



Multidisciplinary Approaches to Cancer Symposium

What's New in Pediatric Sarcoma

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Disclosures

- I do not have any relevant financial relationships.

This presentation and/or comments will provide a balanced, non-promotional, and evidence-based approach to all diagnostic, therapeutic and/or research related content.

Cultural Linguistic Competency (CLC) & Implicit Bias (IB)

STATE LAW:

The California legislature has passed Assembly Bill (AB) 1195, which states that as of July 1, 2006, all Category 1 CME activities that relate to patient care must include a cultural diversity/linguistics component. It has also passed AB 241, which states that as of January 1, 2022, all continuing education courses for a physician and surgeon **must** contain curriculum that includes specified instruction in the understanding of implicit bias in medical treatment.

The cultural and linguistic competency (CLC) and implicit bias (IB) definitions reiterate how patients' diverse backgrounds may impact their access to care.

EXEMPTION:

Business and Professions Code 2190.1 exempts activities which are dedicated solely to research or other issues that do not contain a direct patient care component.

This presentation is dedicated solely to research or other issues that do not contain a direct patient care component.

Intraoperative Tranexamic Acid Infusion





A commentary by Yi Guo, MD, is linked to the online version of this article.

Intraoperative Tranexamic Acid Infusion Reduces Perioperative Blood Loss in Pediatric Limb-Salvage Surgeries

A Double-Blinded Randomized Placebo-Controlled Trial

Ahmed Mohamed El Ghoneimy, MD, Tamer Ahmed Mahmoud Kotb, MD, Ismail Rashad, MSc, Dina Elgalaly, BSPHarm,
Kareem AlFarsi, BS, and Mohamed Ahmed Khalil, MD

Investigation performed at the Children Cancer Hospital, Cairo, Egypt

Intraoperative Tranexamic Acid Infusion Reduces Perioperative Blood Loss in Pediatric Limb-Salvage Surgeries

A Double-Blinded Randomized Placebo-Controlled Trial

- Tranexamic acid (TXA) is an antifibrinolytic drug
- Safety, efficacy has been proven in RCTs in adult patients undergoing arthroplasties
- In pediatric orthopaedic patients, its efficacy has been tested in RCTs of spinal surgeries and pelvic osteotomies, but not in RCTs of arthroplasties or tumor surgeries

TABLE I Patient Demographics *

	Placebo (N = 24)	TXA (N = 24)	P Value
Age (yr)	13.0 ± 3.19	11.5 ± 4.08	0.23
Type of resection			0.188
Distal	21 (87.5%)	20 (83.3%)	
Proximal	1 (4.2%)	4 (16.7%)	
Total	2 (8.3%)	0 (0%)	
Diagnosis			1
Ewing sarcoma	2 (8.3%)	3 (12.5%)	
Osteosarcoma	22 (91.7%)	21 (87.5%)	

Intraoperative Tranexamic Acid Infusion Reduces Perioperative Blood Loss in Pediatric Limb-Salvage Surgeries

A Double-Blinded Randomized Placebo-Controlled Trial

- There was no significant difference between the groups with respect to intraoperative blood loss ($p = 0.0616$) or transfusion requirements ($p = 0.812$), but there was a significant difference in perioperative blood loss at postoperative day 1 ($p = 0.0144$) and at discharge from the hospital ($p = 0.0106$) and in perioperative blood transfusion ($p = 0.023$).

TABLE II Results*

	Placebo (N = 24)	TXA (N = 24)	P Value
EBL (mL)	918 (548, 1,640)	969 (589, 1,520)	0.992
IBL (mL)	535 (333, 725)	279 (113, 626)	0.0616
IBT (mL)	0 (0, 250)	143 (0, 250)	0.812
Operative time (hr)	2.00 (1.49, 2.15)	2.00 (1.45, 2.15)	0.661
PBL until postoperative day 1 (mL)	800 (399, 984)	435 (118, 586)	0.0144
PBL until discharge from hospital (mL)	979 (663, 1,520)	634 (365, 922)	0.0106
PBT (mL)	444 (233.75, 751.25)	242.50 (0.00, 463.75)	0.023
Time until drain removal (days)	3.00 (2.75, 3.00)	3.00 (3.00, 4.00)	0.176
Length of hospital stay (days)	6.00 (5.00, 6.25)	6.00 (5.00, 7.25)	0.174

