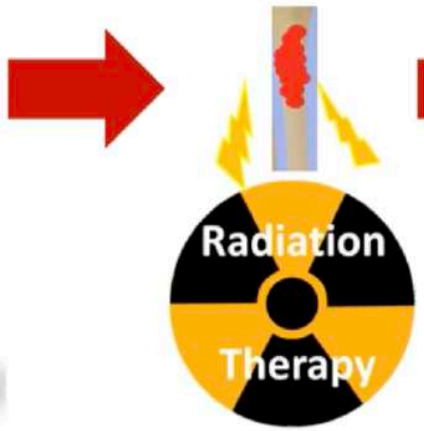
EXTRA CORPOREAL RADIATION THERAPY

ECRT TECHNIQUE





BONE CANCER CLINIC

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OSTEOSARCOMA

16 YEAR BOY

OSTEOSARCOMA

SHIN BONE

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OSTEOSARCOMA

FOLLOW UP AT 2 YEAR

ECRT

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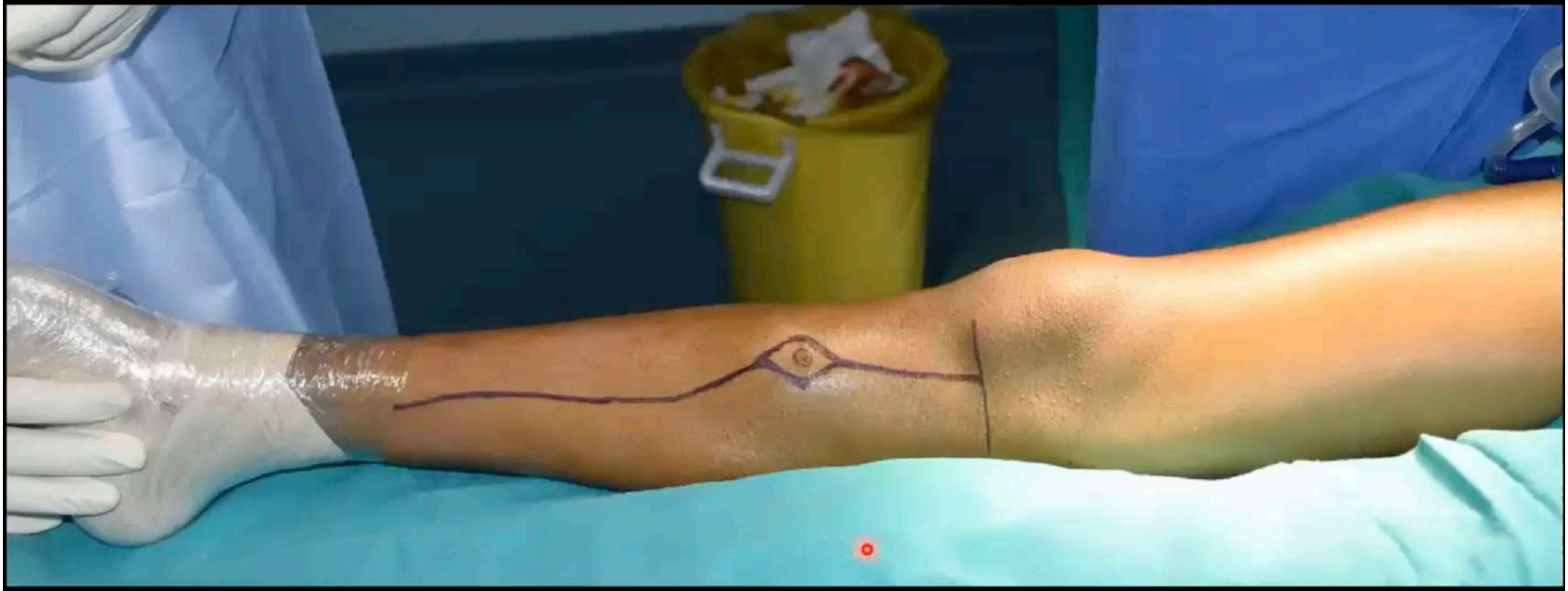
BONE CANCER CLINIC

INCISION



ECRT

BONE CANCER CLINIC

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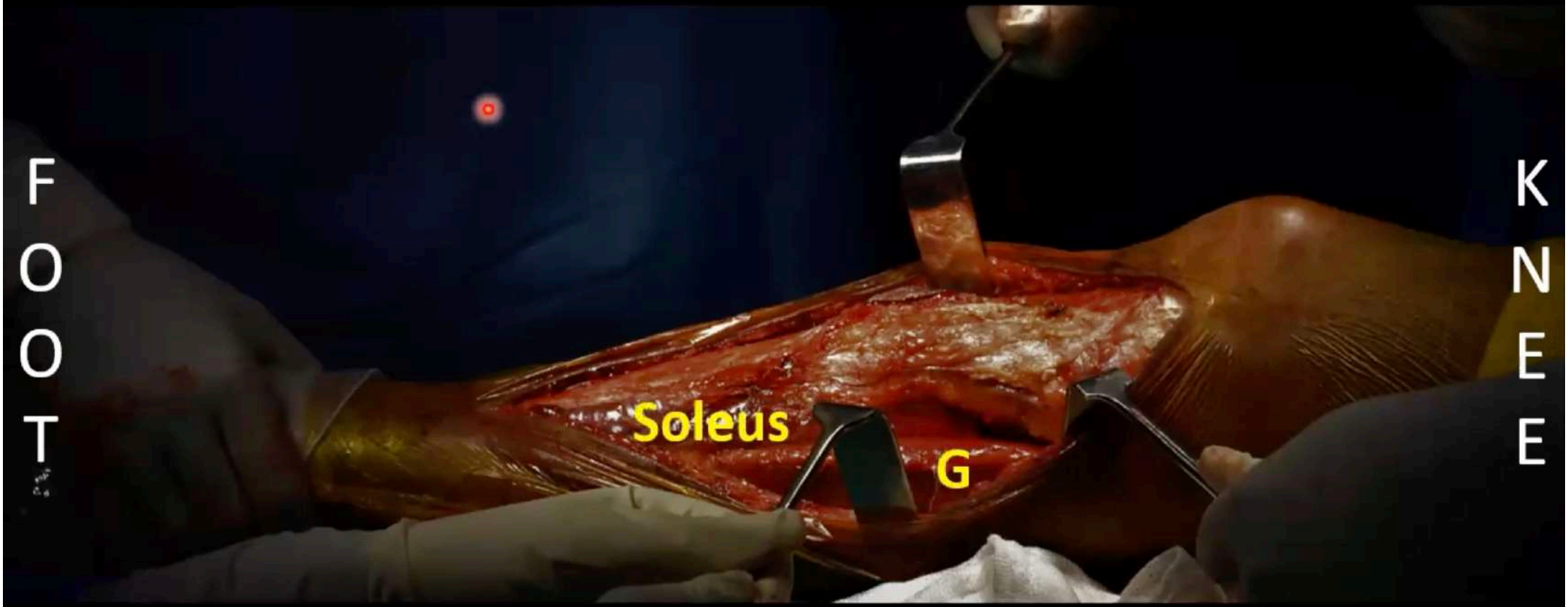
INITIAL EXPOSURE



