

Diaphyseal Reconstruction With Extracorporeal Irradiated Autogenous Tumor Bone Graft

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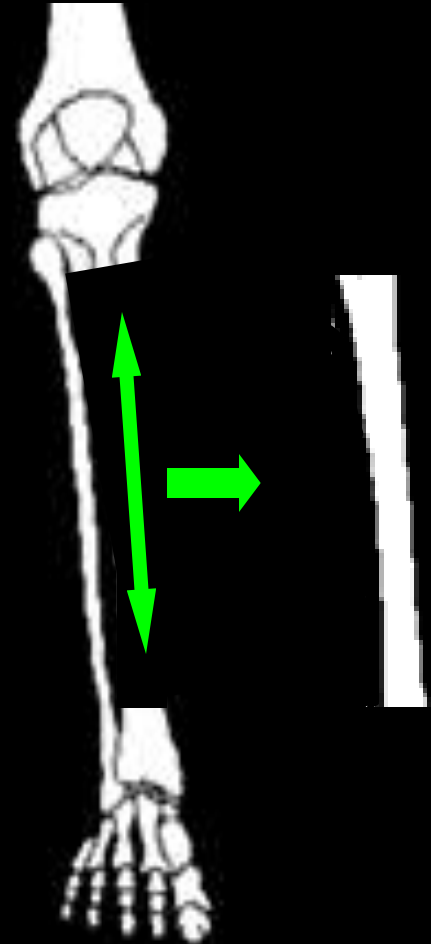
Tata Memorial Hospital
Mumbai
INDIA



