Outcomes of the Quadriceps-sparing Lateral Approach to the Distal Femur for Tumor Resection and Endoprosthetic Reconstruction

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Introduction

- Survival was the traditional outcome measure of success in cases of malignant bone tumors
- Advances in multiple areas have changed this to an expectation of improving pain, function, and quality of life

Introduction

- Distal femoral resection and reconstruction (DFR) is the most common resection and reconstruction performed for malignant bone tumors
  - Commonly reported: overall survival, event free survival, MSTS, type of reconstruction, complications, etc.
- Effect of type of approach has little attention in oncology literature
  - The medial or anteromedial/medial parapatellar (MPP) approach is the most common approach
    - Use cited because of neurovascular dissection, familiarity with approach

Introduction

- The lateral approach is a quadriceps-sparing approach where no neurovascular bundle dissection is required
  - Allowing for improved post-operative function, earlier return to maximal function, lower blood loss, all without compromising implant survivability, function, or oncologic outcome

Purpose

- To present and describe the quadriceps-sparing lateral approach to the distal femur
- To report outcomes for a consecutive series of distal femur resections and reconstructions treated with this approach

Materials and Methods

- IRB approval obtained
- Jan 2000 – Dec 2012
- Inclusion criteria:
  - primary DFR
  - lateral approach only
  - >6 months follow-up
  - Any primary or metastatic distal femur lesion, benign or malignant
- Exclusion criteria:
  - DFR in the face of revision surgery
  - <6 months follow-up
  - any approach other than lateral approach

Material and Methods

- Demographic data collected
  - age, sex, race, past medical and surgical history, height, weight, body mass index at the time of index surgery
- Surgical data collected
  - date of surgery, length of surgery, estimated blood loss, pre-operative knee range of motion (ROM), length of hospital stay, length of resection
- Oncologic data collected:
  - Enneking tumor stage, pathologic diagnosis, margin status, recurrence status, failure mode/classification (as described by Henderson, et al.), complications
- Outcomes data collected
  - post-operative knee ROM, Musculoskeletal Tumor Society (MSTS) Score.

MSTS Score

SCORE	PAIN	FUNCTION	EMOTIONAL	HAND POSITIONING	MANUAL DEXTERITY	LIFTING ABILITY
5	No pain	No restriction	Enthused	Unlimited	Unlimited	Normal load
4	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate
3	Modest Non-disabling	Recreational restriction	Satisfied	Not above shoulder or no Prerequisites	Loss of fine movements	Limited
2	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate
1	Moderate Disabling	Partial restriction	Accepts	Not above waist	Cannot pinch	Helping only
0	Severe disabling	Total restriction	Dislikes	None	Cannot grasp	Cannot help

a: For Upper Limb.

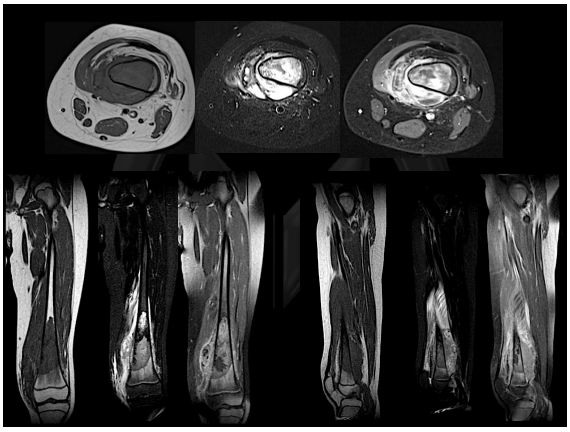
SCORE	PAIN	FUNCTION	EMOTIONAL	SUPPORTS	WALKING	GAIT	Final Patient Score of FUNCTIONAL EVALUATION
5	No pain	No restriction	Enthused	None	Unlimited	Normal	
4	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	
3	Modest Non-disabling	Recreational restriction	Satisfied	Brace	Limited	Minor cosmetic	
2	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	
1	Moderate Disabling	Partial restriction	Accepts	One cane or crutch	Inside only	Major cosmetic	
0	Severe disabling	Total restriction	Dislikes	Two canes or crutches	Not independent	Major handicap	
Patient score							

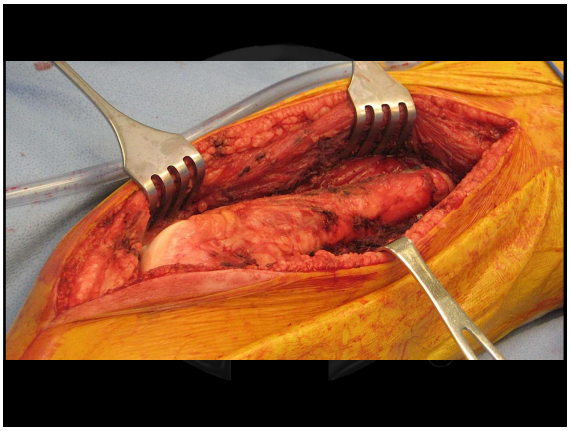
b: For Lower Limb.