BONE CANCER CLINIC

ECRT

DR RAJAT GUPTA

EXPOSURE

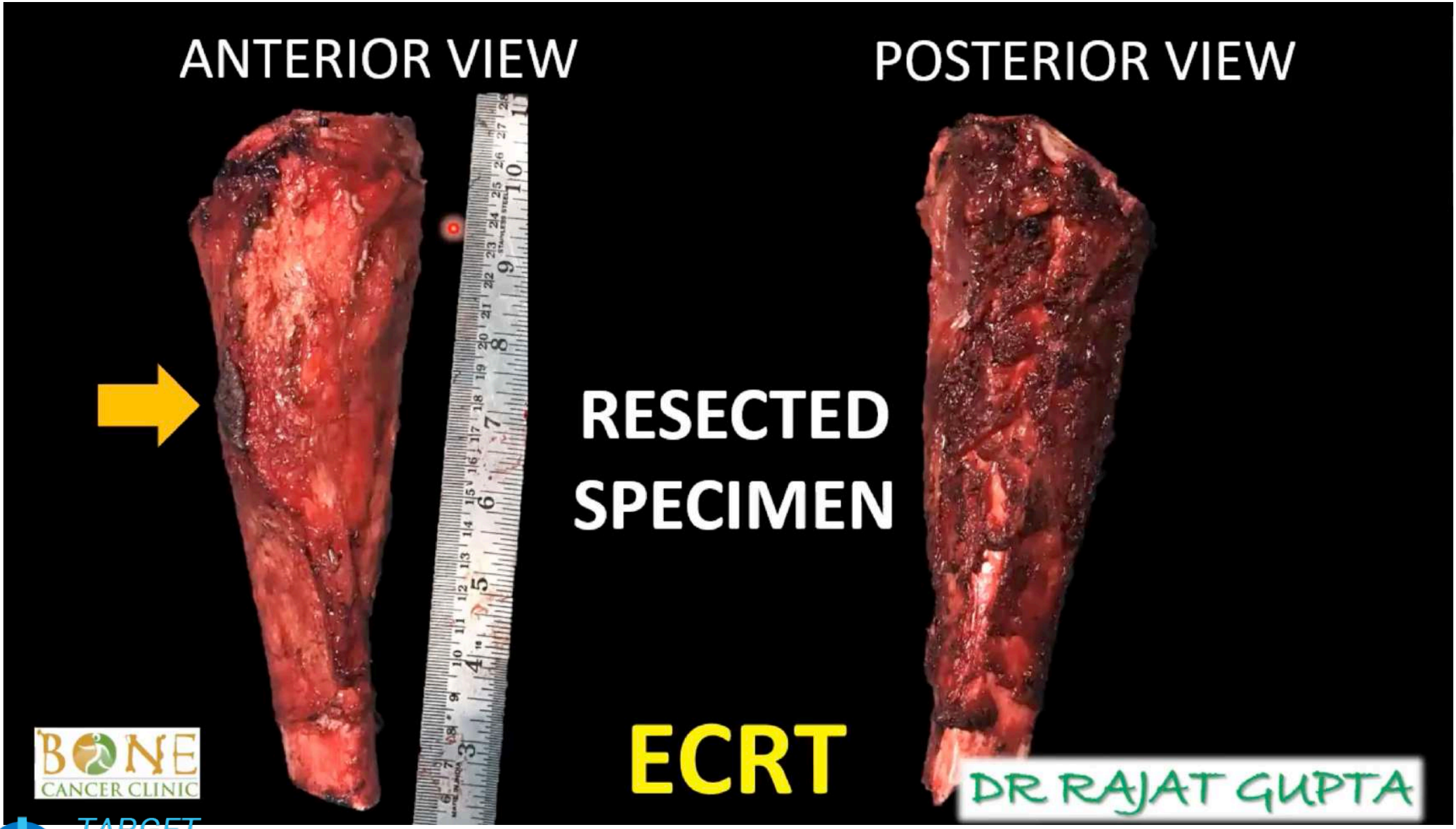
FOOT

KNEE

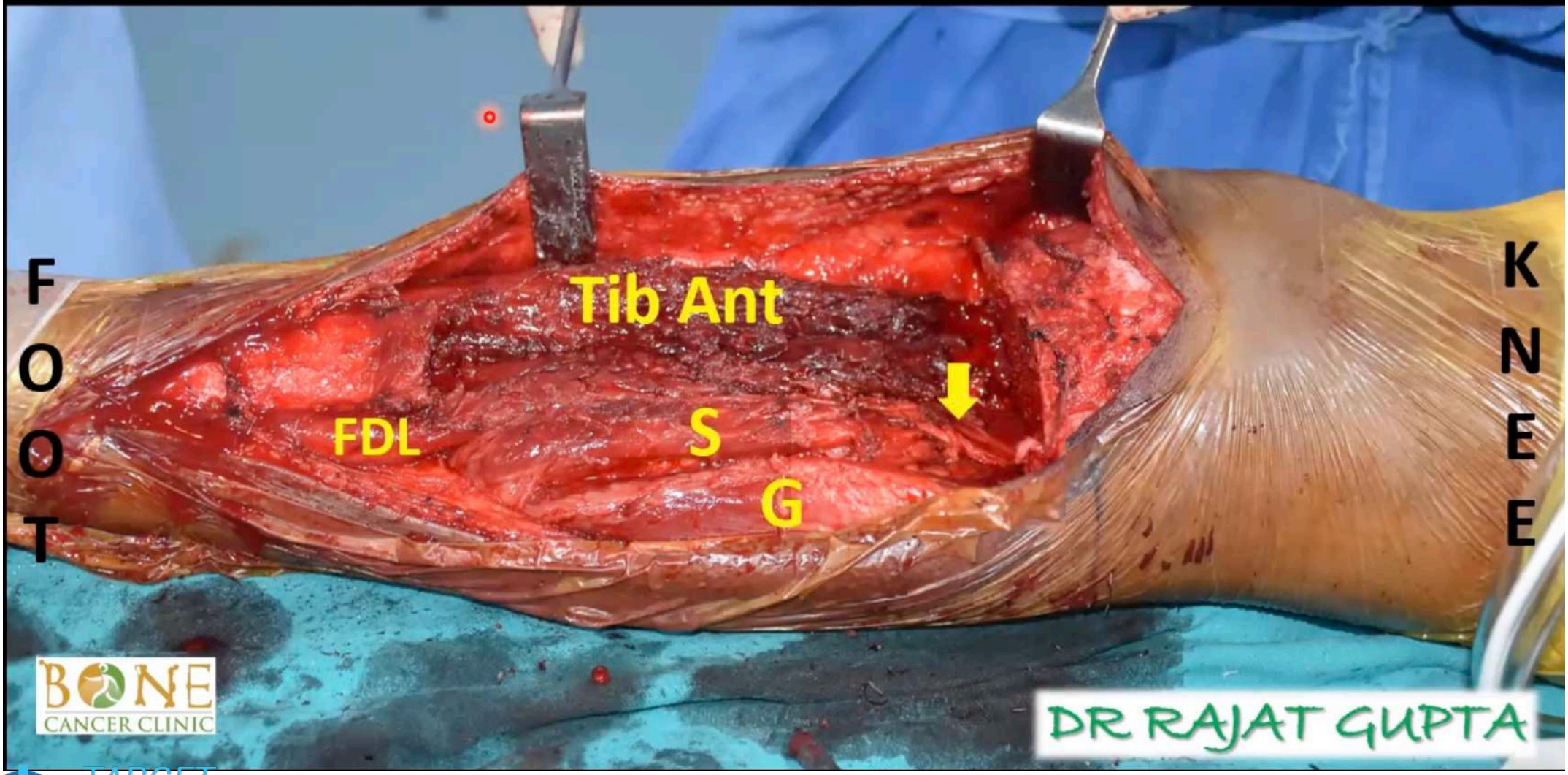
BONE CANCER CLINIC

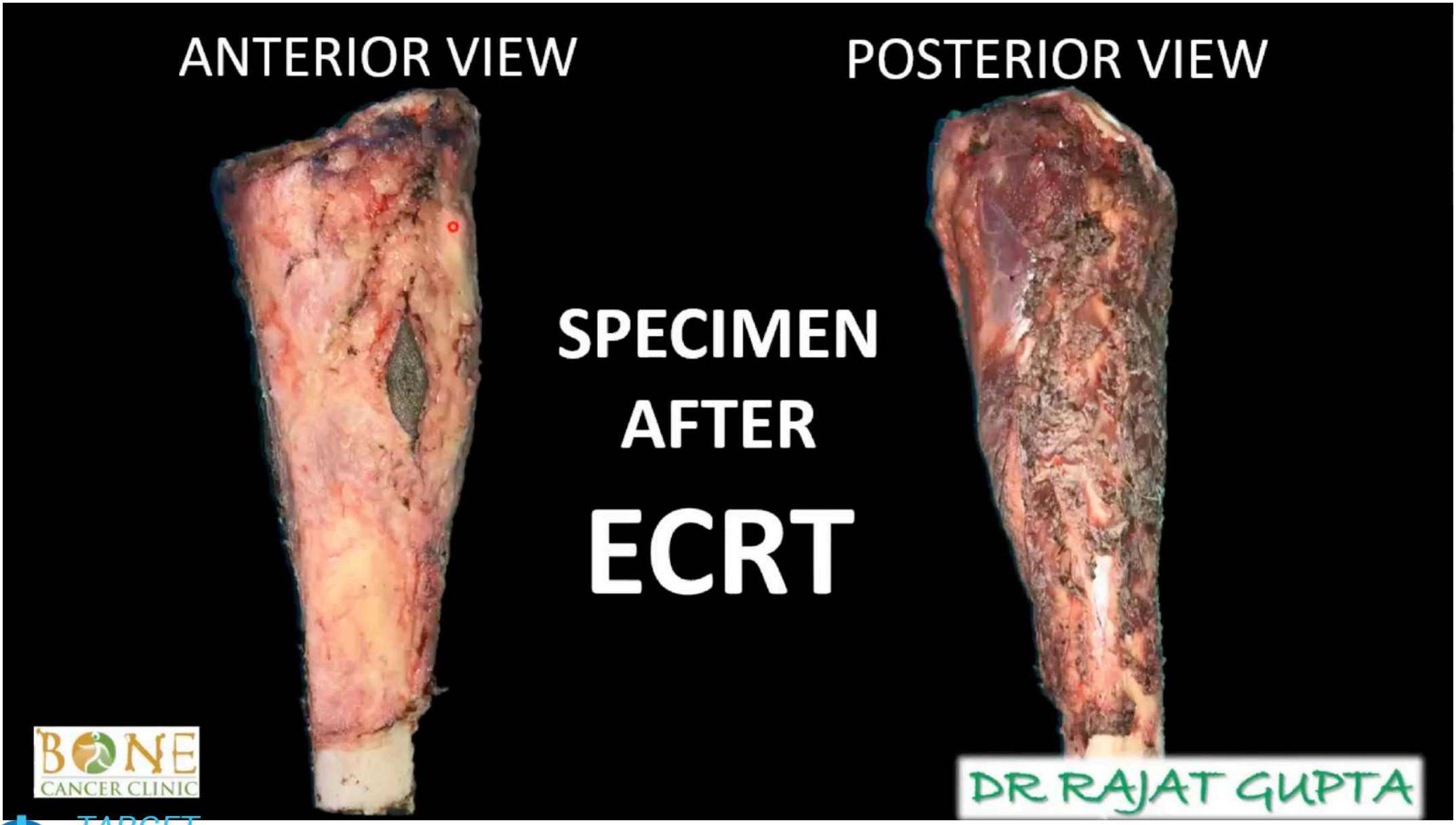
ECRT

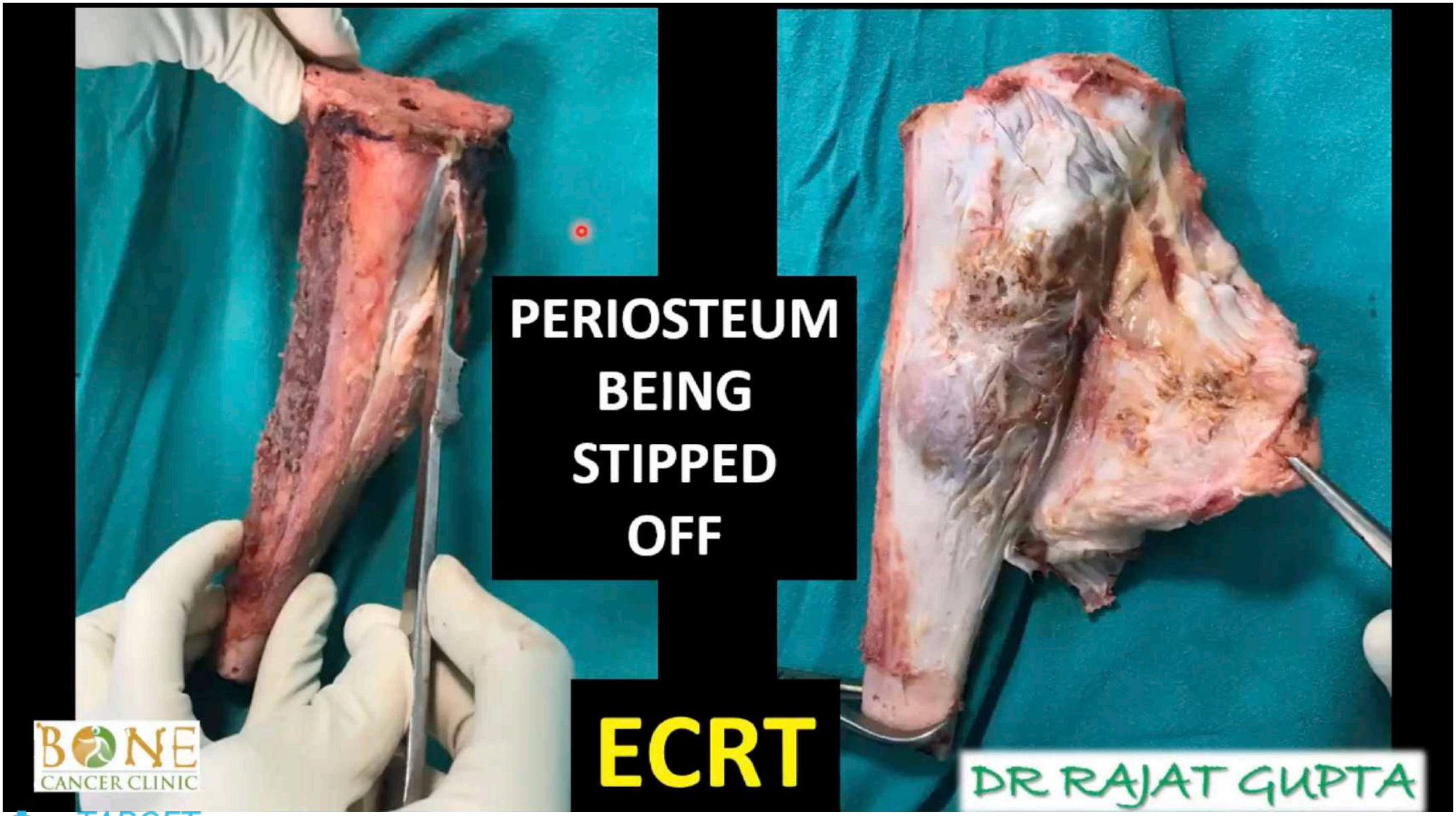
DR RAJAT GUPTA



TUMOUR BED







CEMENTING OF CANAL

BONE CANCER CLINIC

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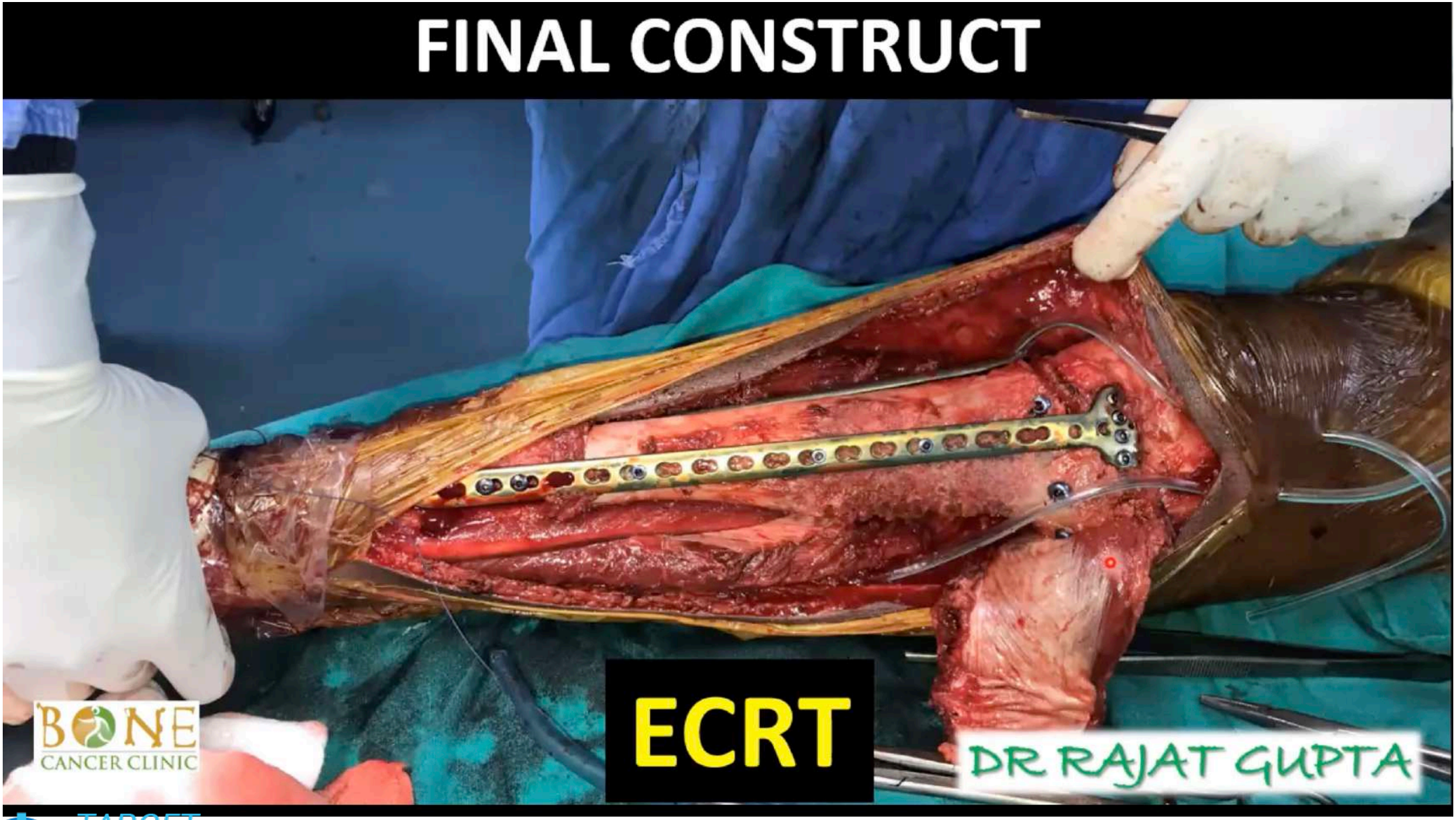
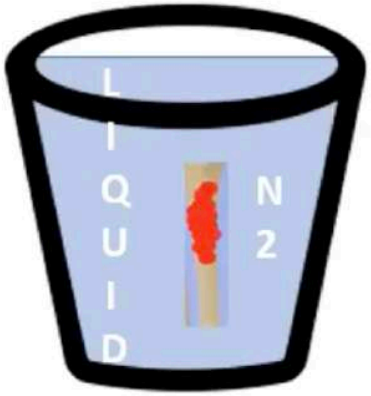
FINAL CONSTRUCT



OSTEOSARCOMA

CRYOTHERAPY TECHNIQUE

LIMB SALVAGE SURGERY ?