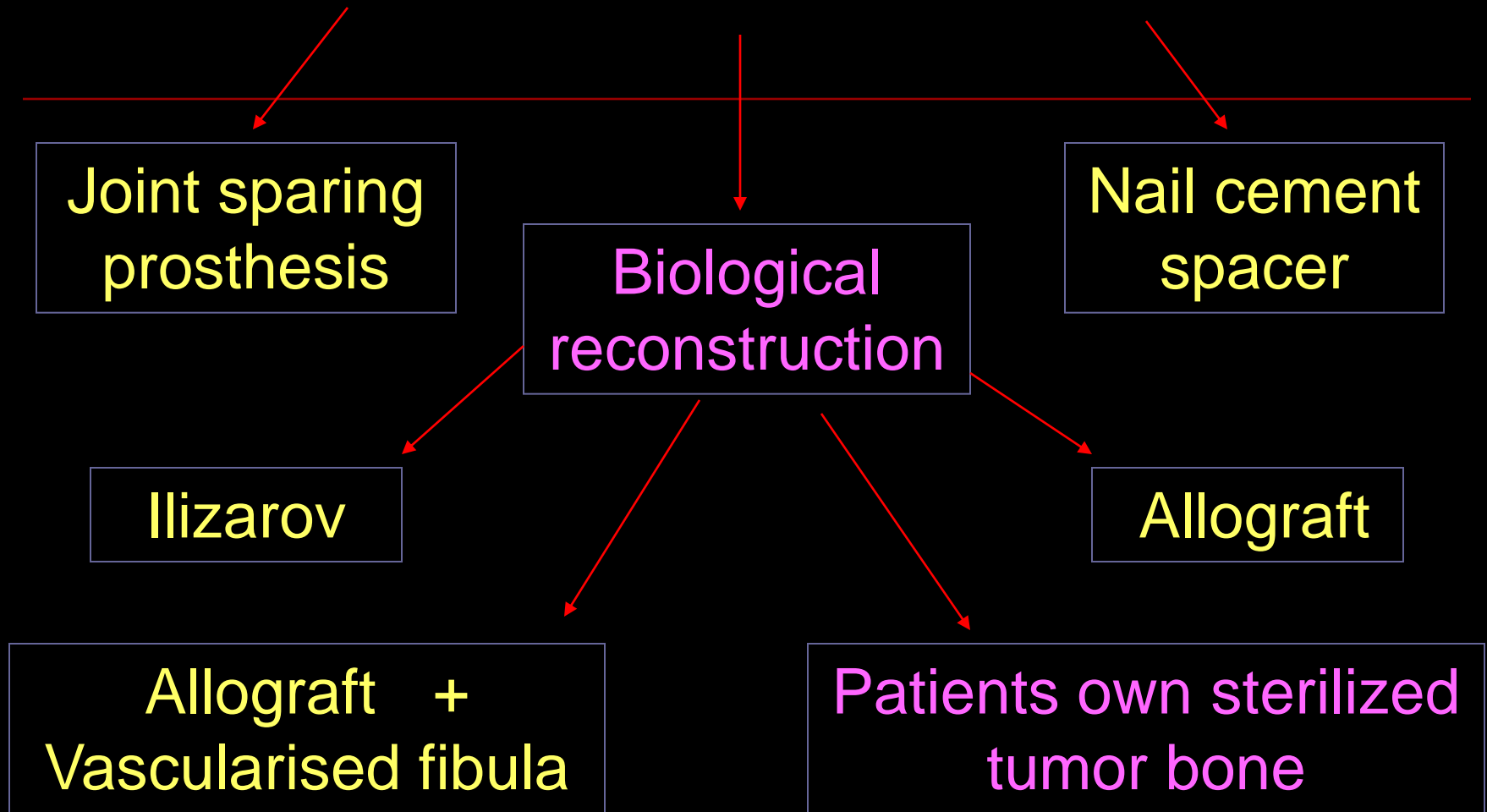
Intercalary Resection

Resection which does not include the intra articular areas of bone

Joint sparing at both ends, thro diaphysis



Reconstruction Options



Patients own sterilized bone

- Methods of sterilization:

Autoclaving

Microwave

Pasteurization

Liquid nitrogen

***Radiotherapy (Extra Corporeal
Radiotherapy)***

Advantages of ECRT

- Anatomically matched bone graft
- Auto bone graft (Irradiated)
- **Bone bank not required**
- **Inexpensive**
- Good union rate
- Bone stock restored



Disadvantages

- Structurally strong bone required
- Not feasible in pathological fractures
- **Radiotherapy unit required**
- Assessment of margins and tumor necrosis is not as per convention



Aim of the study

- To analyse the results of Irradiated autogenous tumor bone graft

Materials and Methods

- Retrospective study
- March 2006 to March 2008
- Total **16** cases

Results

Age:

2 years to 29 years

Mean: 15.1 years

Sex:

Male: 13

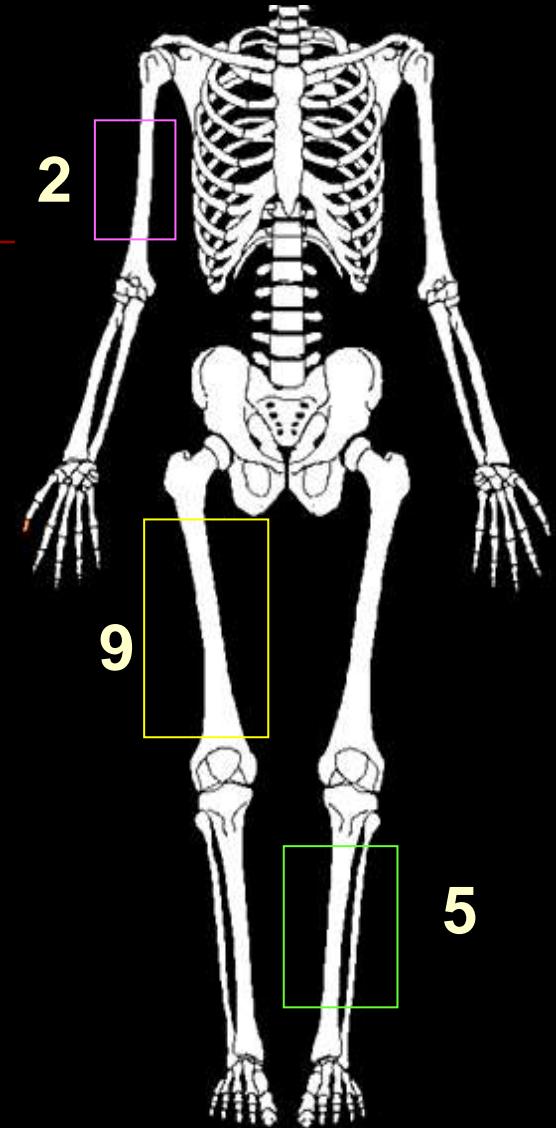
Female: 3

Primary Diagnosis

Tumor	No.
PNET	10
Osteogenic sarcoma	5
Adamantinoma	1

Site

Bone	No.
Femur	9
Tibia	5
Humerus	2



Surgical Planning

Se:1
Im:1

S, H, SHIVA
Study Date:29/09/2008
Study Time:15:35:13
MRN:CD/20856

[R] [L]

