UC San Diego Health

PRIMARY SPINAL MALIGNANCY:
Not Everyone Needs Surgery

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Learning Objectives

1

Identify guideline-concordant non-operative care

- Identify primary spinal malignancies for which non-operative management represents appropriate, guideline-concordant first-line care

2

Know when surgery IS indicated

- Use a multidisciplinary framework to determine when surgery is indicated, and avoid exposing patients to unnecessary surgical morbidity by defaulting to the OR.

Epidemiology at a Glance

<5%

of all primary bone tumors arise in the spine

<1/100k

annual incidence for most histologies

30–50%

present with neurological symptoms at diagnosis

3–5 yr

median diagnostic delay in community settings

Clinical implication

Rarity and diagnostic delay mean most spine surgeons see only a handful of these cases in their career. Referral to high-volume centers with multidisciplinary expertise is the single highest-yield intervention.

The Surgical Bias: Why We Default to the OR

Legitimate Indications to Operate

- Tissue diagnosis when percutaneous biopsy fails
- Mechanical instability (SINS ≥ 7–13)
- Acute neurological compromise unresponsive to medical management
- Radioresistant tumor with epidural cord compression
- Failure of systemic or radiation therapy

Drivers of Surgical Over-Treatment

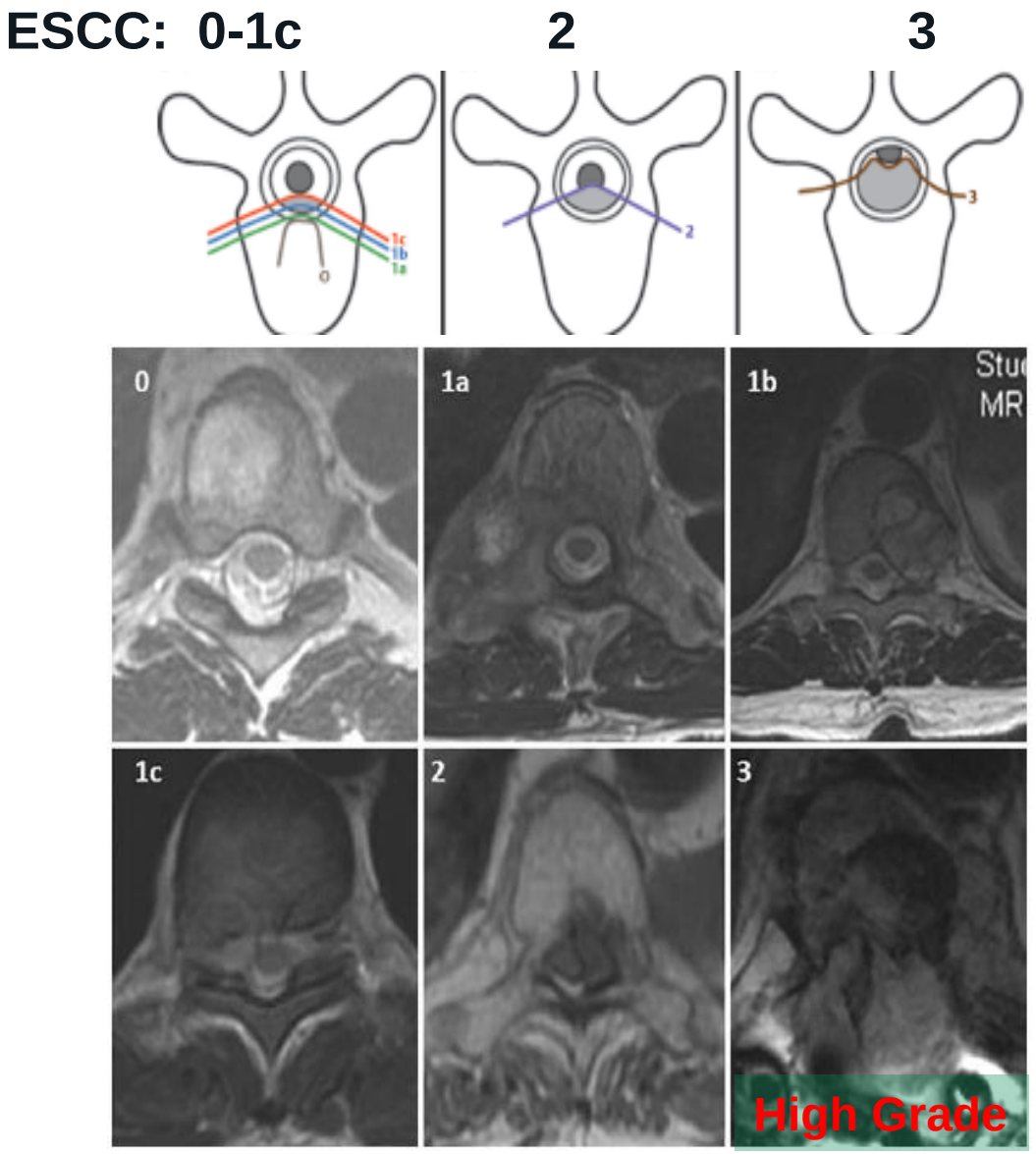
- Referral bias: spine surgeons see it first
- Unfamiliarity with tumor-specific biology
- Neurological urgency overrides staging workup
- Incomplete staging before OR consent
- No MDT tumor board at treating facility
- Assumption: surgery = more aggressive = better