Liquid Nitrogen

-196 C

DR RAJAT GUPTA

OSTEOSARCOMA

18 YEAR BOY

OSTEOSARCOMA

ANKLE BONE

DR RAJAT GUPTA

OSTEOSARCOMA

CRYOTHERAPY
TECHNIQUE

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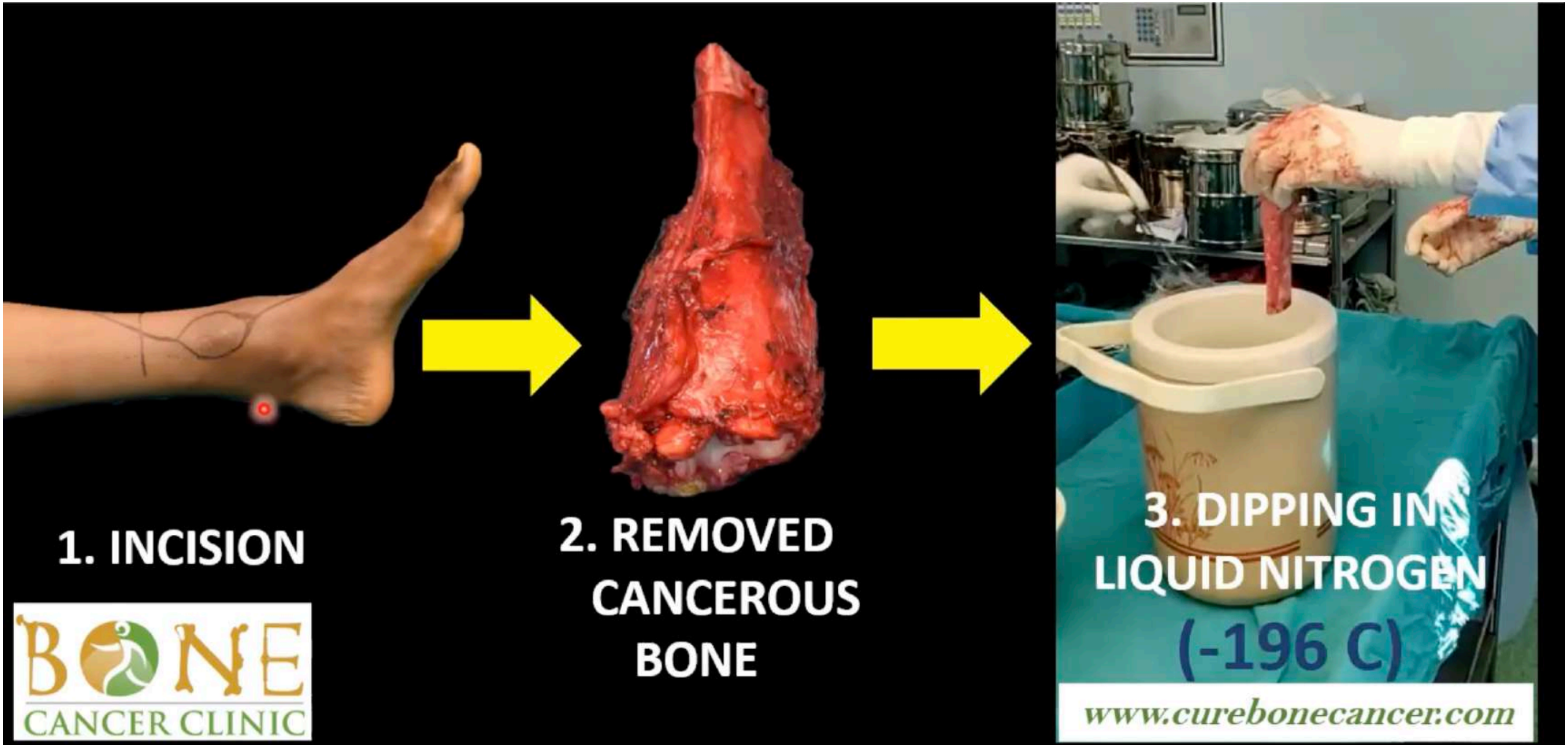
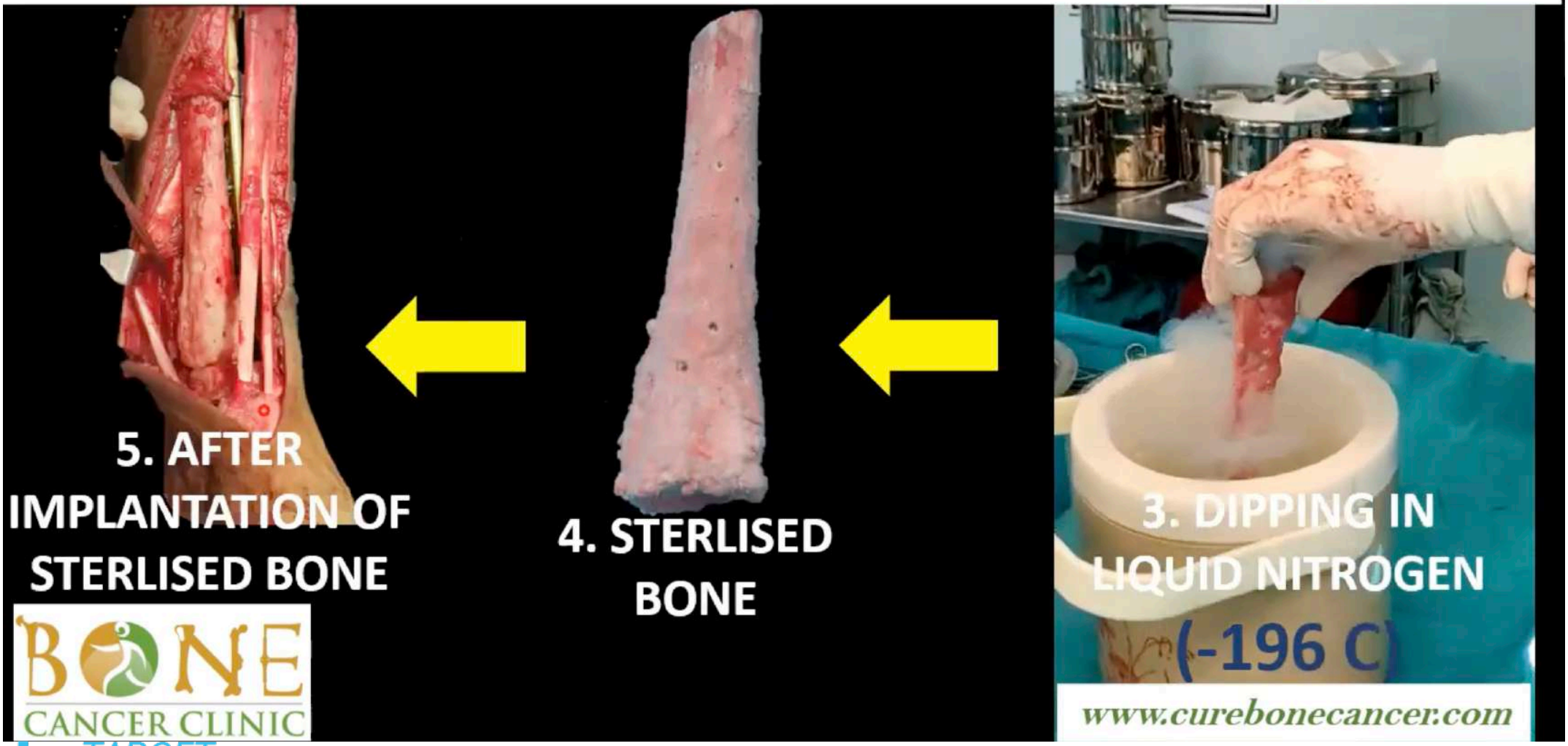
BONE CANCER CLINIC

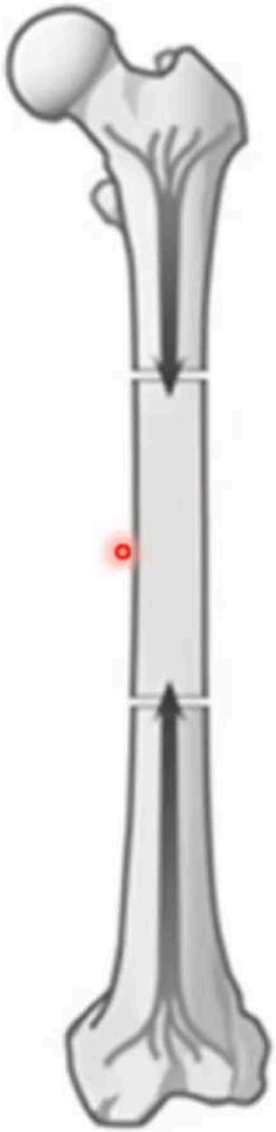


CRYOTHERAPY TECHNIQUE



BONE CANCER CLINIC

TARGET ORTHO



BONE CANCER CLINIC

TARGET ORTHO

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J Orthop Sci (2010) 15:340–349
DOI 10.1007/s00776-010-1458-0

JOURNAL OF
ORTHOPAEDIC SCIENCE

Original article

Pedicle frozen autograft reconstruction in malignant bone tumors

Hiroyuki Tsuchiya[1], Hideji Nishida[1], Phutsapong Srisawat[2], Toshiharu Shirai[1], Katsuhiro Hayashi[1], Akihiko Takeuchi[1], Norio Yamamoto[3], and Katsuro Tomita[1]

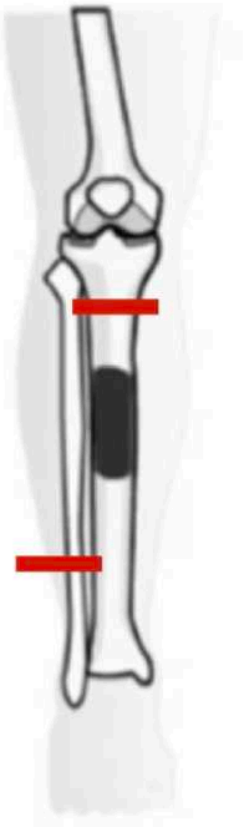
J Orthop Sci (2014) 19:156–163
DOI 10.1007/s00776-013-0487-x

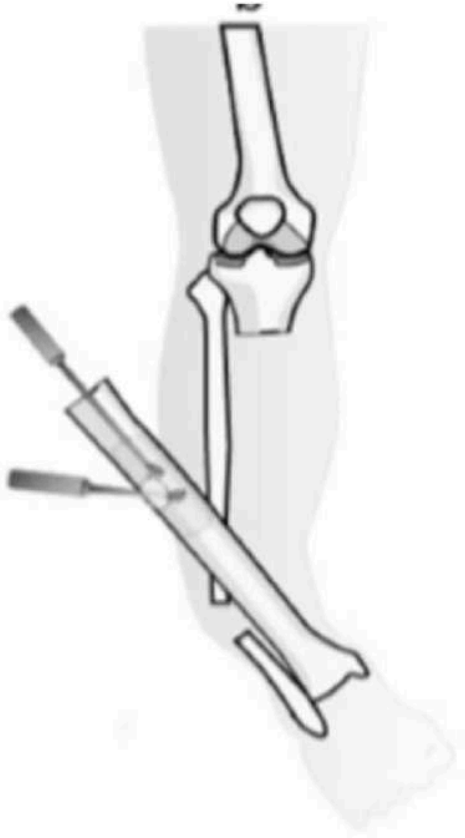
ORIGINAL ARTICLE

Pedicle versus free frozen autograft for reconstruction in malignant bone and soft tissue tumors of the lower extremities

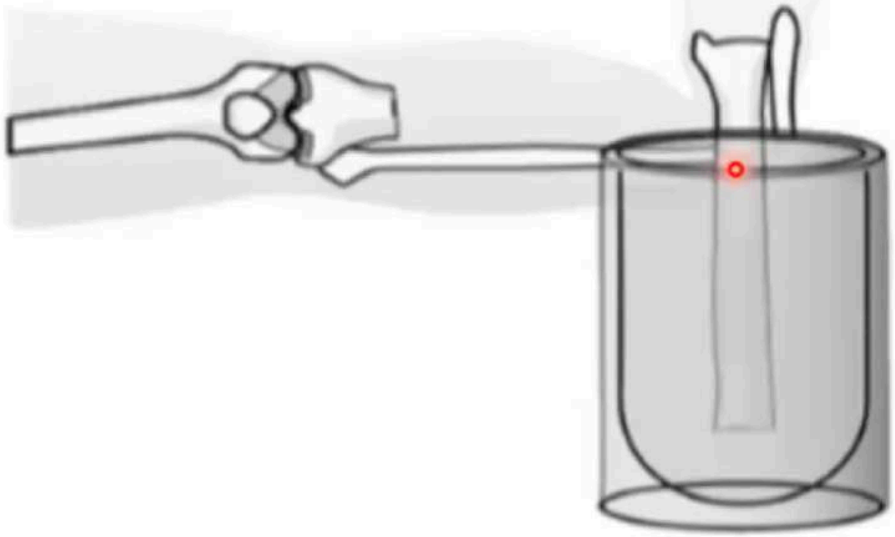
Shingo Shimozaki · Norio Yamamoto · Toshiharu Shirai · Hideji Nishida · Katsuhiro Hayashi · Yoshikazu Tanzawa · Hiroaki Kimura · Akihiko Takeuchi · Kentaro Igarashi · Hiroyuki Inatani · Takashi Kato · Hiroyuki Tsuchiya

PEDICLED CRYOTHERAPY

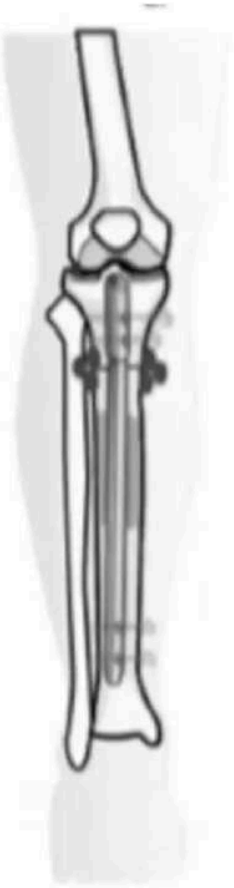




TUMOUR
DEBULKING

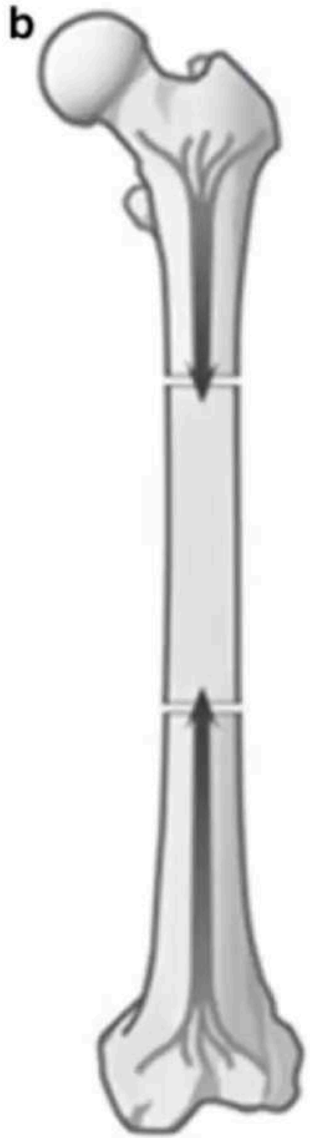


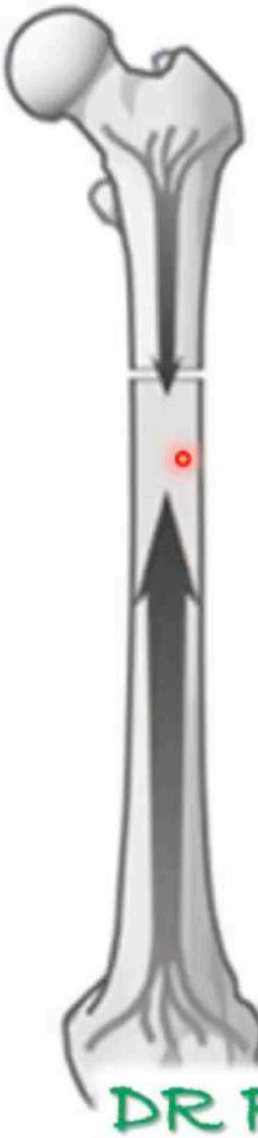
DIPPING
IN
LIQUID N2



BONE CANCER CLINIC

DR RAJAT GUPTA



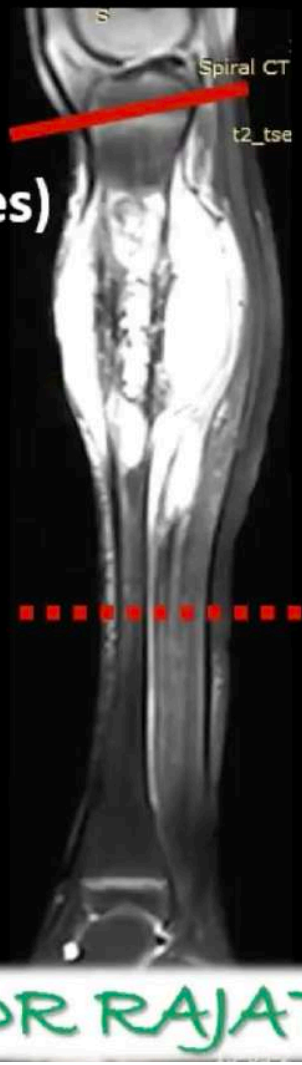


PEDICLED CRYOTHERAPY

Proximal Osteotomy
(Oblique cut in both planes)