CT SCOUT HEAD IN

C50
W500

Report S, H SHIVA PET SCAN WHOLE BODY (NON CONTRAST) 29/09/2008 CT

Sex: M
Date of Exam: 2008.10.01
Case No.: WAAPT08005752

Radiological Diagnosis:

Reason for Exam: Kn C/O Admantinoma of left tibia, For pre-treatment evaluation,
FDG avid active disease at the primary site involving midshaft of left tibia.
No evidence of FDG avid active disease elsewhere within the body.

WORK UP FOR STAGING

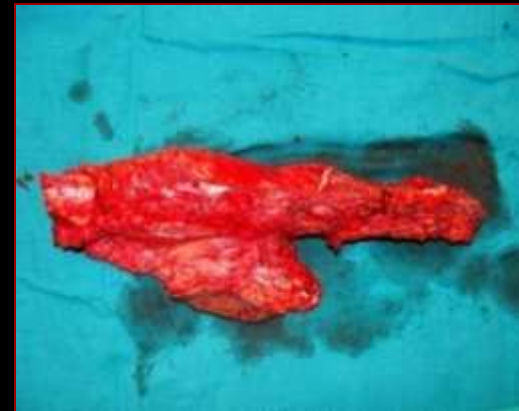


Surgical Planning

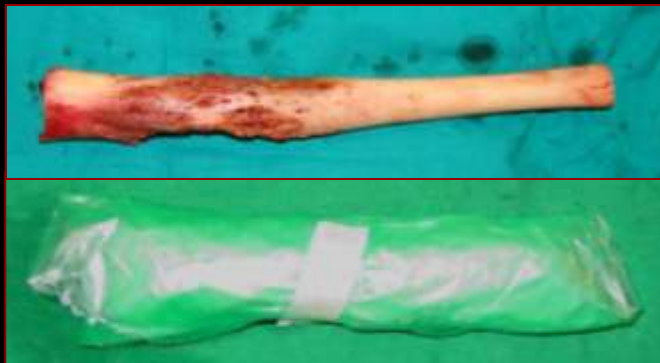
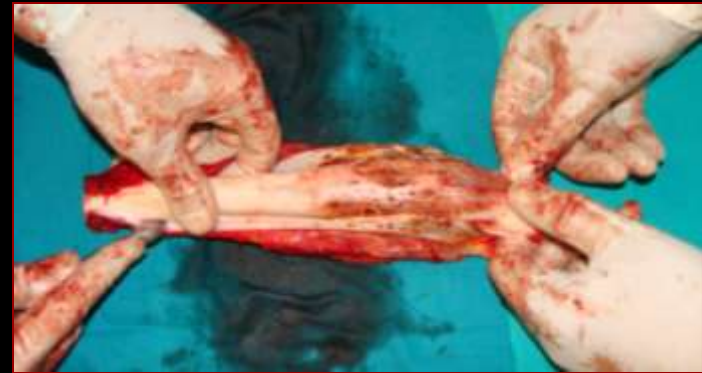
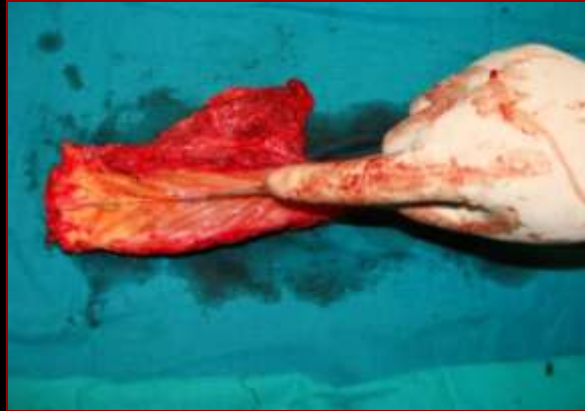