Table- 1: Musculoskeletal Tumour Society (MSTS) scoring system.

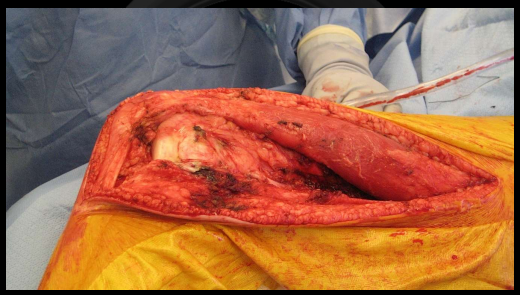
Surgical Technique

12yo Male with Knee Pain

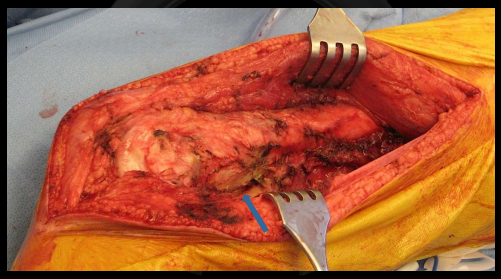




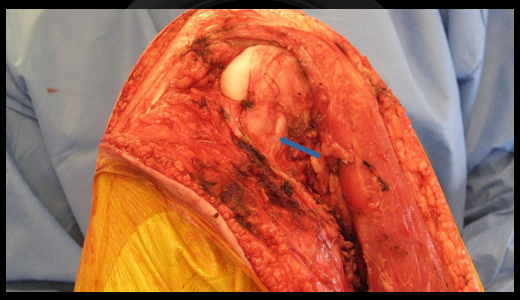
Extensor Mechanism



Posterior Compartment



LCL & PLC



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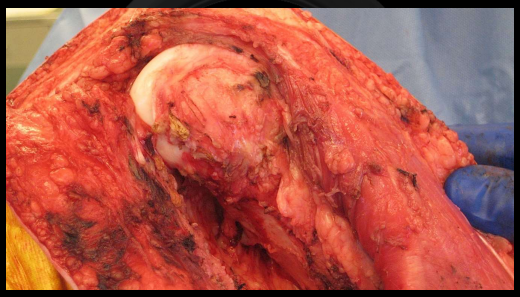
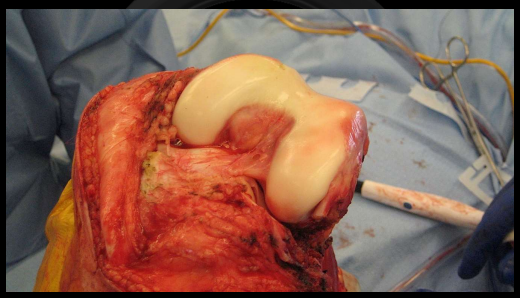


Cruciate Ligaments



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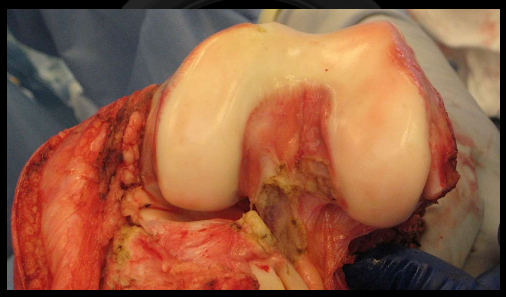
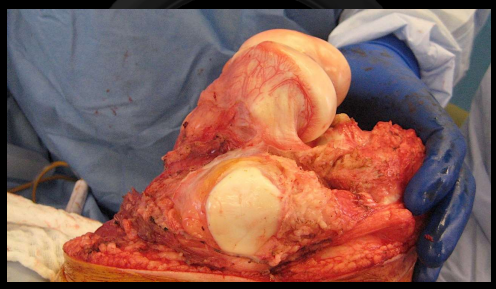
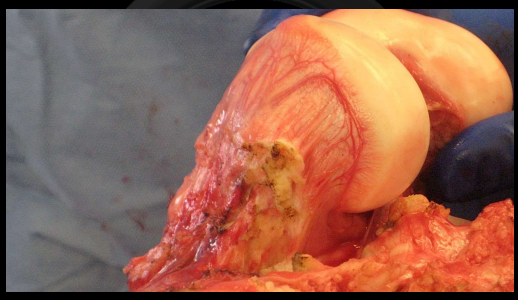