SURGICAL PLAN

Proposed site of
Dipping into Liquid N_2



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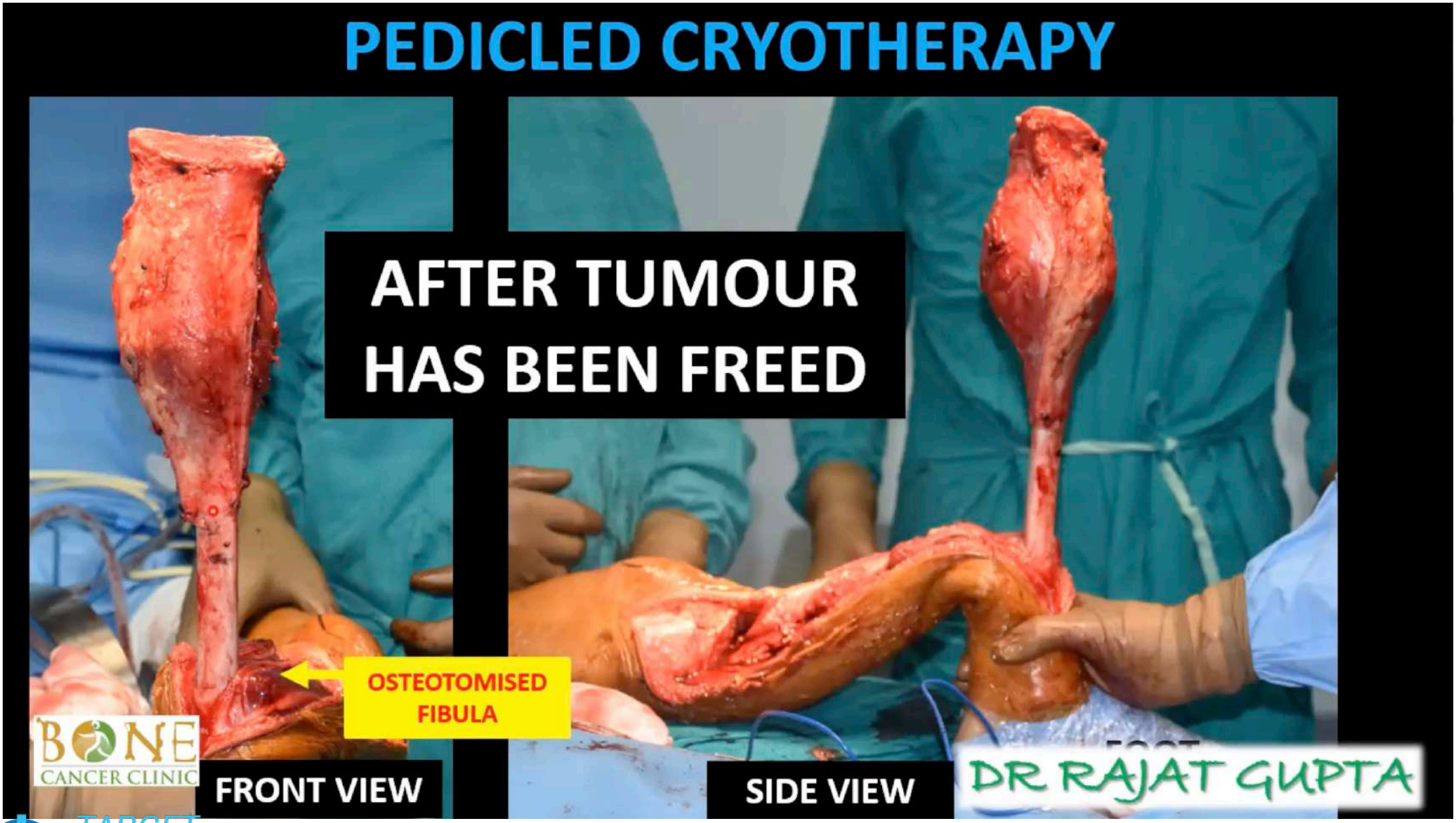
PEDICLED CRYOTHERAPY



PEDICLED CRYOTHERAPY

TUMOUR ISOLATED

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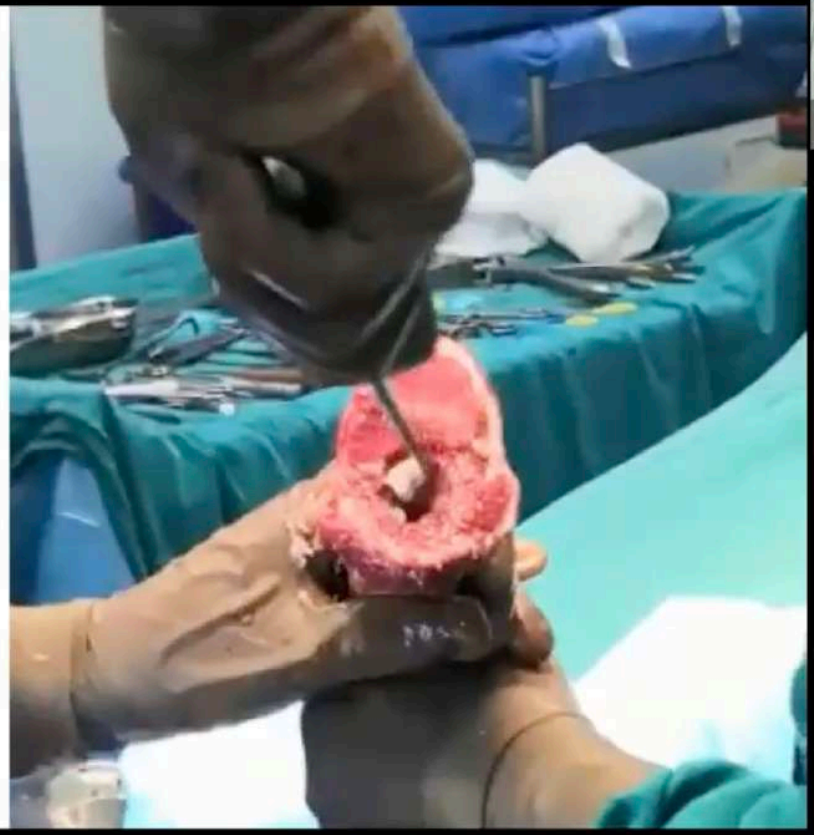
PEDICLED CRYOTHERAPY



TUMOUR BEING DEBULKED

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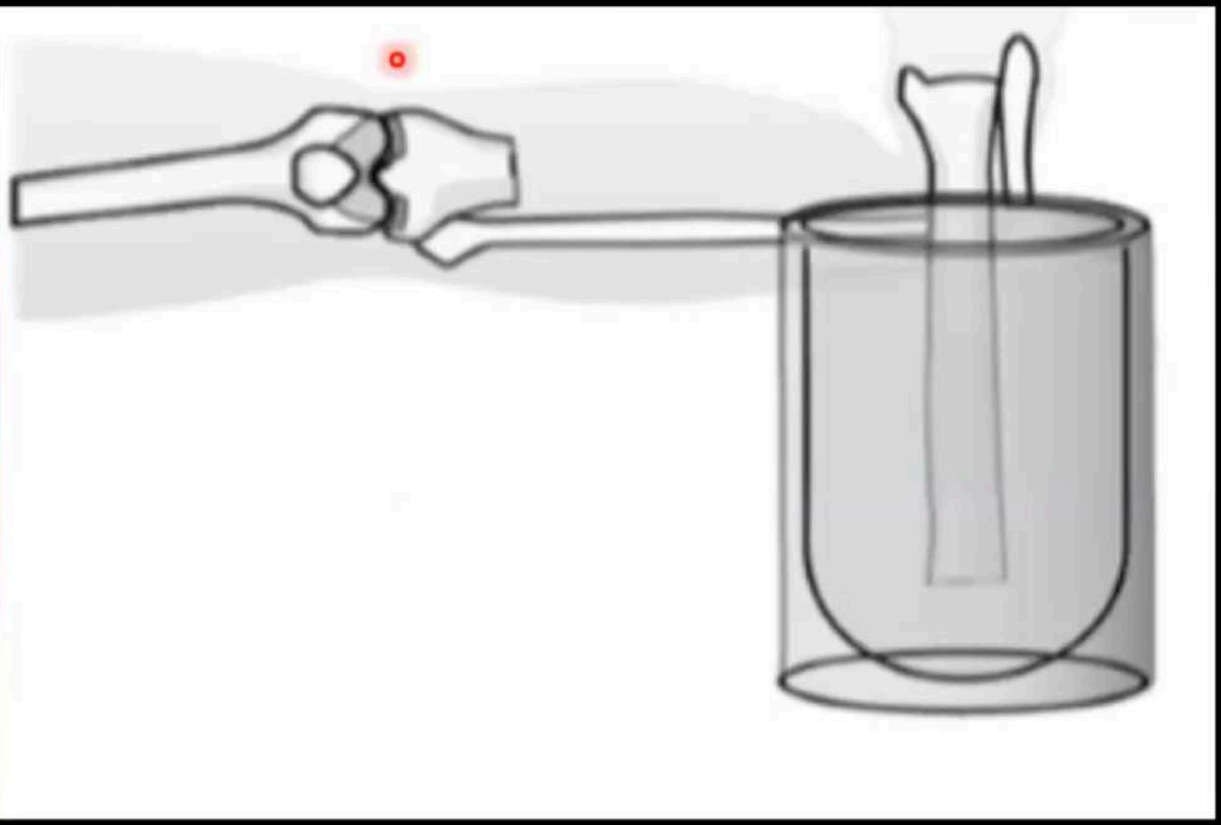
PEDICLED CRYOTHERAPY

POURING
LIQUID N_2

-192°C

PEDICLED CRYOTHERAPY



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DIPPING IN LIQUID N2 (-192 C)

PEDICLED CRYOTHERAPY

EXCLUSIVE ORTHOPAEDIC ONCOLOGY CLINIC

REMOVING FROM LIQUID N2

PEDICLED CRYOTHERAPY

THAWING AT
ROOM TEMPERATURE

REMOVING FROM LIQUID N2

ICE CRYSTALS
AFTER THAWING

PEDICLED CRYOTHERAPY

WASHING WITH VANCOMYCIN SALINE

BONE CANCER CLINIC

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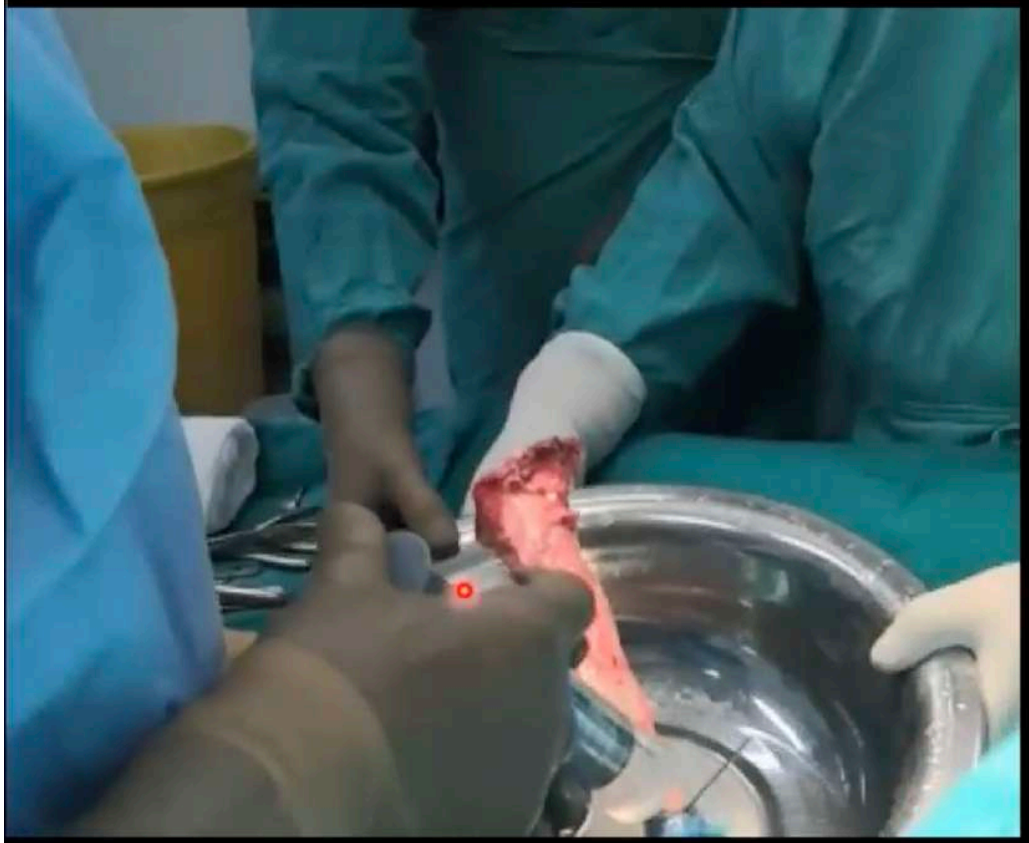
PEDICLED CRYOTHERAPY