Extent of disease

ECRT- Surgical Procedure



Tumor Debulking & Packing

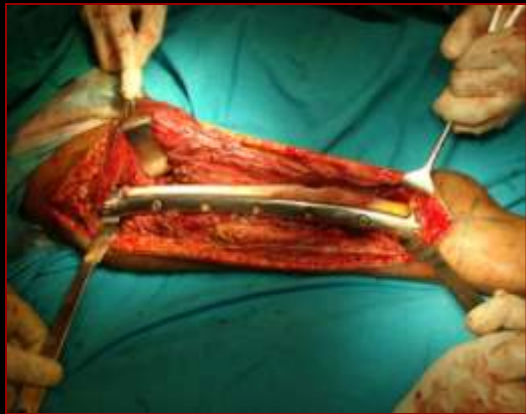
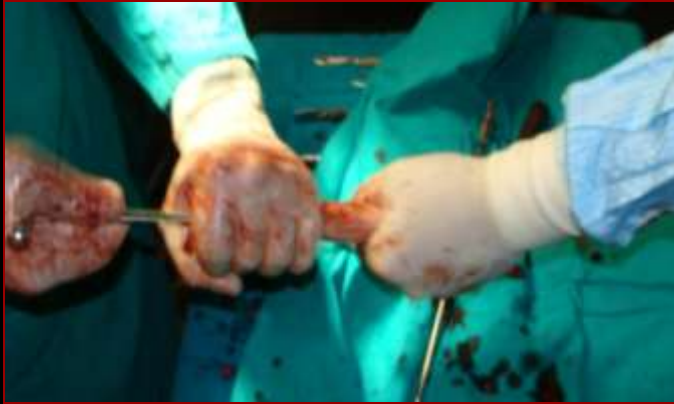


Extra Corporeal Radiotherapy (ECRT)

- 50 Gy of Radiation
- Linear accelerator
- Average time of radiation: 28 min.



Re-implantation



Follow up Evaluation

- Clinical Examination:
 - Local Examination
 - Functional scoring using
Musculoskeletal tumor society (MSTS) score
- Radiological examination:
 - Local X ray every 3 months
 - CXR / CT Thorax / Bone Scan

Results

Duration of Surgery

- 5 hours – 9 hours
Mean: 7.2 hours
- Total time for graft transport and radiation:
 - 55 min
- Radiation time:
 - 28 min

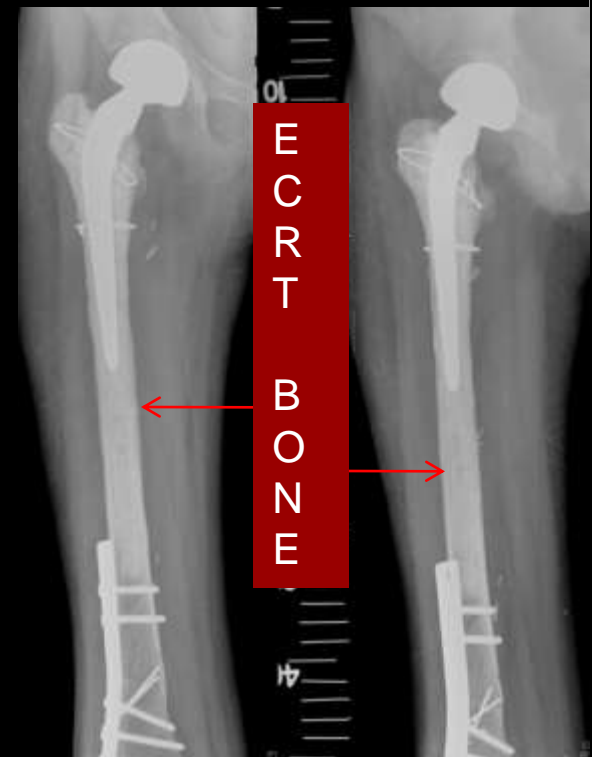
Follow up

- Total cases: 16
- LFU: 1 (12 months)
- Follow up period:
27 months – 45 months
Mean: **33 months**