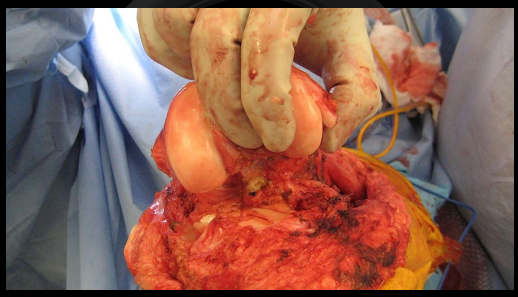
Medial Collateral Ligament



Medial Collateral Ligament

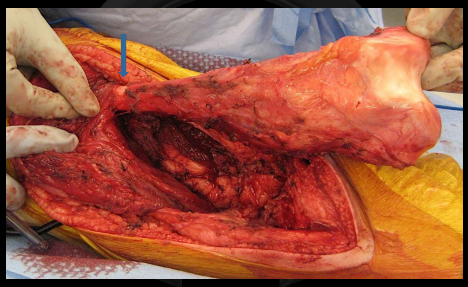


Gastroc & Posterior Capsule

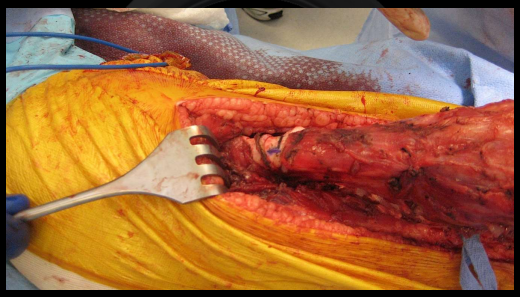


Hamstrings

Open Periostium at the Resection

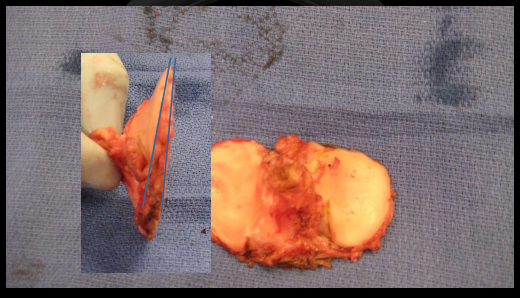


Mark for Rotation

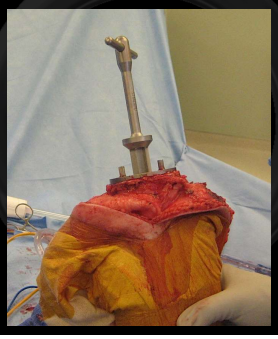


Resection

Remove Posterior Slope



Tibia Preparation



Skin, Fascia & Muscle

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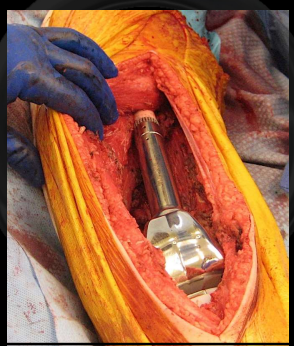
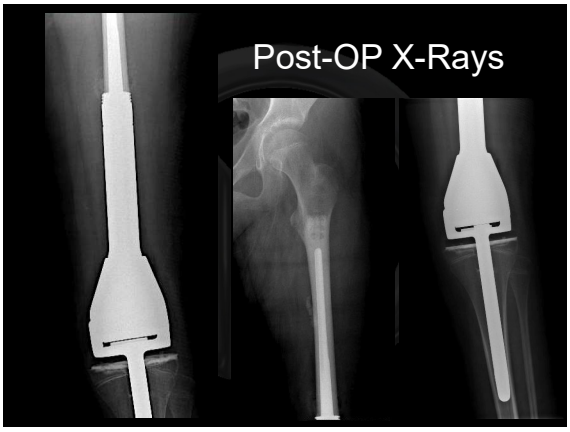
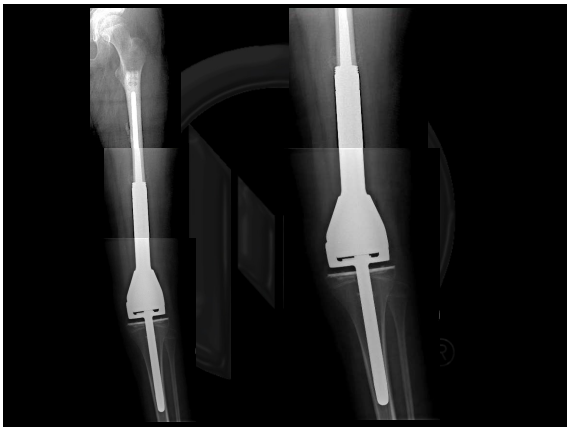