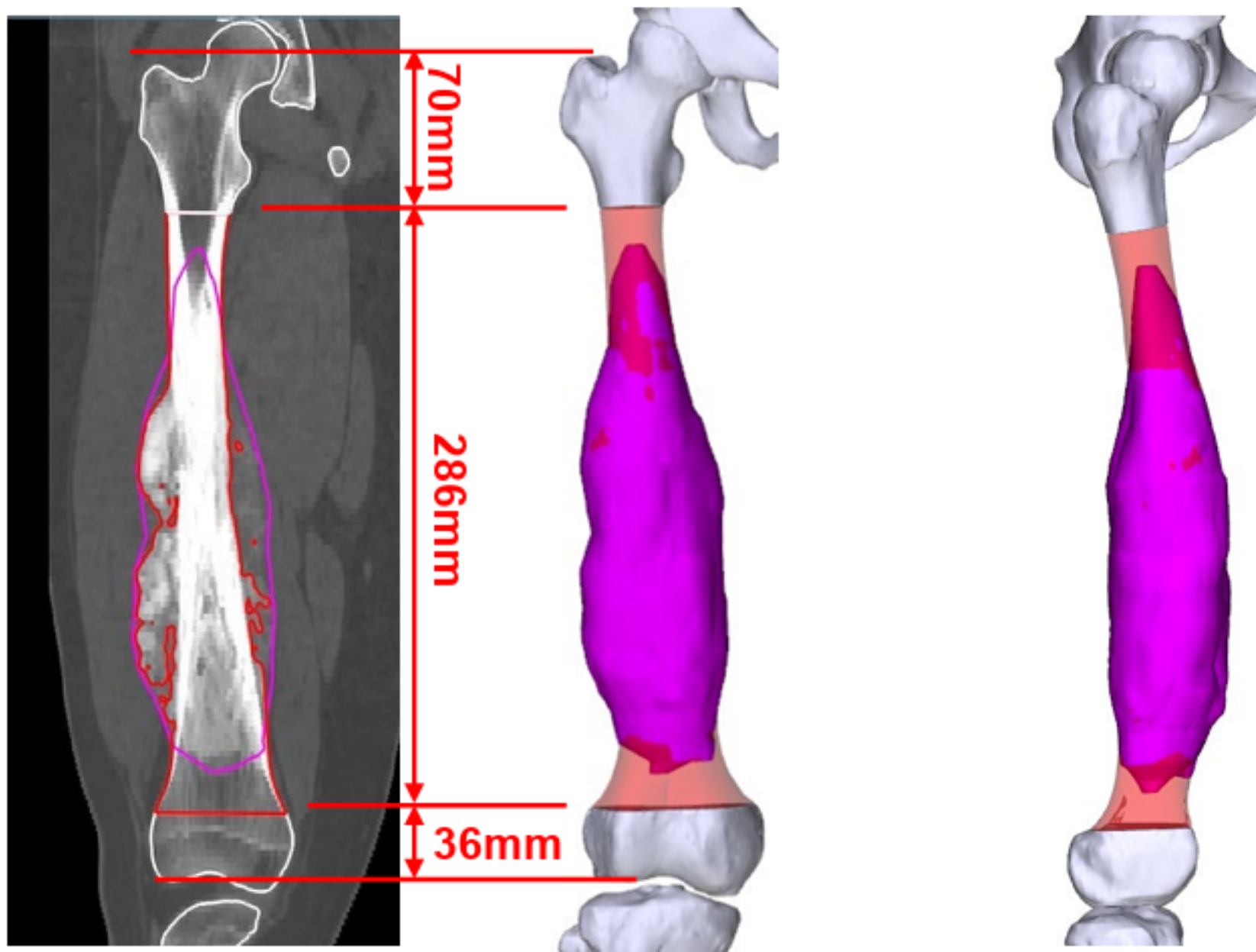
*Values are given as the median, with the Q1 and Q3 values in parentheses. EBL = estimated blood loss, IQR = interquartile range, Q1 = quartile 1, Q3 = quartile 3, IBL = intraoperative blood loss, IBT = intraoperative blood transfusion, PBL = perioperative blood loss, PBT = perioperative blood transfusion.