NOMS Framework:
Originally Created for Metastatic Spine Disease

- **N**eurologic
- **O**ncologic
- **M**echanical Stability
- **S**ystemic disease

NOMS: Neurologic

- **Neurologic**
  - **Degree of ESCC**
  - **Myelopathy**
- Oncologic
  - Radio/Chemosensitivity
  - Wide resection advantageous for LR/OS
- Mechanical Instability
  - SINS criteria
- Systemic Disease
  - Survival Nomograms: SORG, PathFX



NOMS: Oncologic

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  - Myelopathy
- **Oncologic**
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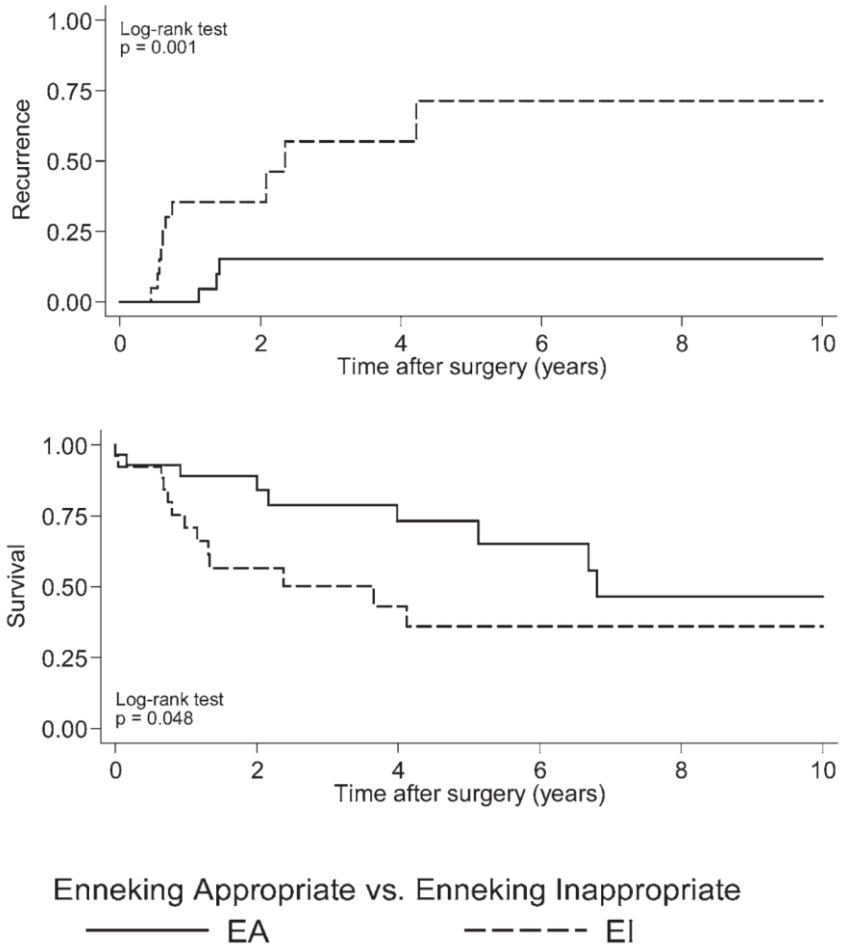
Tumor	Biology	Preferred Treatment	Surgery Role
Chordoma	Notochordal origin	Surgery + RT: preferred combo	Wide resection if acceptable morbidity
Chondrosarcoma	Cartilage origin	Surgical Resection	Wide resection if acceptable morbidity
Osteosarcoma	MAP chemo neoadjuvant	Wide margins goal	Wide resection if acceptable morbidity
Ewing Sarcoma	Chemo-sensitive	RT often provides local control	Wide resection if acceptable morbidity
Plasmacytoma / MM	Exquisitely radiosensitive	Systemic therapy essential	Rarely first-line
Primary Bone Lymphoma	Chemo + RT standard	Surgery: neurologic emergency only	Rarely first-line