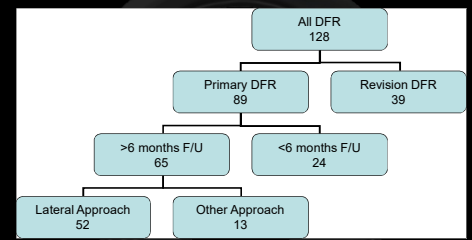
Extensor Mechanism

Post-OP X-Rays





Results



Age @ Surgery
45.38(14-82)

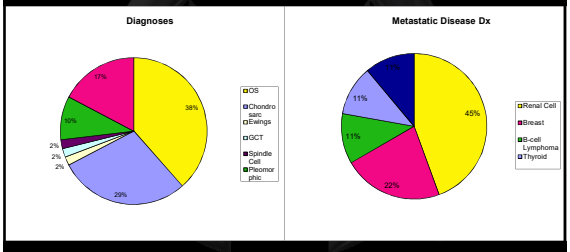
Sex	
M	F
35.00	17.00

Laterality	
R	L
29.00	23.00

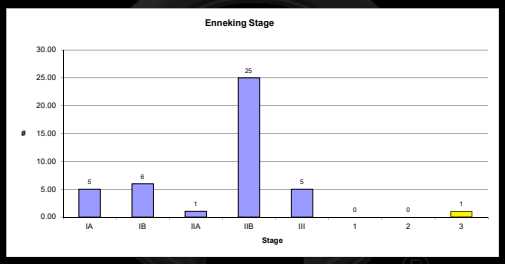
Follow-Up
32.71(6-99)

Results

Pathology						
OS	Chondrosarc	Ewing's	GCT	Spindle Cell	Pleomorphic	Mets
20.00	15.00	1.00	1.00	1.00	5.00	9.00

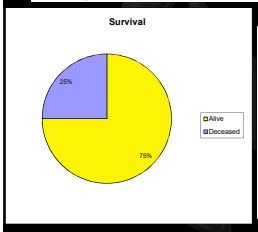


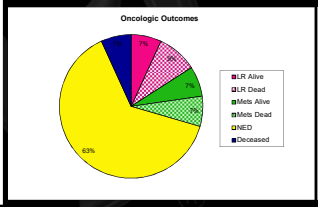
Results



Results

Oncologic Outcome					
Local Recurrance		Mets s/p Sx		No Recurrance	
7		9		34	
LR Alive	LR Dead	Mets Alive	Mets Dead	NED	Deceased
3	4	3	3	28	3





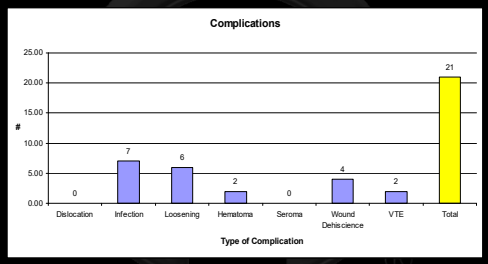
Results

Operative Details					
Length Resected (cm)	Op Time (min)	EBL (ml	Preop hgb	Postop hgb	LOS (days)
18.6(12-35)	215.9(120-436)	376.08(100-1500)	12.4(8.3-17.2)	10.04(6.4-14.2)	4.56(2-9)

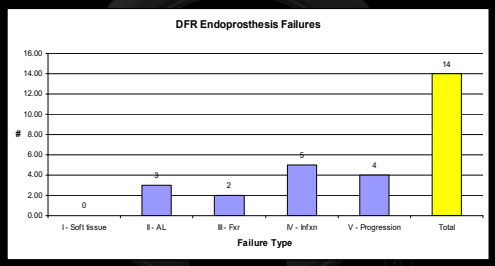
ROM	
F/U EXT LOSS	F/U FLEX
2.9(0-45)	106.9(45-130)

MSTS SCORE								
Overall	Pain	Function	Emotional	Supports	Walking Ability	Gait	Total	% Total
3.59(1-5)	3.98(1-5)	3.72(0-5)	4.28(1-5)	4.33(0-5)	4.19(0-5)	3.86(0-5)	24.35(2-30)	81.16(6.67-100)