3D Printed, Patient Specific Cutting Guides



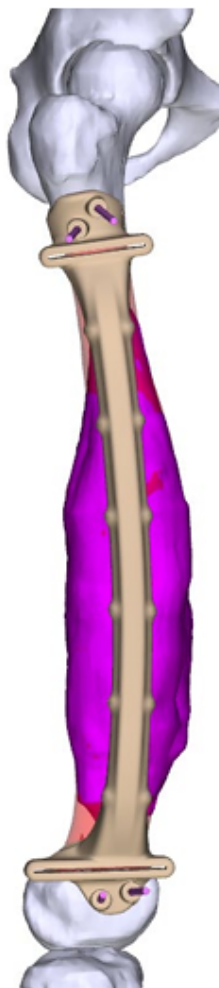
12-year-old male with right femur osteosarcoma



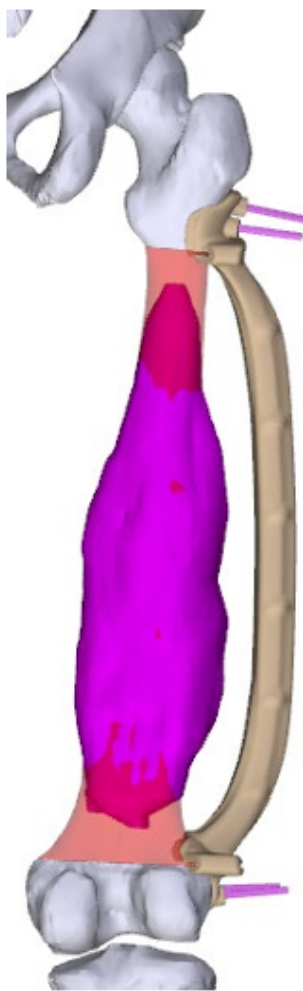




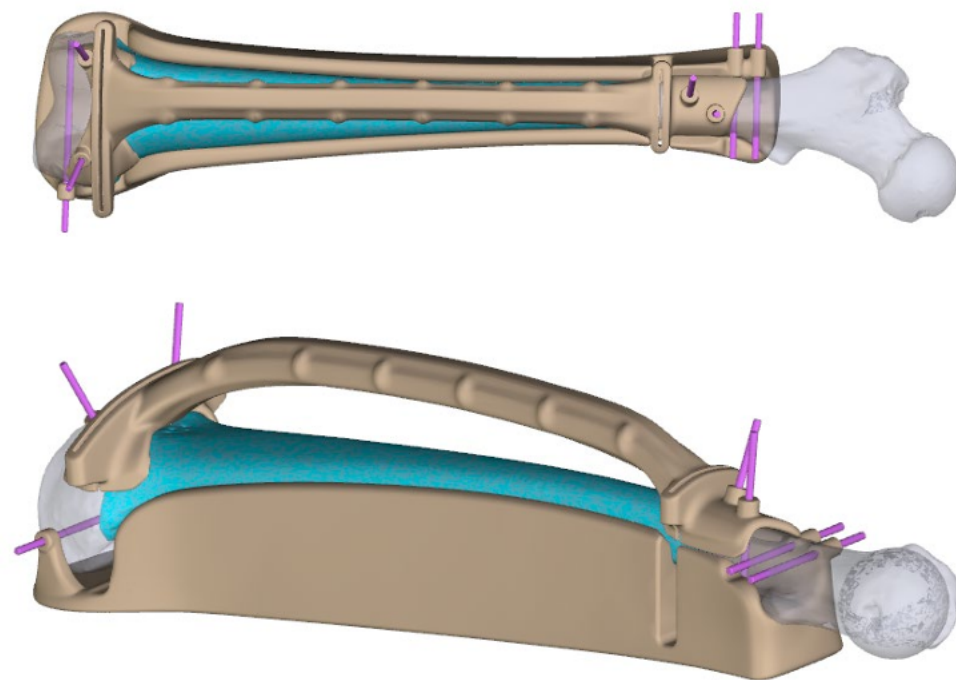