Results

- Total cases – 16
 - Infection – 4 cases (bone strut removed)
-
- Total cases analyzed – 12
 - These 12 cases had 24 bony ends assessed for union
 - At 1 end a prosthesis was inserted
 - Bony ends assessed for union - 23

PNET Prox. femur



Results

- To assess union –
 - 12 cases.
 - 23 osteotomies
- Osteotomy sites -
 - Metaphyseal: 11
 - Diaphyseal: 12



Time to Union

- Total Osteotomies: 23
- Total Union time: 3 months – 12 months
Mean: **6.8 months**
- Metaphyseal end: 3 – 12 months
Mean: **6 months**
- Diaphyseal end: 3 – 18 months
Mean: **7.8 months**

EWING'S in 2 years Old

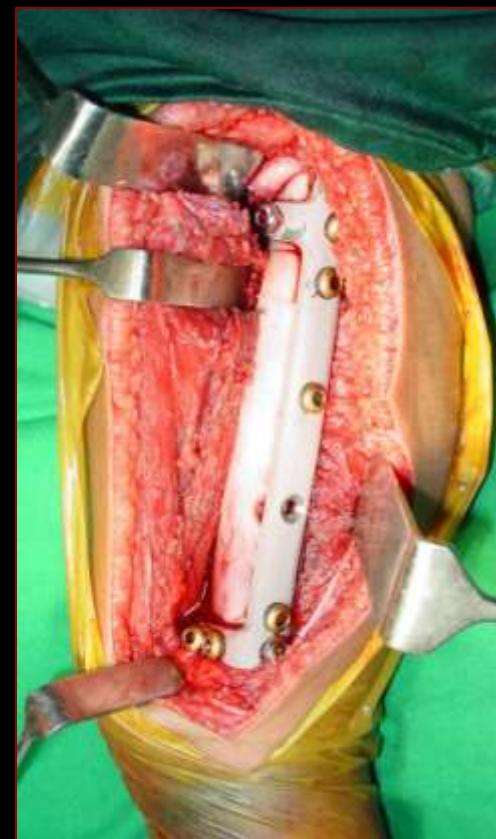


Internal surface
HA coated

Cuff with holes
for Ø4.5 screws

Cuff with holes
for Ø4.5 screws

EWING'S in 2 years Old



Post -op



F/up – 18 months



F/up – 26 months



Complications

Reconstruction related complications:

- Total: **8 complications in 7 cases**
- Implant Failure & Nonunion: 2/23 (8.6%)
- Infection: 4/16 (25%)
early – 2, late – 2
- Deep skin necrosis: 1 (Flap cover done)
(Associated Nerve palsy: 1)

Infection: 4 cases

Early infections - 2
Late infections - 2



Antibiotic Beads



Persistent infection



Rotationplasty

CASE -1

Infection

CASE -2



Gap Nonunion

CASE -3



Nail Cement Spacer

CASE -4



Nail Cement Spacer

Hypertrophic Nonunion/Implant Failure: 2 Replating + Bone Graft



Pre - op



Post - op



Non union



Revision sx

Oncological Results

- Local Recurrence: 1
- Local Recurrence + Disseminated disease: 2
- Distant metastasis: 2

Total Deaths - 5

- Deaths due to disease progression - 4
- Death due to unrelated cause -1

Functional Score

MSTS SCORE

Excellent: 11

Fair: 01

Lessons Learnt

- Use of **Locking plates and custom plates** can minimize the rate of nonunion and implant failure
- **Primary bone grafting** of diaphyseal osteotomy site may reduce incidence of non union
- Augmentation of ECRT bone graft with **bone cement** may prevent early graft fracture
- **Infection** is deadliest complication – requires prompt and aggressive measures

Conclusion

- Extracorporeal irradiation is an **oncologically sound** procedure with good functional outcome
- **Convenient and inexpensive technique** for limb salvage which avoids the logistic issues involved in allograft procurement and the specialized expertise for micro vascular anastomosis
- Present results are short term, enough long term data is available in literature to support the usefulness of the procedure

THANK YOU