Results



Results



Discussion

- Overall results show good functional and oncologic outcomes
  - 52 patients with 14 endoprosthetic failures
  - 75% patient survivability
  - 7 local recurrences
  - ROM 2.9-106 degrees

Year	Journal	Authors	Title	Construct	Approach
Current Study					
2012	JSR	Mo S et al	Modified technique using allograft-prosthetic composite in the dital femur after bone tumor resection	allograft-prosthesis/ORIF	medial parapatellar
2008	JA	Malawer et al	The Anterior Popliteal Approach for Popliteal Exploration, Distal Femoral Resection, and Endoprosthetic Reconstruction	modular dfr	Anterior Popliteal/Medial
2007	JBJS - British	Myers GJ et al	Endoprosthetic replacement of the distal femur for bone tumours	custom dfr	medial parapatellar
2006	JBJS - Am	Biau D et al	Survival of Total Knee Replacement with a Megaprosthesis after Bone Tumor Resection	GUEPAR custom dfr	anteriomedial/anterolateral
2002	CORR	Bickels J et al	Distal Femur Resection with Endoprosthetic Reconstruction: A Long-Term Followup Study	modular/custom/expandable dfr	medial parapatellar
1999	JBJS - British	Kerry RM et al	The Quadriceps Myocutaneous Flap for Operationon the Distal Femur	allograft/arthrodesis/dfr/curretage-cementation	u-shaped flap with medial and lateral approaches
1998	JBJS - Am	Kawai A et al	Prosthetic Knee Replacement after Resection of a Malignant Tumor of the Distal Part of the Femur	custom dfr	midline medial/lateral parapatellar
1994	JBJS - British	Capanna R et al	Modualar Uncemented Prosthetic Reconstruction after Resection of Tumours of the Distal Femur	modular uncemented dfr	anteromedial/anterolateral

# Pts (dead)	F/U	Age	Ext Lag	Flex	MSTS	Infection	Local Recurrence	Failures
44 (10)	34.95(6-99)	46.43(14-82)	2.88(0-45)	106.28(45-130)	24.24(2-30)	7	7	14
12 (1)	45.7 (12-81	29.5	NR	112 (50-135)	27 (10-30) - only retained dfr	1	1	2
46 (1)	27 (6-66)	27 (6-71)	5 (0-20)	NR	26.2 (20-29)	1	1	4
335 (142)	71 (60-360)	24 (17-48)	NR	NR	NR	32	20	81
92/14	62 (0.5-343)	29 (13-78)	13 with >5 degrees (5-90)	NR	NR	5	4	21
110 (NR)	93.6 (24-198)	21.5 (10-80)	NR	NR	Good 85% Moderate 8% Poor 6%	6	5	20
13	42 (12-132)	24.5 (11-58)	1.7 (0-5)	105 (40-135)	NR	1	0	2
26/14 (excluded dead)	96 (60-204)	25.6 (12-68	13/3 (0-90)	95/88 (NR)	24 (14-29)	4	0	19
95 (3)	51 (2-102)	23 (11-69)	NR	NR	NR	5	5	18

Discussion

- Mo, et al, 2012 study
  - MPP approach
  - Series of 12
  - 2 failures
  - 3 degree extension loss, 106 degrees flexion
  - MSTS 24.24
- Malawer, et al, 2008
  - Medial/popliteal approach
  - Series of 46
  - 14 failures
  - 5 degree extension loss, flexion not recorded
  - MSTS 26.2
- Other studies with equivalent or worse outcomes

Discussion

- In comparison, our data shows equivalent or better than outcomes
- The lateral approach is a viable option for DFR
- Added benefits of the approach
  - No need for NV dissection
  - Can be extended proximally for total femur

Discussion

- Weaknesses
  - Retrospective nature
  - No comparative group
  - Low(ish) numbers

Conclusion

- The lateral approach to the distal femur for oncologic resection and reconstruction provides appropriate exposure utilizing a quadriceps-sparing technique
- Postoperatively, patients have very good range of motion and functional outcome scores
- Failure rates are comparable to previously reported series of distal femoral replacements
- This approach also minimizes vascular exposure medially, allows for proximal extension to expose the entire femur if necessary
- Potentially allows for faster functional recovery by sparing the quadriceps.

Next step

- Comparative analysis of lateral to other approaches
  - Case-matched or randomized study
- Breakdown of those treated for metastatic disease versus those treated for primary malignancy

Special Thanks

- Doug Letson
- Odion Binitie
- Dave Joyce


Questions?