Anterior

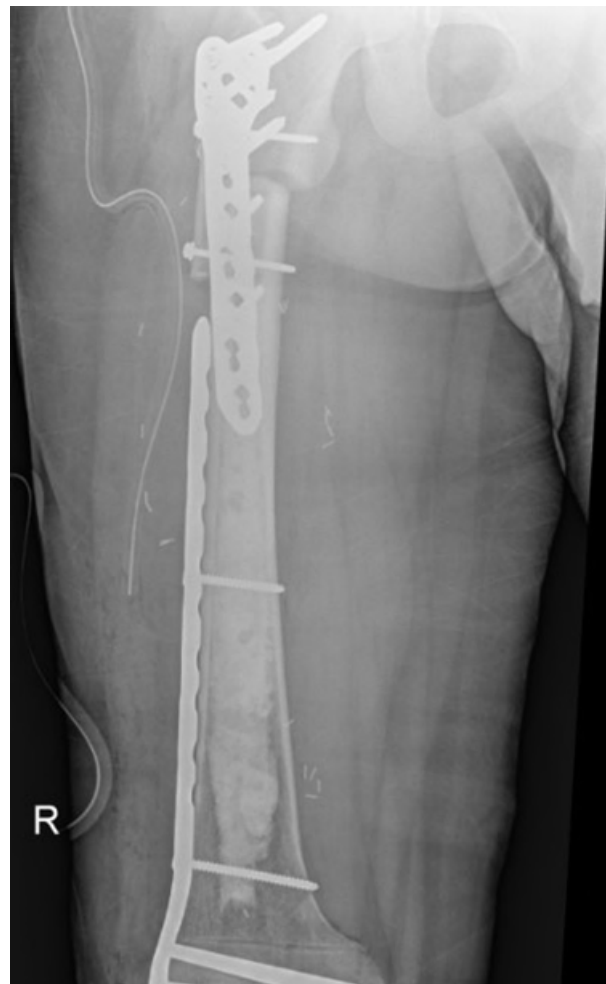
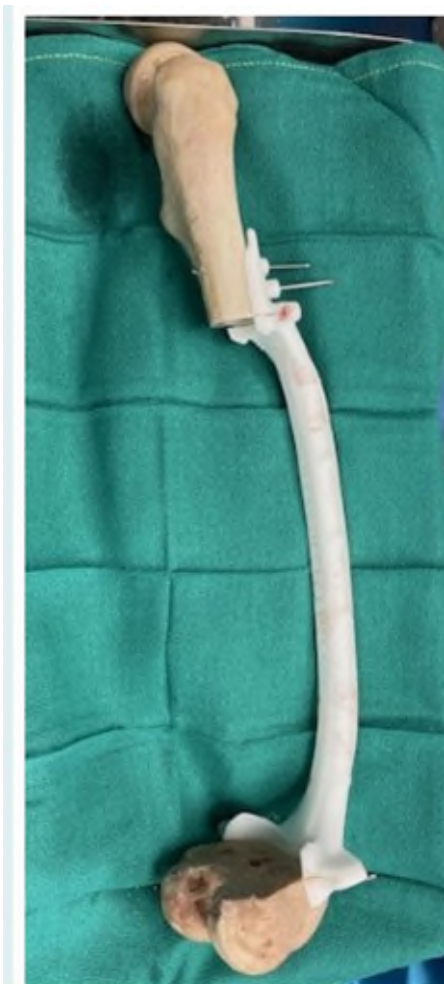


Lateral



Posterior

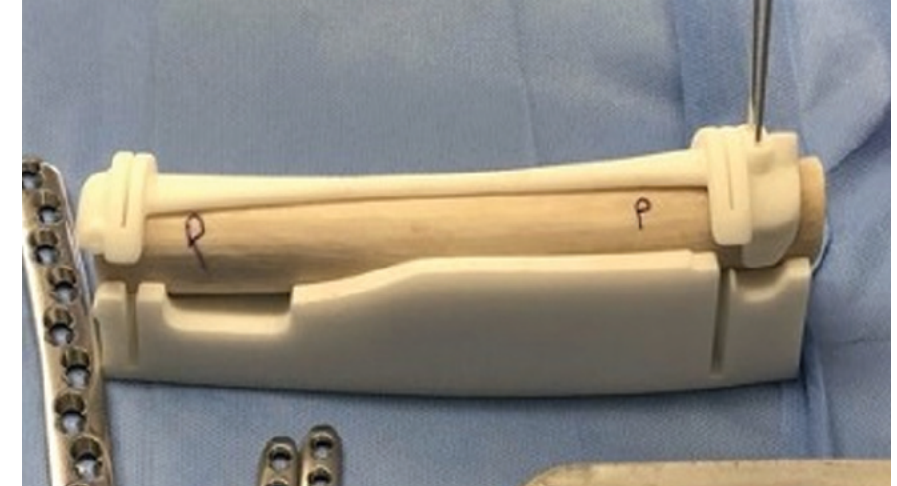
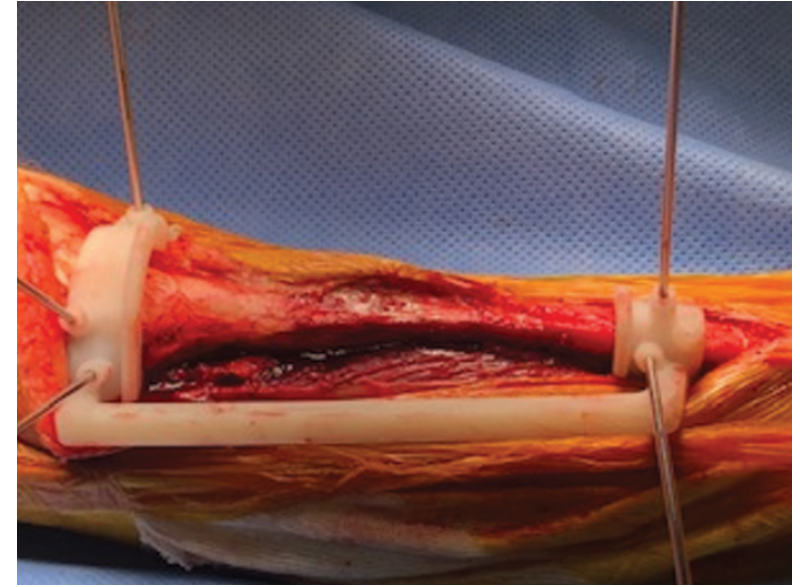




