Expandable Prostheses:

The **RUTGERS** experience

Disclosures:
- Musculoskeletal Transplant Foundation
- Biomet
- Merete, Implant Cast
- Musculoskeletal Tumor Society

**Expandables**

**Objective:**

Present the important problems and issues surrounding expandables so Surgeons may better select and inform patients.

- Patient Selection: Who should be considered?
- Informed Consent: What do we say to patients?
- Managing Expectations: Can you and the patient handle the complications?
Indications

- Open Physis
- Wide Resection
- ≥6 cm LE Limb

Malignant Bone Tumors

- Osteosarcoma
  - Chemo + Surgery
- Ewing's
  - Chemo + Surgery +/- Radiotherapy

When should we consider Expandables?

**Limb Length Inequality**

- ≥2 to ≤6 cm
  - 2 cm Lengthen
  - 2 cm Epiphysiodesis
  - 2 cm Discrepency
- >6 cm
  - Expandable
  - Rotationplasty
  - Amputation
Other Options?

- Amputation
- Rotationplasty
- Physeal Distraction

### Complications

<table>
<thead>
<tr>
<th>Prosthesis</th>
<th># pts</th>
<th>Soft-Tissue Failure (Type 1)</th>
<th>Aseptic Loosening (Type 2)</th>
<th>Structural Failure (Type 3)</th>
<th>Infectious Comp. (Type 4)</th>
<th>Tumor Prog. (Type 5)</th>
<th># Comp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEAP</td>
<td>49</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Repiphysis</td>
<td>86</td>
<td>6</td>
<td>10 (12%)</td>
<td>18 (21%)</td>
<td>4 (5%)</td>
<td>2</td>
<td>40 (47%)</td>
</tr>
<tr>
<td>Stanmore</td>
<td>89</td>
<td>5</td>
<td>14 (16%)</td>
<td>12 (13%)</td>
<td>0</td>
<td>32 (36%)</td>
<td></td>
</tr>
<tr>
<td>Hwang 2012, Picardo 2012</td>
<td></td>
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</tbody>
</table>

### Published Studies

- Hwang 2012, Picardo 2012
Early Designs: Invasive Expandables


Total Humeral Resection
Open Lengthening Procedures
Expansion

LINK Expandable Endoprostheses

Lengthening Screw Mechanism

Custom Expandable, Total Femur Replacement

Telescoping Press-fit pins
Early Designs: Invasive Expandables

These are fraught with complications: modular exchange of modular segments’ excision of capsule, contracture, infection, and inadequate lengthening...
Minimally Invasive Expandables

Non-Invasive Expandables

Non-Invasive vs Open Lengthening

- Less surgical morbidity
- Multiple lengthenings more feasible
- More anesthetic options
- Revision Necessary (Repiphysis)

- Increased surgical morbidity
- Infection
- Nerve palsy
- Contracture and scar
- "Acute" lengthenings
- Increased cost:
  - open surgeries
  - Hospitalization.
Prerequisites for Expansion

- Chemotherapy complete
- Current limb-length discrepancy ≥ 1.5 cm
- Functional ROM

Hinge Considerations:

**Rotating Hinge**
- Smooth/Polished surfaces (PMMA-Ingrowth)

**Fixed Hinge**
- Physeal Growth
**Stem Fixation:** Cemented vs Cementless

- PMMA
- HA Collar

**Stem Fixation:** Crosspin

- Simple Transverse
- Cephalomedullary
- Cephalo-Intra-Extramedullary

**Total Femur:** Femoral Head-Acetabulum

- Acetabular Erosion
- Trochanteric Attachment
- Unipolar
- Bipolar
**Adult Conversion:** Femur / Tibia / Humerus

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**Complications Classification System**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>Soft-Tissue (Contracture)</td>
<td>2</td>
<td>10 (7%)</td>
</tr>
<tr>
<td>Type 2</td>
<td>Aseptic loosening</td>
<td>4</td>
<td>20 (12%)</td>
</tr>
<tr>
<td>Type 3</td>
<td>Prosthetic breakage/</td>
<td>5</td>
<td>25 (21%)</td>
</tr>
<tr>
<td></td>
<td>Periprosthetic fractures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 4</td>
<td>Deep Infection</td>
<td>3</td>
<td>15* (5%)</td>
</tr>
<tr>
<td>Type 5</td>
<td>Recurrence</td>
<td>1</td>
<td>5 (2%)</td>
</tr>
</tbody>
</table>

**Complications Prosthetic breakage**

Femur / Tibia / Humerus

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Complications

Aseptic Loosening

Compress Revision

Long Stem Revision

Complications

Aseptic Loosening

Cephalomedullary Revision

Complications

Perprosthetic Fractures

Closed Treatment
**Complications**  *Deep Infection*

- Explant and Wide Debridement Prostalac

- Re-implantation after Prostalac and IV antibiotics

- Antibiotic PMMA Coating

5.5y (12y)
Expandables

Patient Selection: Who should be considered?
Patients with an expectation of “normal” body image.

Informed Consent: What do we say to patients?
Every method has complications.
Be clear about the shortcomings of each method.

Managing Expectations & Complications:
Can you and the patient handle the complications?
Be knowledgeable about the prosthesis.
Know how to “recover” from a bad situation.

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*Thank You!!*