WASHING WITH VANCOMYCIN SALINE

BONE CANCER CLINIC

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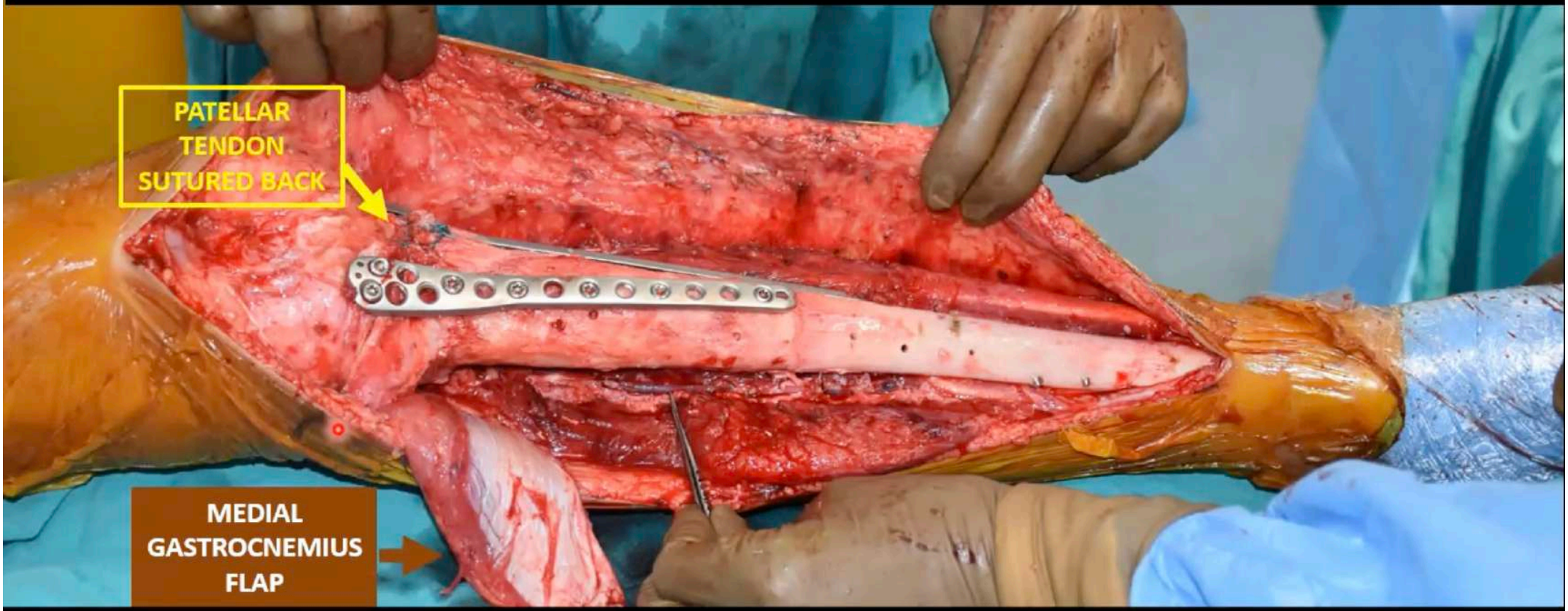
PEDICLED CRYOTHERAPY



FINAL CONSTRUCT

BONE CANCER CLINIC

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PEDICLED CRYOTHERAPY

LIMB SALVAGE SURGERY

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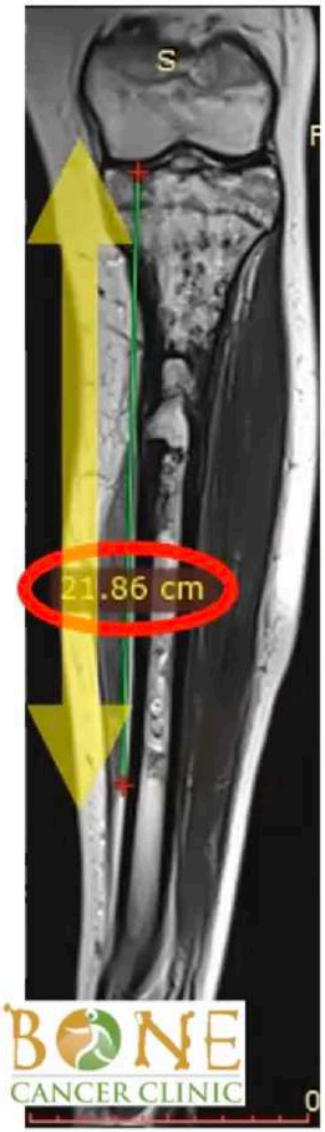
BONE CANCER CLINIC

TARGET ORTHO



Preserve natural bone

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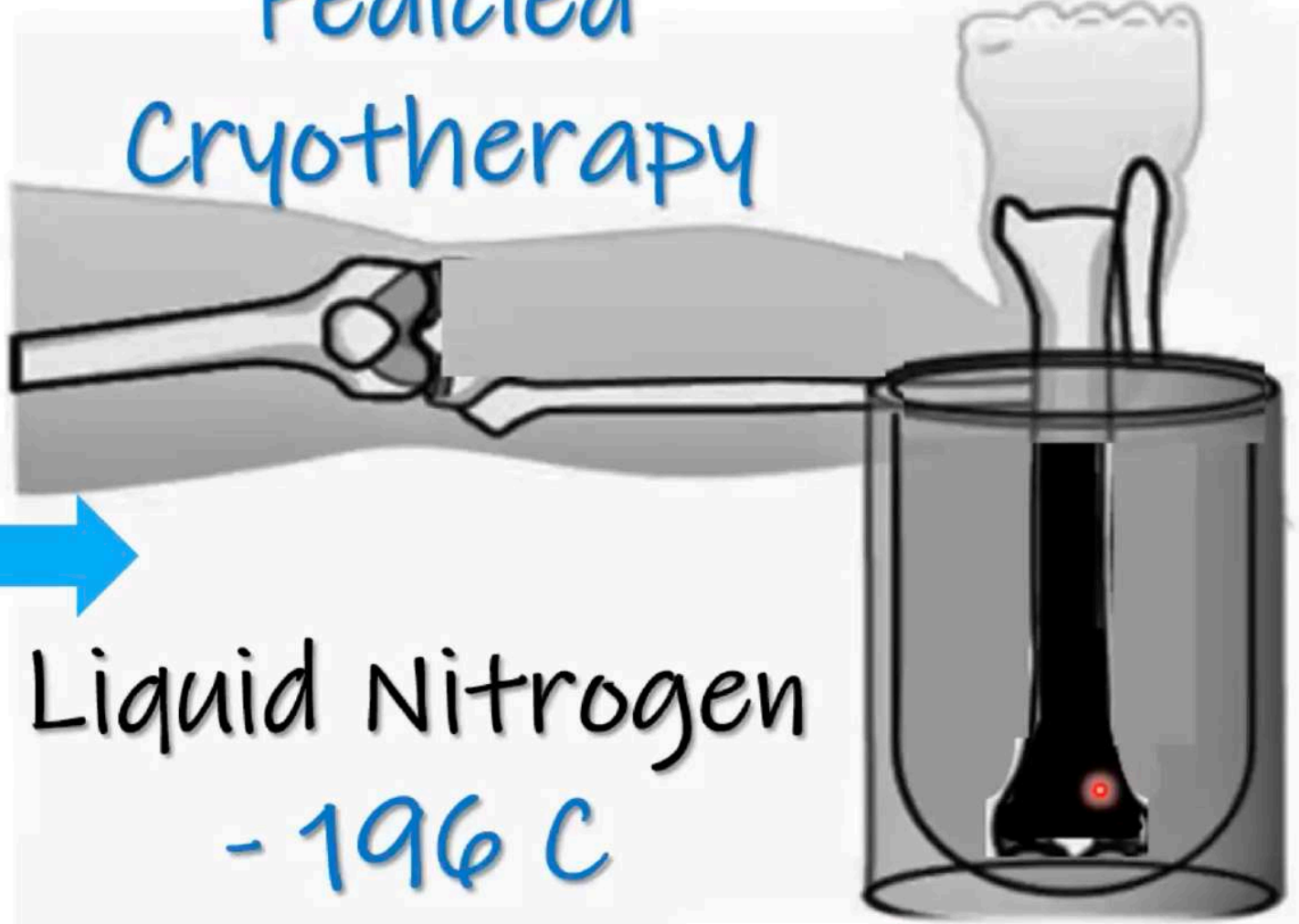
Pedicled Cryotherapy



Liquid Nitrogen

-196 C

BONE CANCER CLINIC

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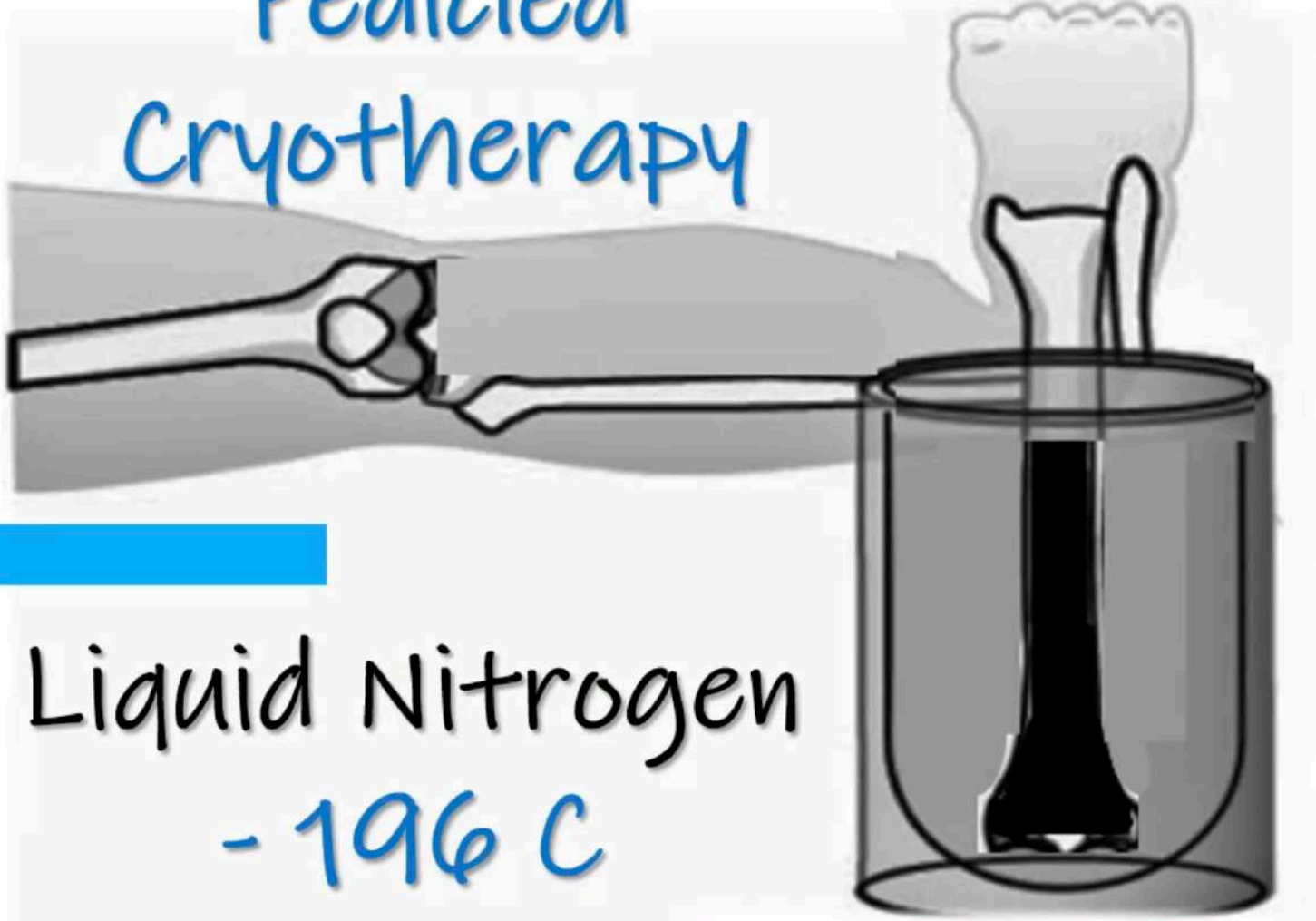
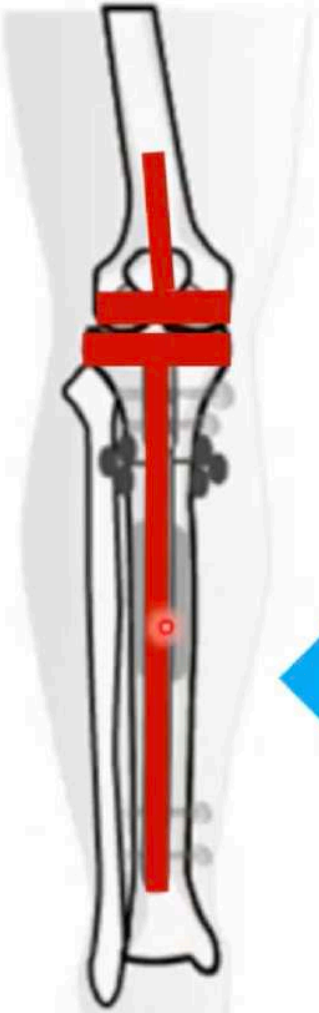
Pedicled Cryotherapy



Liquid Nitrogen

-196 C



BONE CANCER CLINIC

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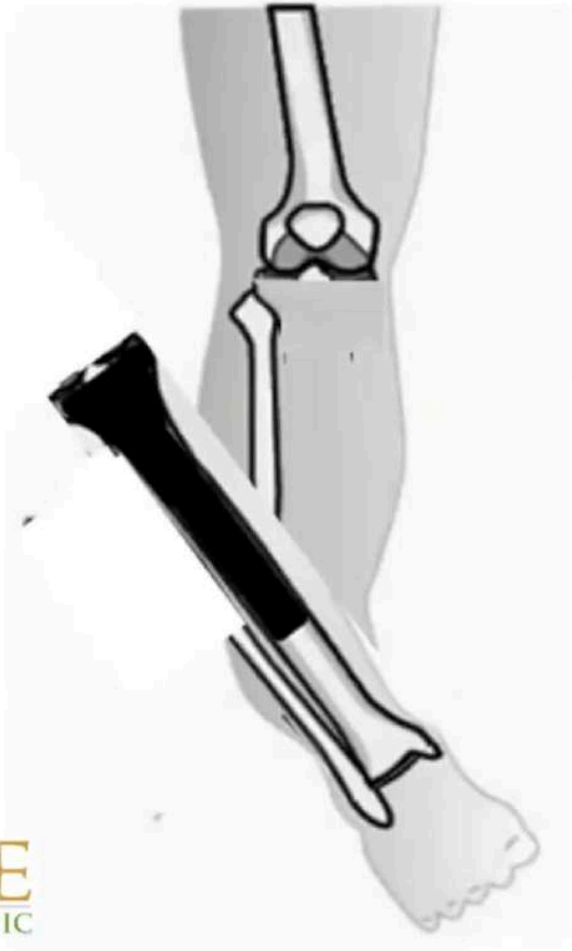
Pedicled Cryotherapy