3D-Printed Cutting Guides for Resection of Long Bone Sarcoma and Intercalary Allograft Reconstruction

MATTHEW A. GASPARRO, BS; CHARLES A. GUSHO, BS; OBIANUJU A. OBIOHA, MD; MATTHEW W. COLMAN, MD; STEVEN GITELIS, MD; ALAN T. BLANK, MD, MS

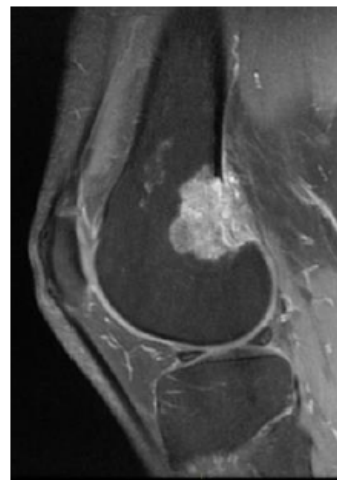
- 6 patients (3 Ewing, 2 Osteosarcoma, 1 chondrosarcoma)
- All 6 cases had negative margins
- Mean post-op FU of 108 weeks (range, 8-211 weeks) – no LR
- Nine of 12 (75%) cumulative (proximal and distal) osteotomy sites went on to achieve union, with a nonunion rate of 25% per osteotomy. One (33%) nonunion occurred after adjuvant radiation therapy.
- Long-term complications were limited to 2 (33.3%) patients overall who had implant failure



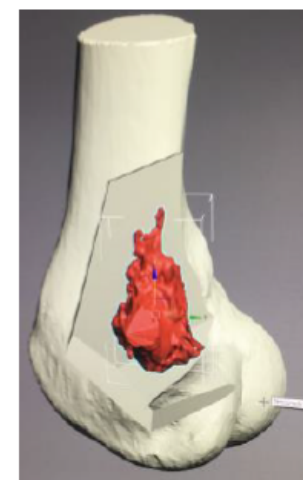
Review Current Concepts in the Resection of Bone Tumors Using a Patient-Specific Three-Dimensional Printed Cutting Guide

Hisaki Aiba ^{1,2}, Benedetta Spazzoli ¹, Shinji Tsukamoto ³ , Andreas F. Mavrogenis ⁴, Tomas F. Hiroaki Kimura ², Hideki Murakami ², Davide Maria Donati ¹ and Costantino Errani ^{1,*} 

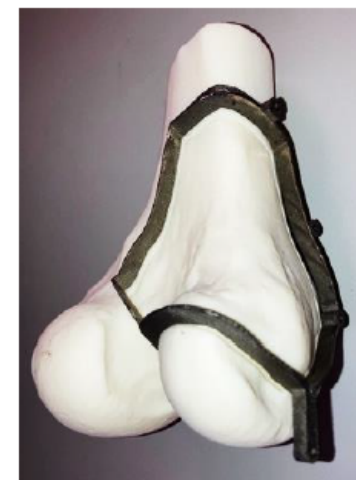
Figure 1. Osteosarcoma in the distal femur with a hemi-cortical resection with a patient specific cutting guide, followed by reconstruction with a massive bone allograft (cut via the patient specific cutting guide)



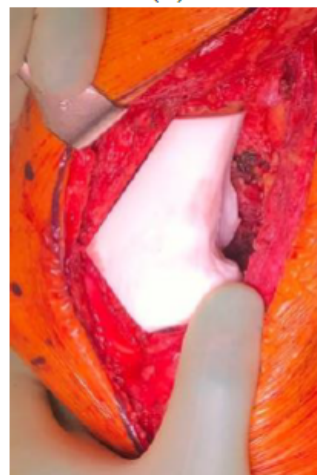
(a)



(b)



(c)



(d)



(e)



(f)

Table 2. Clinical studies investigating PSGs for the resection of bone tumors.

Authors and Study Type	Tumor	Site	Patient Number	Surgical Technique	Negative Surgical Margin	Blood Loss (Mean)	Operation Time (Mean)	Local Recurrence	Accuracy of Osteotomy
Gouin et al. [10], case series	CS, EWS, SS	Pelvis	11	PSG	100%	NA	NA	9%	Mean cutting error * = 0.8 mm
Ma et al. [8], case series	OS	Femur	8	PSG + ALO	NA	746 mL	213 min	0%	NA
Wang et al. [34], randomized control study	CS, GCT, OS	Femur, tibia	33	PSG + ALO	90.9% (CTR) vs. 93.9% (PSG); NS	689 mL (CTR) vs. 650 mL (PSG); $p = 0.037$	136 min (CTR) vs. 145 min (PSG); $p = 0.685$	15.2% (CTR) vs. 9.1% (PSG); $p = 0.708$	NA
Evrard et al. [56], case-control study	CS, EWS, OS	Pelvis	9	PSG + ALO	68.4% (CTR) vs. 89% (PSG); $p = 0.479$	NA	633 min (CTR) vs. 612 min (PSG); $p = 0.877$	37% (CTR) vs. 0% (PSG); $p = 0.035$	NA
Park et al. [57], case series	CS, Meta, OS, SS	Various	12	PSG + PSI or ALO	100%	NA	118 min	8.3%	Maximal cutting error = 3 mm
Hu et al. [30], case series	CS, GCT, OS	Shoulder	7	PSG + PSP + RSA	100%	NA	NA	0%	NA
Liu et al. [28], case-control study	CS, EWS, SS	Pelvis	19	PSG + PSI	89.4% (CTR) vs. 100% (PSG), $p = NA$	2,248 mL (CTR) vs. 1,390 mL (PSG); $p = 0.002$	272 min (CTR) vs. 209 min (PSG); $p = 0.002$	42% (CTR) vs. 5% (PSG); $p = 0.008$	5 mm deviation from the planned margin, 58% (CTR) vs. 0% (PSG), $p = NA$
Müller et al. [6], case series	CS, EWS, OS	Various	12	PSG + ALO	92%	NA	NA	0%	Range of cutting error = 0.7–3.6 mm
Liu et al. [58], case series	CS, EWS, SS	Femur, tibia (intercalary)	19	PSG + PSI	100%	NA	155 min	8.3%	Mean cutting error = 1.9 mm
Wong et al. [44], case series	EWS, OS	Femur, tibia	3	PSG + NVI	100%	NA	276 min	0%	Mean cutting error = 1.6 mm
Evrard et al. [24], case series	ADA, CS, EWS, FD GCT, OS, SS	Various	31	PSG	100%	NA	NA	NA	Mean cutting error = 0.4 mm
Dong et al. [7], case series	EWS, Meta, OS, CS, GCT	Pelvis, femur, tibia	17	PSG + ALO or AUTO	98%	Pelvis, 2,100 mL Limb, 957 mL	618 min	0%	NA

* Mean cutting error indicates the distance between the planned and actual resection lines. ADA, adamantinoma; ALO, allograft; AUTO, autograft; CTR, control group; CS, chondrosarcoma; EWS, Ewing sarcoma; FD, fibrous dysplasia; GCT, giant cell tumor; MAN, manual cutting; Meta, metastatic tumors; min, minute; OS, osteosarcoma; NA, not analyzed; NVI, navigation guide cutting; NS, not significant; PSG, patient-specific guide; PSI, patient-specific implant; RSA, reverse shoulder arthroplasty; SS, soft-tissue sarcomas.