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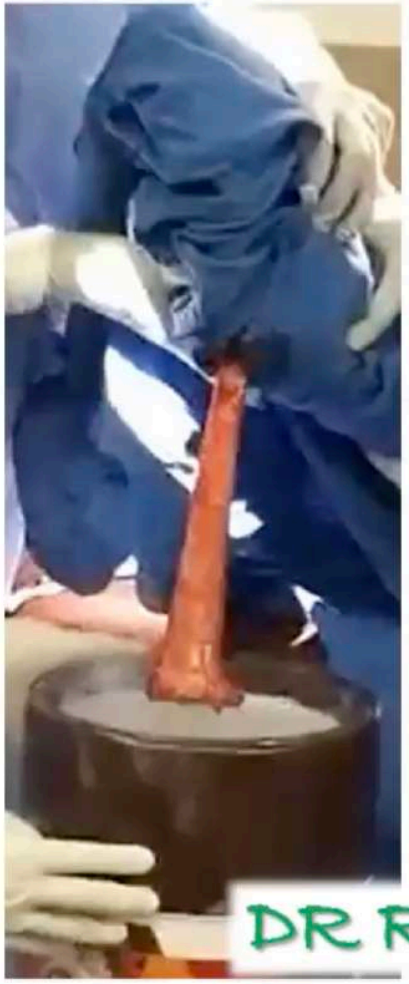
BONE CANCER CLINIC

Pedicled Cryotherapy



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Pedicled Cryotherapy

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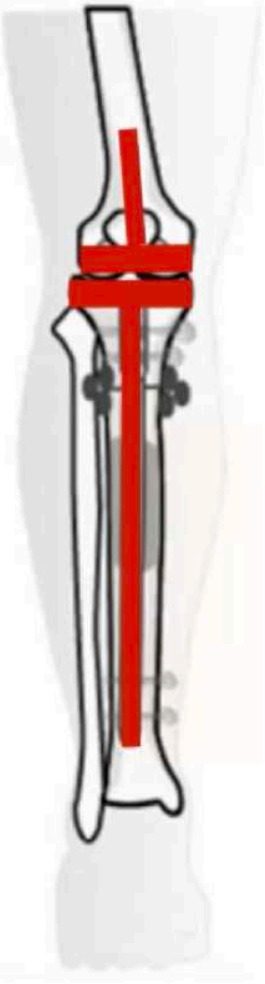

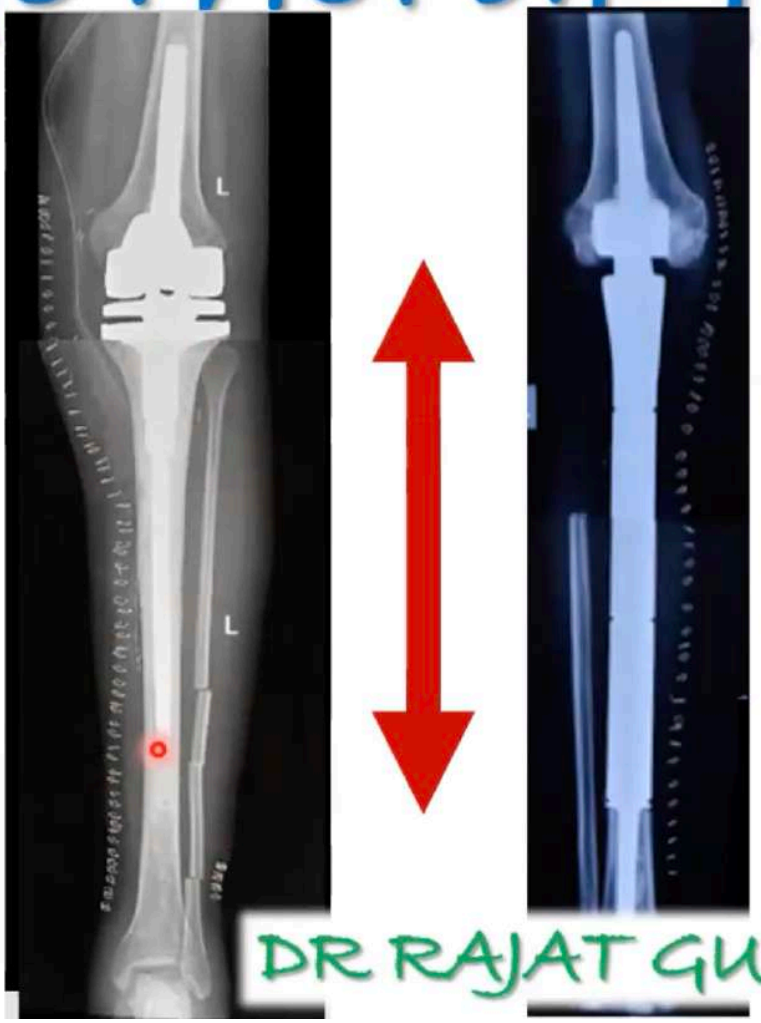

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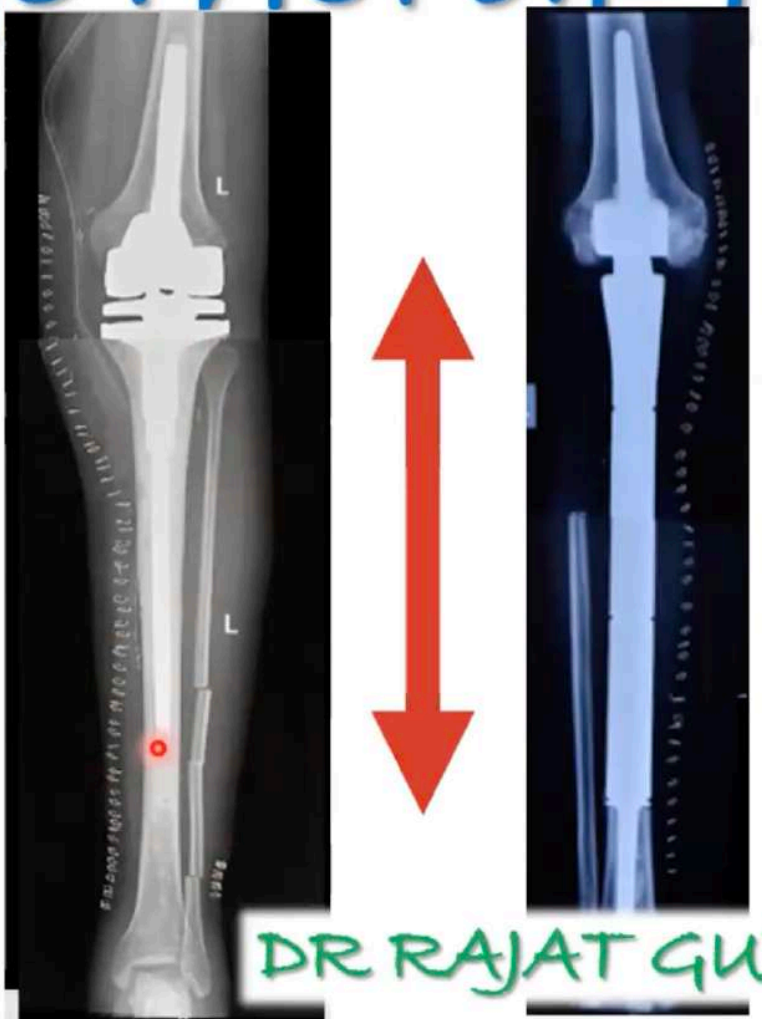
BONE CANCER CLINIC

TARGET ORTHO

Pedicled Cryotherapy



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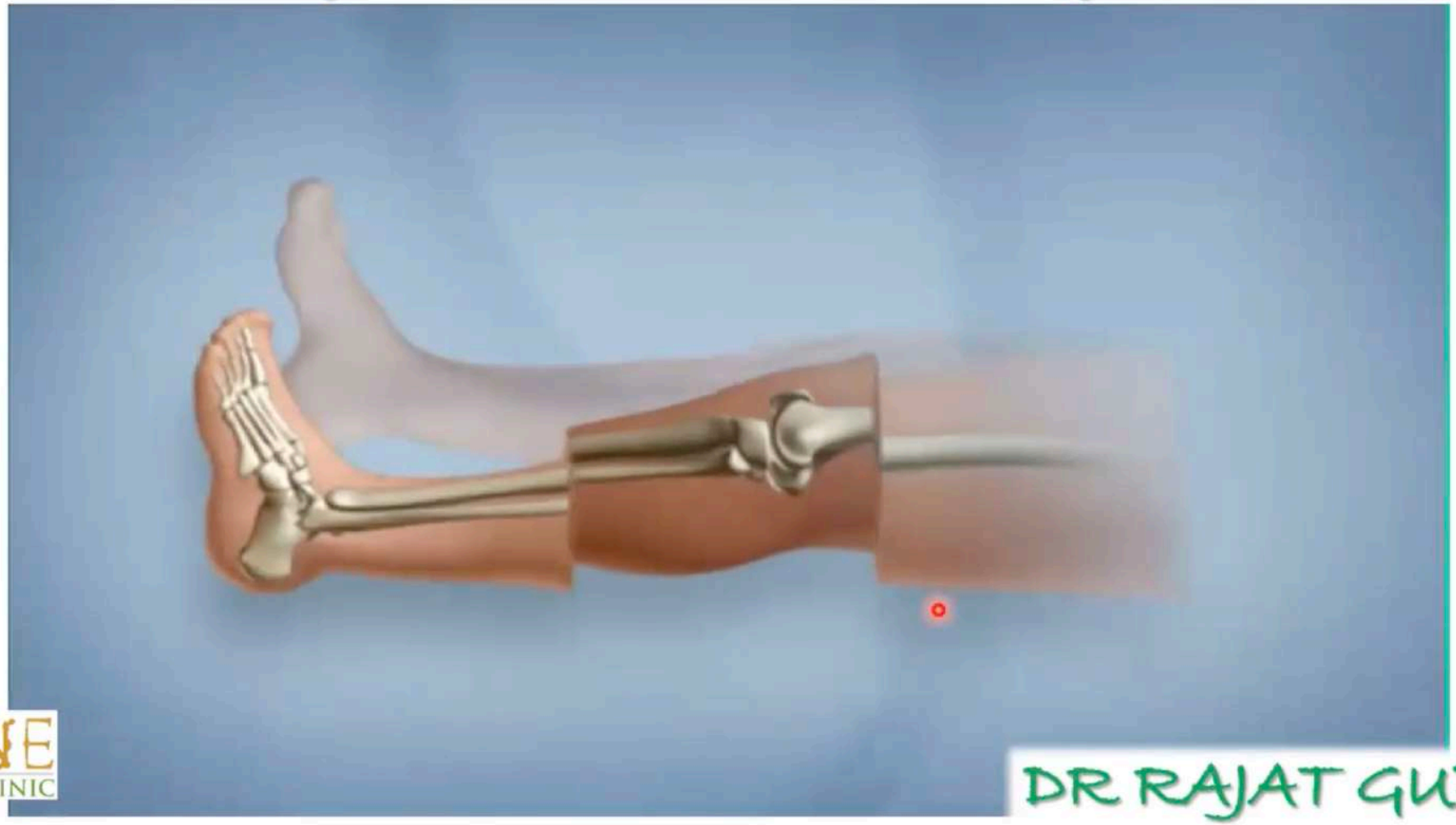
TARGET ORTHO

ROTATIONPLASTY



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TARGET ORTHO

ROTATIONPLASTY

BONE CANCER CLINIC

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TARGET ORTHO

NON METASTATIC OSTEOSARCOMA PROXIMAL TIBIA

PRE CHEMOTHERAPY

AFTER 2 CYCLE CHEMOTHERAPY

(HIGH DOSE METHOTREXATE BASED MAP PROTOCOL)

POST CHEMOTHERAPY

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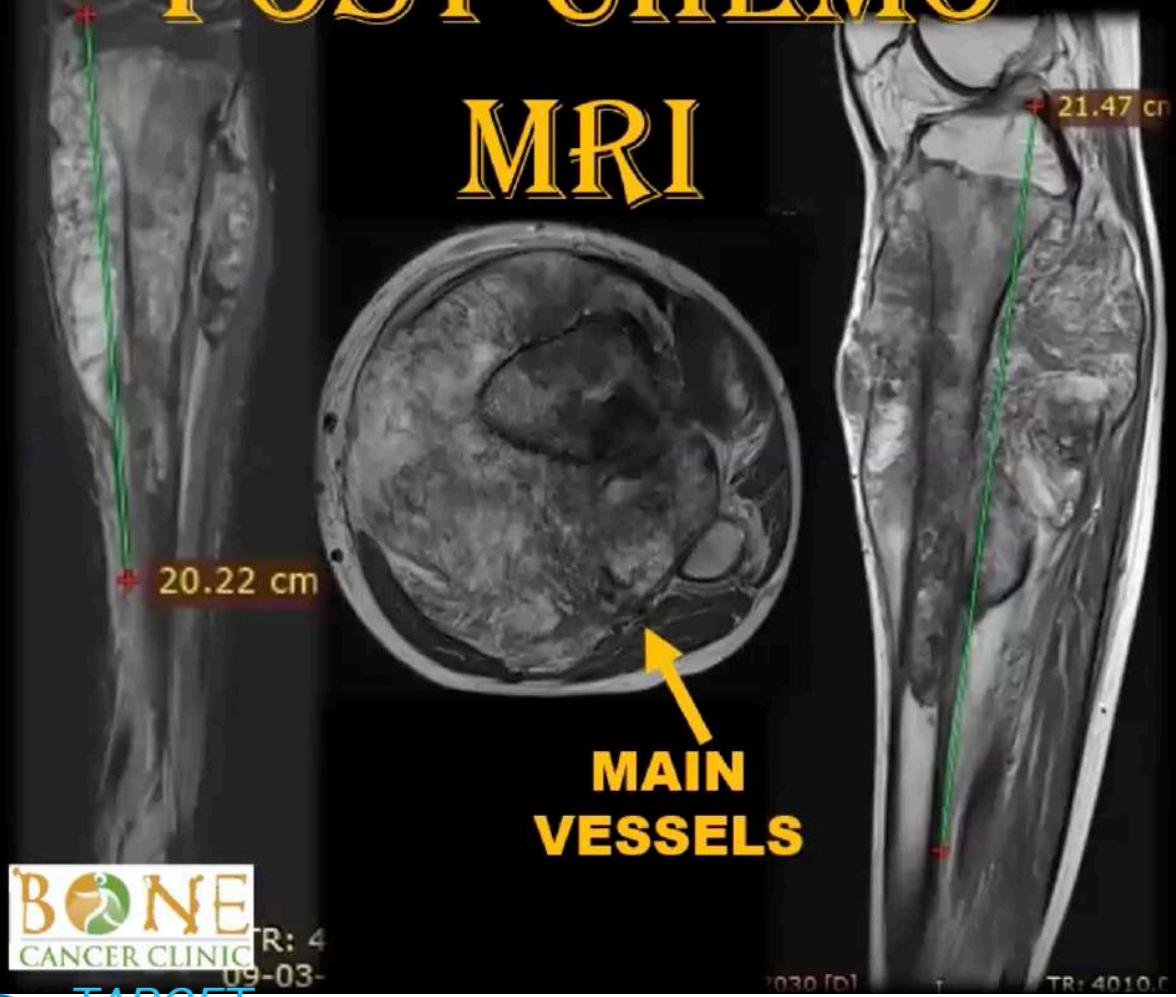
BONE CANCER CLINIC

TARGET ORTHO

POST CHEMO MRI



Surgical options given

1. Rotationplasty
2. Expandable megaprosthesis
3. Amputation

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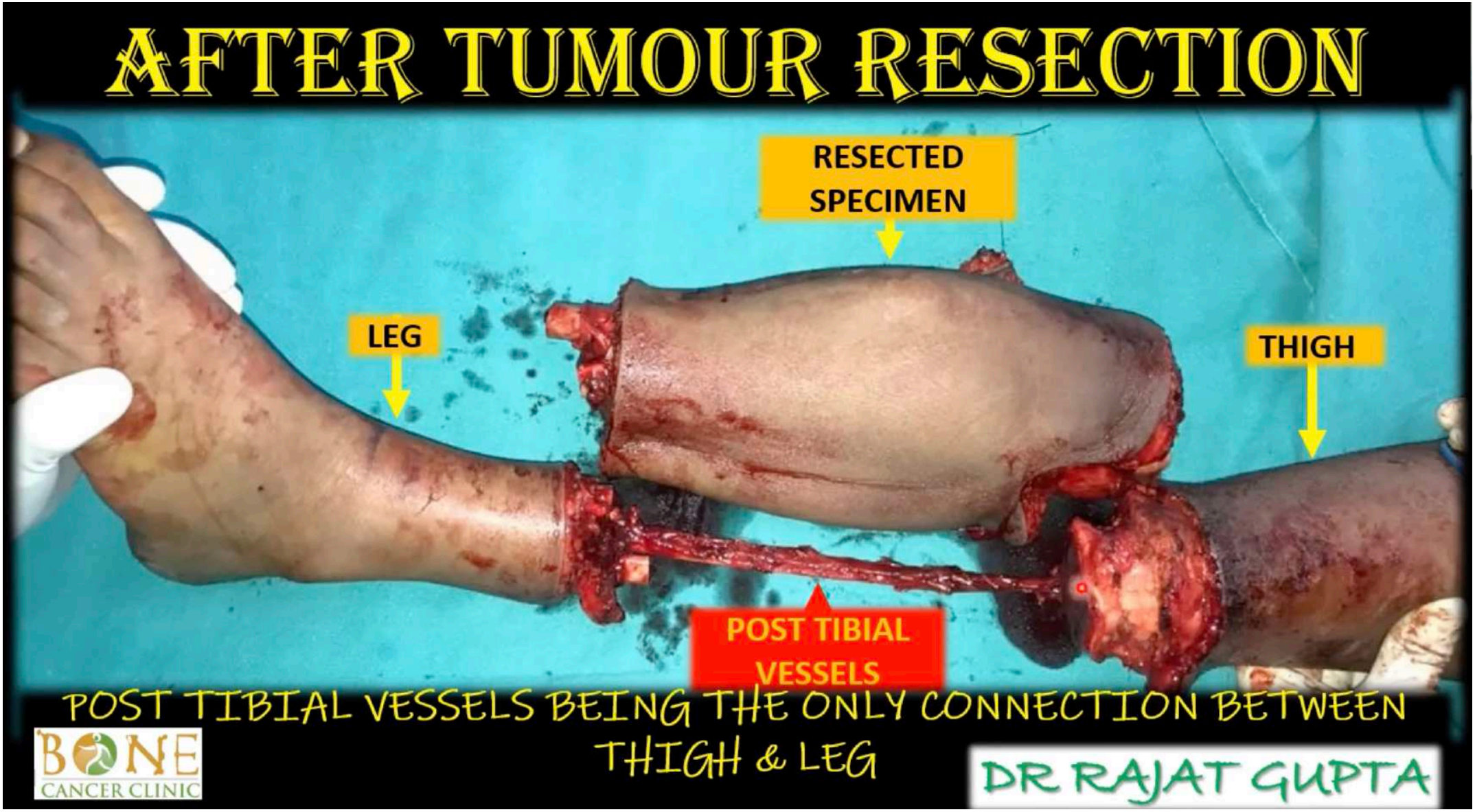
AFTER TUMOUR RESECTION



POST TIBIAL VESSELS BEING THE ONLY CONNECTION BETWEEN THIGH & LEG

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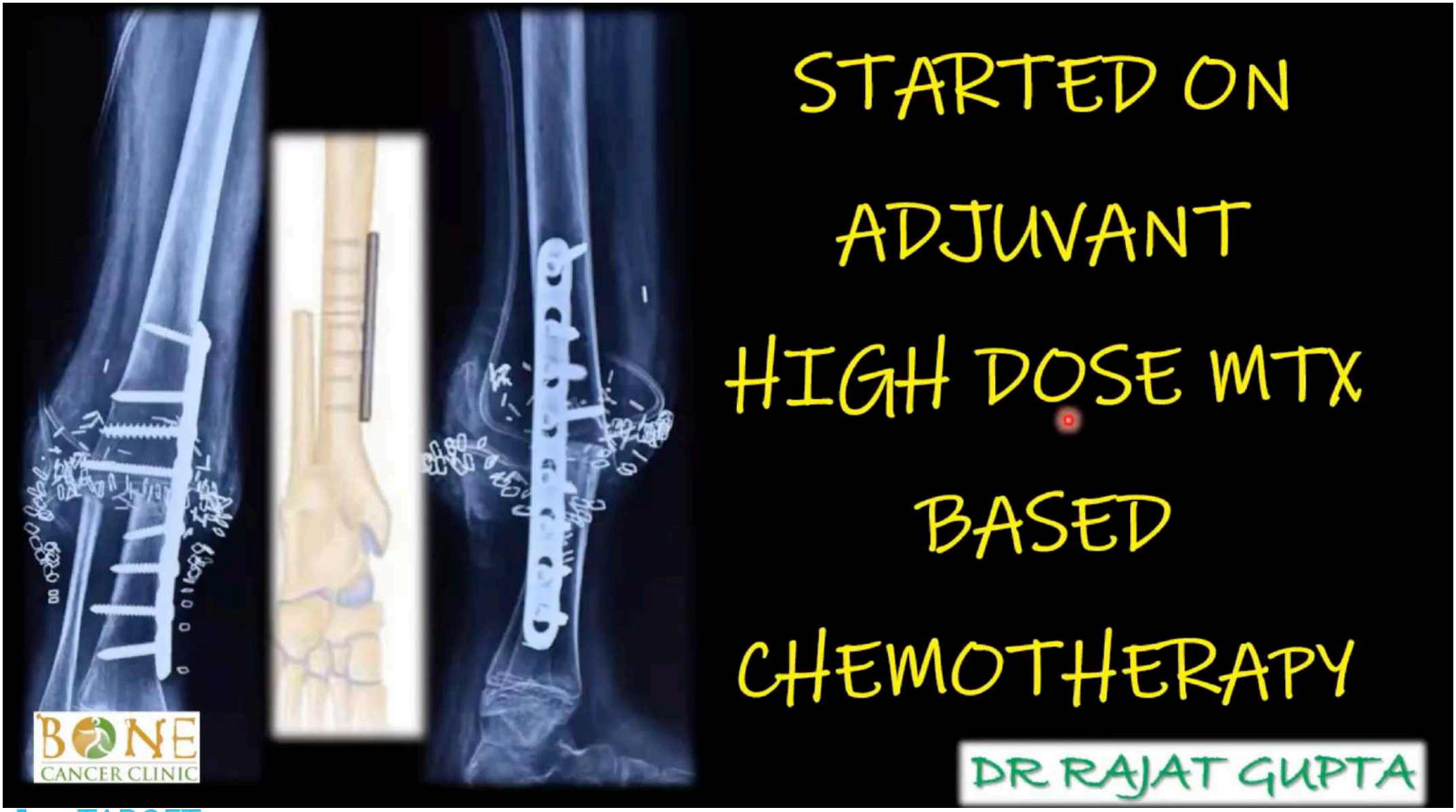

ROTATIONPLASTY

BONE CANCER CLINIC

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ROTATIONPLASTY

- Functional knee joint
- Longer lever arm for prosthesis
- Better tolerance of socket load
- Functional and psychological advantages over amputees
- Function and strength improves with time

BONE CANCER CLINIC

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IS ROTATIONPLASTY OR EXPANDABLE PROSTHESIS THE ONLY OPTIONS AVAILABLE FOR KIDS WITH SARCOMA?

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5Y/F EWING'S SARCOMA DISTAL FEMUR

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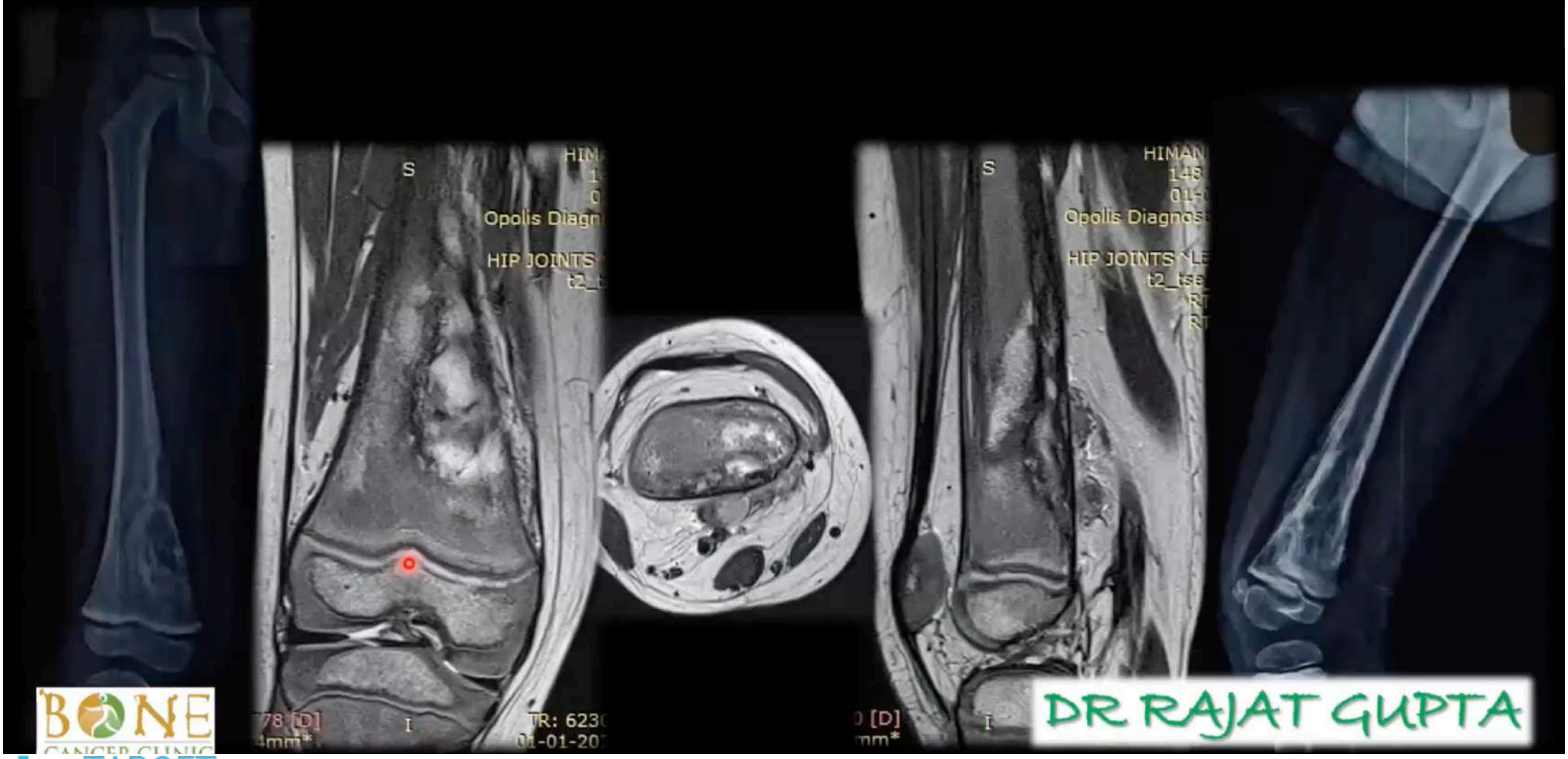
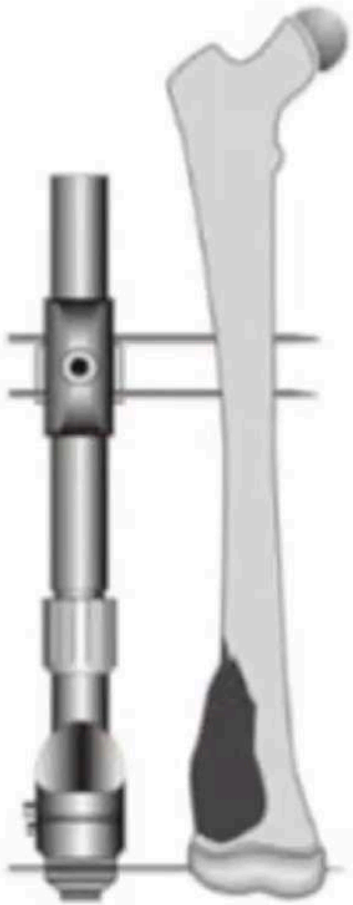
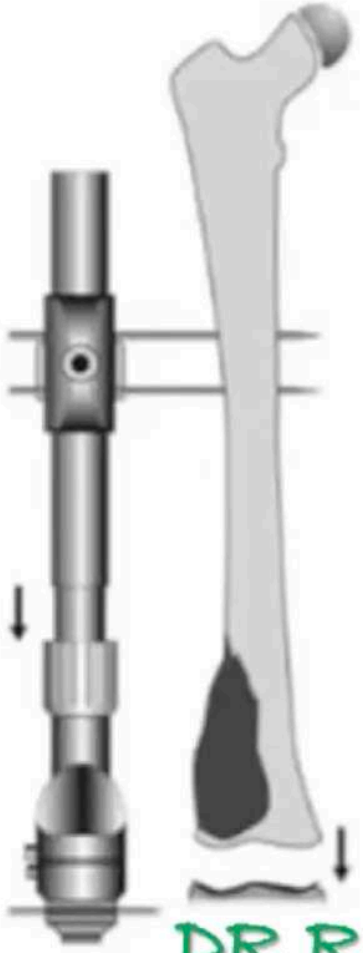
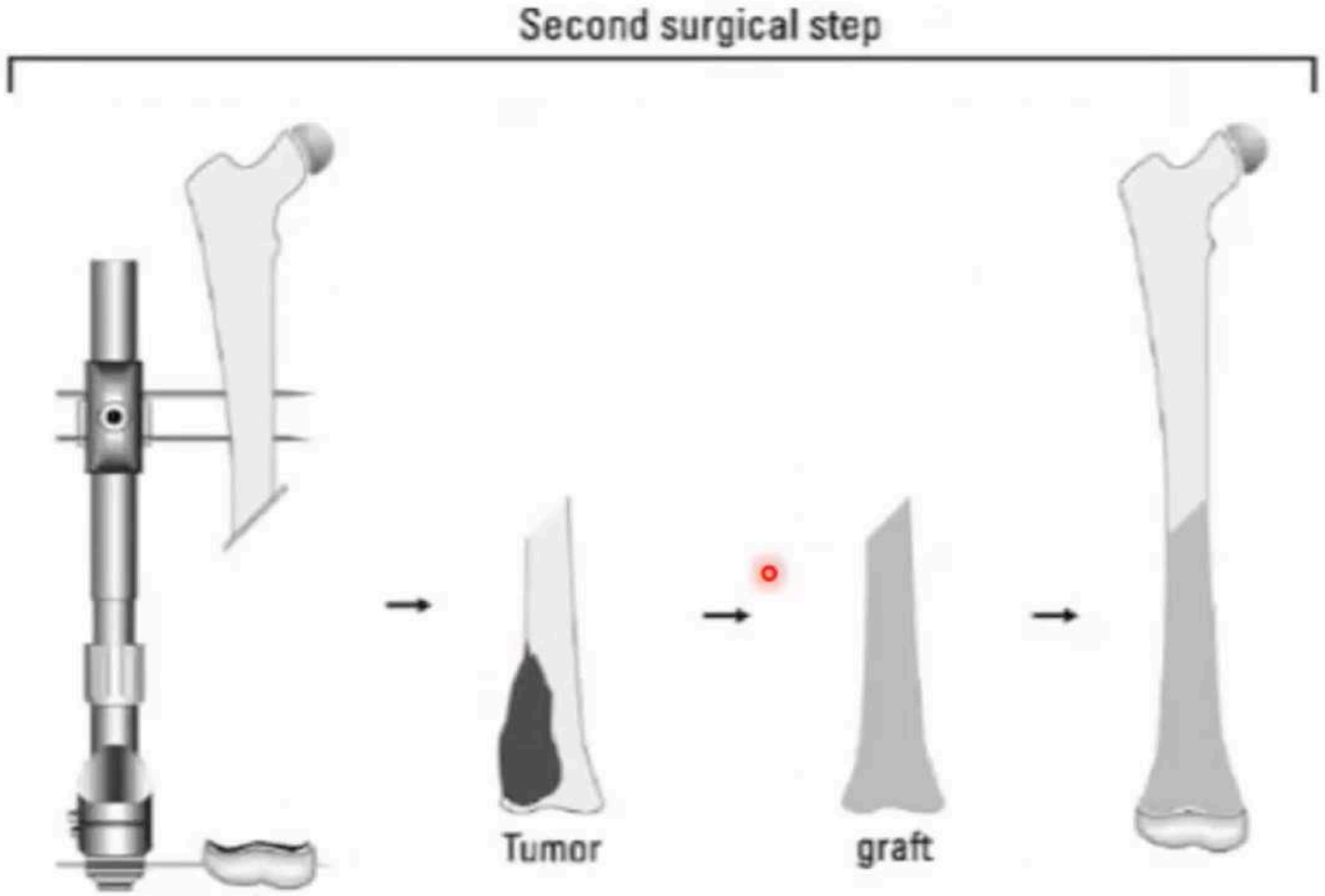
POST NEO ADJUVANT CHEMOTHERAPY