Reconstruction Options



Right Femur Diaphyseal Osteosarcoma



Allograft Reconstruction with Free Vascularized Fibula Graft



Cemented Metal Intercalary Endoprosthesis



Double Compress Endoprosthesis Reconstruction



Growing Endoprosthesis

- 13-year-old female with high grade osteosarcoma



Type II/III IHP without Reconstruction (Flail Hip)

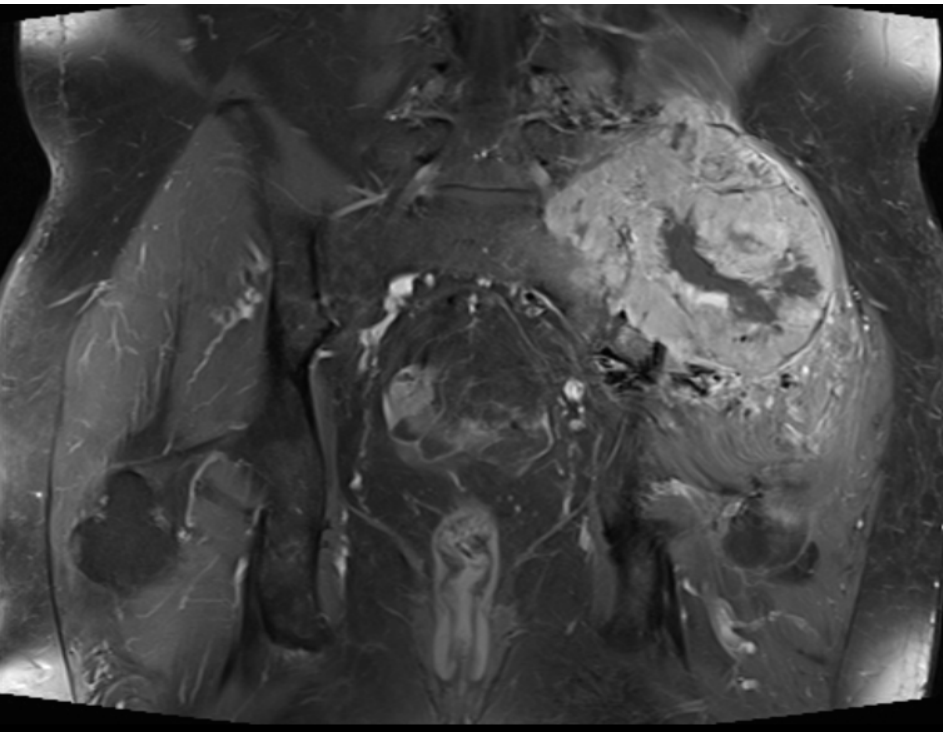
- 5-year-old with Ewing Sarcoma



Bilateral Type III IHP



Type I/IV IHP with Double Barrel Vascularized Fibula Graft



SarcoSIGHT





SarcoSIGHT

Full Title: A Randomised-Control Trial of Fluorescence Guided Sarcoma Surgery
Versus the Standard of Care



Dr. Kenneth Rankin
Chief Investigator



Dr. Thinzar Min Lwin
COH Principal Investigator

SarcoSIGHT

Full Title: A Randomised-Control Trial of Fluorescence Guided Sarcoma Surgery
Versus the Standard of Care

Background

- Surgeons use pre-operative imaging to plan resection
- Operations are then performed by eye and palpation
- There are few adjuncts available for intraoperative guidance

Positive margins significantly correlate with

- higher rate of local recurrence
- reduced time to local recurrence
- poorer overall survival