First surgical step 10-15 days







- Retained epiphysis together whit most of the growth plate

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TARGET ORTHO

STEP 1 (PHYSEAL DISTRACTION)

DAY 1

DAY 5

DAY 9

BONE CANCER CLINIC

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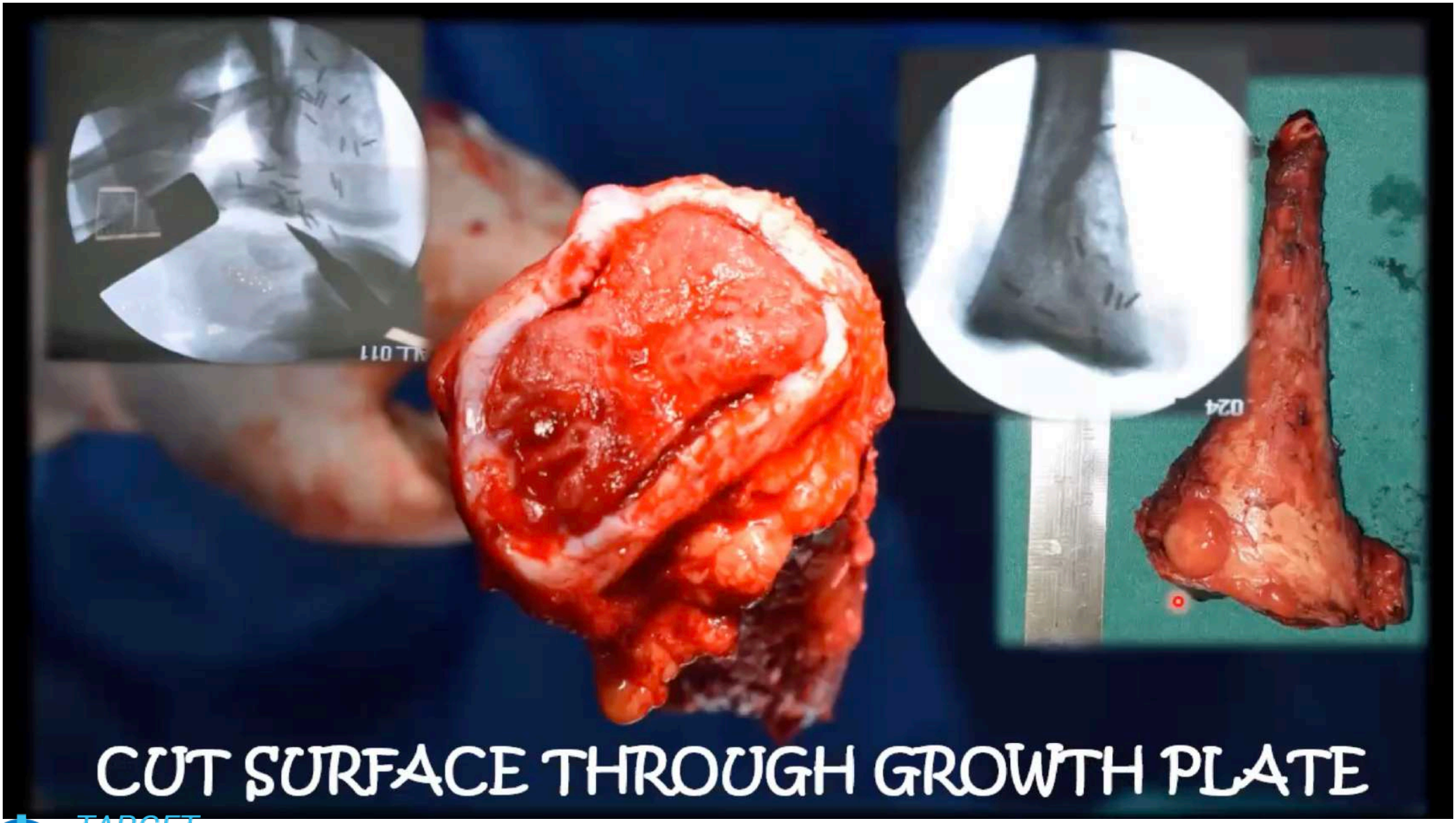

POST OP

BONE CANCER CLINIC

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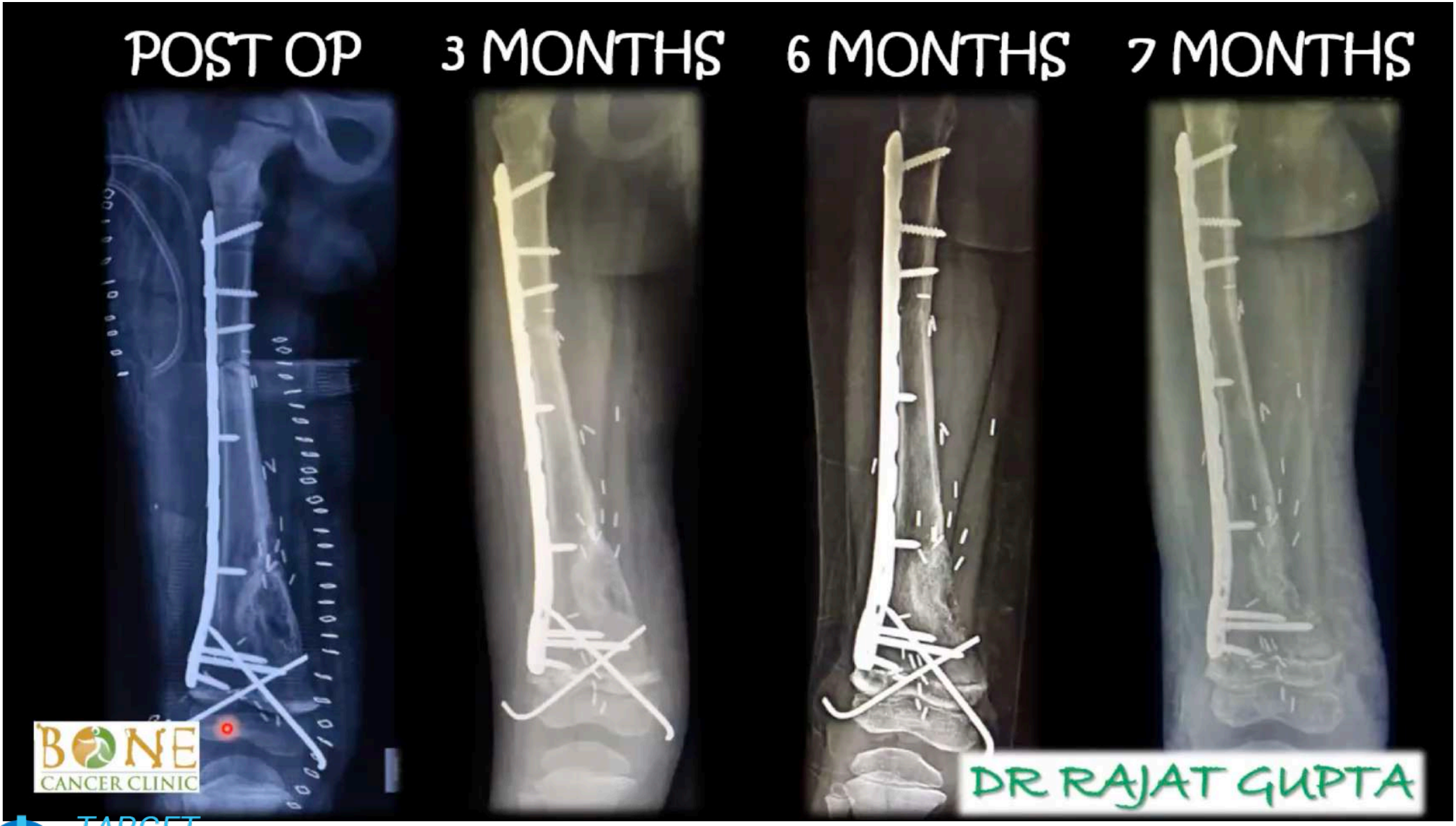

EQUAL FEMUR LENGTHS AT 6 MONTHS POST OP

CANADELL'S PROCEDURE

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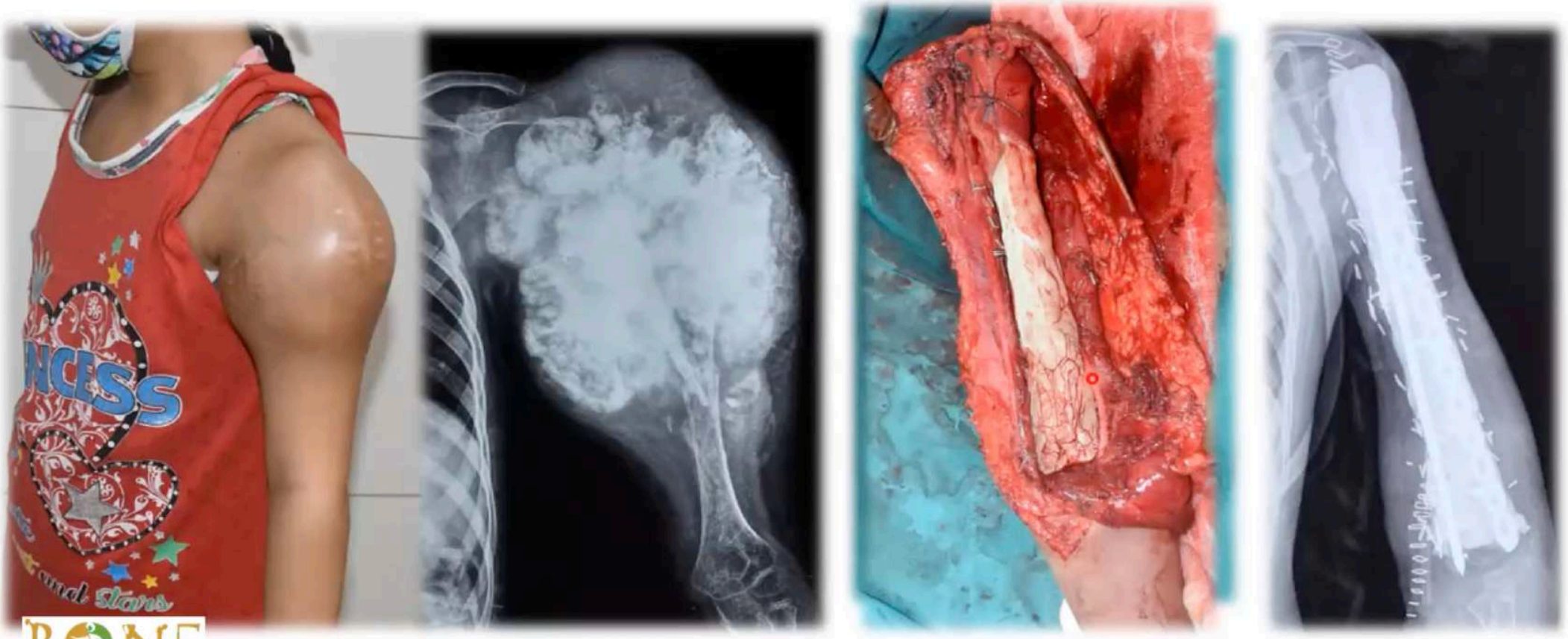
BONE CANCER CLINIC

TARGET ORTHO

NAIL CEMENT SPACER



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