SarcoSIGHT

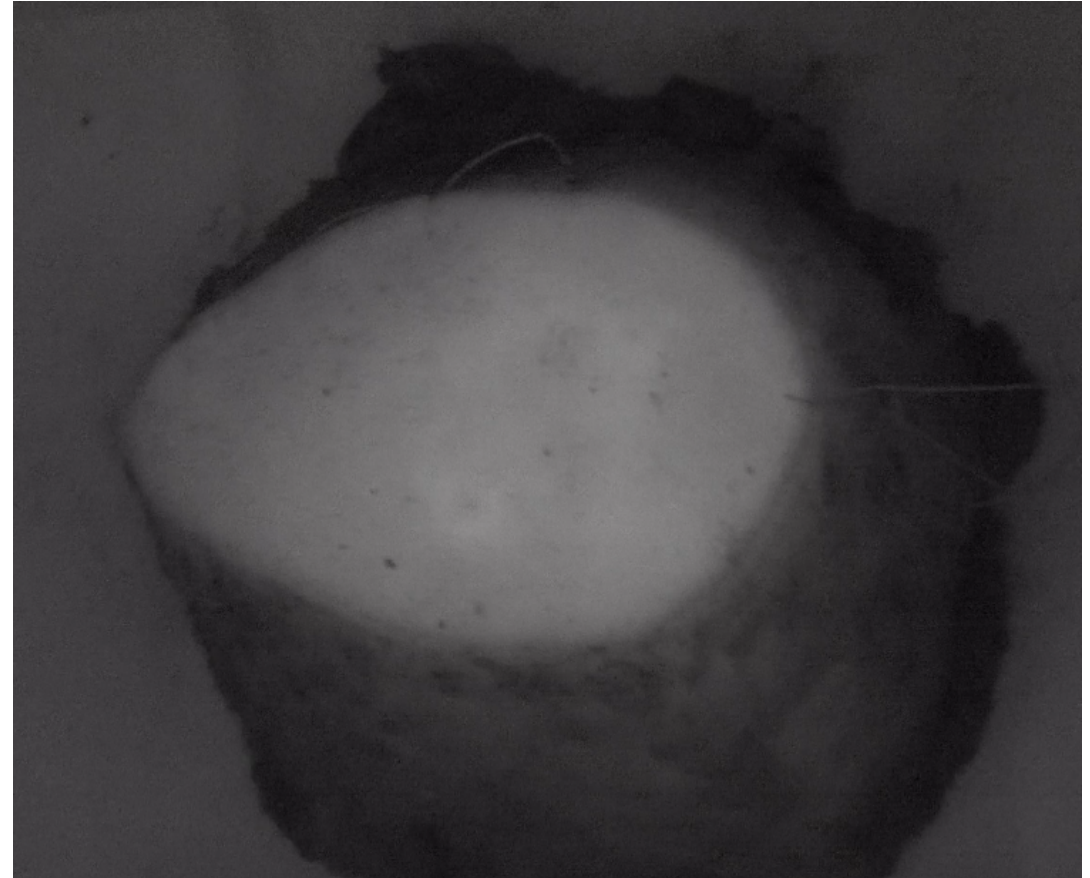
Full Title: A Randomised-Control Trial of Fluorescence Guided Sarcoma Surgery
Versus the Standard of Care

Fluorescence Guided Surgery (FGS)

- Established method
- Administration of fluorescent dye (Indocyanine Green; ICG) followed by visualization of fluorescence intensity using near-infrared camera intra-operatively
- ICG used for decades to assess cardiac output and hepatic function
- ICG used more recently for tissue perfusion assessments intra-operatively in other surgical fields to accurately identify healthy from diseased/poorly vascularized tissue.
- ICG is approved by European Medicines Agency (EMA) – safe and rarely linked to AEs

SarcoSIGHT

Full Title: A Randomised-Control Trial of Fluorescence Guided Sarcoma Surgery
Versus the Standard of Care



Article

Intraoperative Near-Infrared Fluorescence Guided Surgery Using Indocyanine Green (ICG) for the Resection of Sarcomas May Reduce the Positive Margin Rate: An Extended Case Series

Marcus J. Brookes ^{1,2,*}, Corey D. Chan ^{1,2} , Fabio Nicoli ¹ , Timothy P. Crowley ¹, Kanishka M. Ghosh ¹, Thomas Beckingsale ¹, Daniel Saleh ¹, Petra Dildey ¹, Sanjay Gupta ³, Maniram Ragbir ¹ and Kenneth S. Rankin ^{1,2,*} 

- 115 suitable patients were identified: 39 received ICG + NIR fluorescence guided surgery, 76 received conventional surgery.
- Of the patients given ICG, 37/39 tumours fluoresced
- Surgeons felt the procedure was guided by the intra-operative images in 11 cases.
- **Patients receiving ICG had a lower unexpected positive margin rate (5.1% vs. 25.0%, $p = 0.01$).**
- Conclusions: The use of NIR fluorescence cameras in combination with ICG may reduce the unexpected positive margin rate for high grade sarcomas.