NOMS: Osteosarcoma

J Neurosurg Spine 25:59–68, 2016

Osteosarcoma of the spine: prognostic variables for local recurrence and overall survival, a multicenter ambispective study

*Mark B. Dekutoski, MD,[1] Michelle J. Clarke, MD,[2] Peter Rose, MD,[3] Alessandro Luzzati, MD,[4] Laurence D. Rhines, MD,[5] Peter P. Varga, MD,[6] Charles G. Fisher, MD, MHSc, FRCSC,[7] Dean Chou, MD,[8] Michael G. Fehlings, MD, PhD, FRCSC,[9] Jeremy J. Reynolds, FRCS,[10] Richard Williams, FRACS,[11] Nasir A. Quraishi, FRCS,[12] Niccole M. Germscheid, MSc,[13] Daniel M. Sciubba, MD,[14] Ziya L. Gokaslan, MD,[15] Stefano Boriani, MD,[16] and the AOSpine Knowledge Forum Tumor



- Local recurrence
  - EA (10%) vs. EI (44%); **p=0.001**
- Overall survival (69% of EA patients alive)
  - EA (6.8 years) vs. EI (3.7 years); **p=0.048**

NOMS: Ewing Sarcoma

Spine

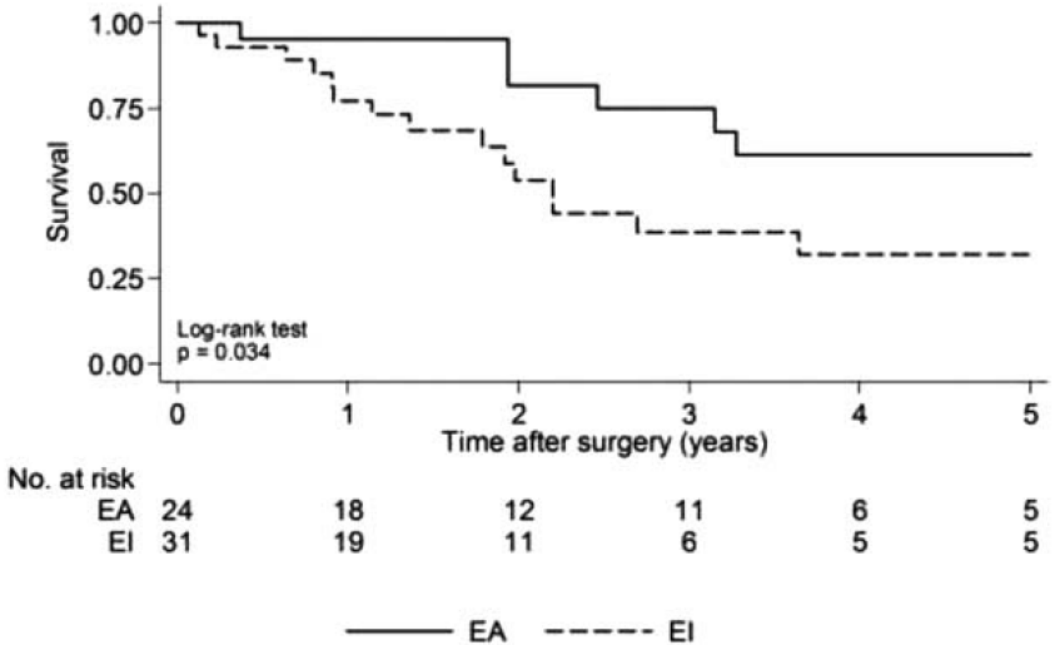
SPINE Volume 43, Number 9, pp 622–629

CLINICAL CASE SERIES

Ewing Sarcoma of the Spine

Prognostic Variables for Survival and Local Control in Surgically Treated Patients

Raphaële Charest-Morin, MD,* Michael S. Dirks, MD,† Shreyaskumar Patel, MD,‡ Stefano Boriani, MD,§ Alessandro Luzzati, MD,¶ Michael G. Fehlings, MD, PhD,|| Charles G. Fisher, MD, MHSc,** Mark B. Dekutoski, MD,†† Richard Williams, MD,‡‡ Nasir A. Quraishi, MD,§§ Ziya L. Gokaslan, MD,¶¶ Chetan Bettegowda, MD, PhD,|||| Niccole M. Germscheid, MSc,*** Peter P. Varga, MD,††† and Laurence D. Rhines, MD‡‡‡, AOSpine Knowledge Forum Tumor



- Local recurrence
  - En bloc (17%) vs. IL (45%); **p=0.025**
- Mortality
  - EA (25%) vs. EI (48%); **p=0.034**
- Limitations: EA group had more chemo, preop chemo, needle biopsy

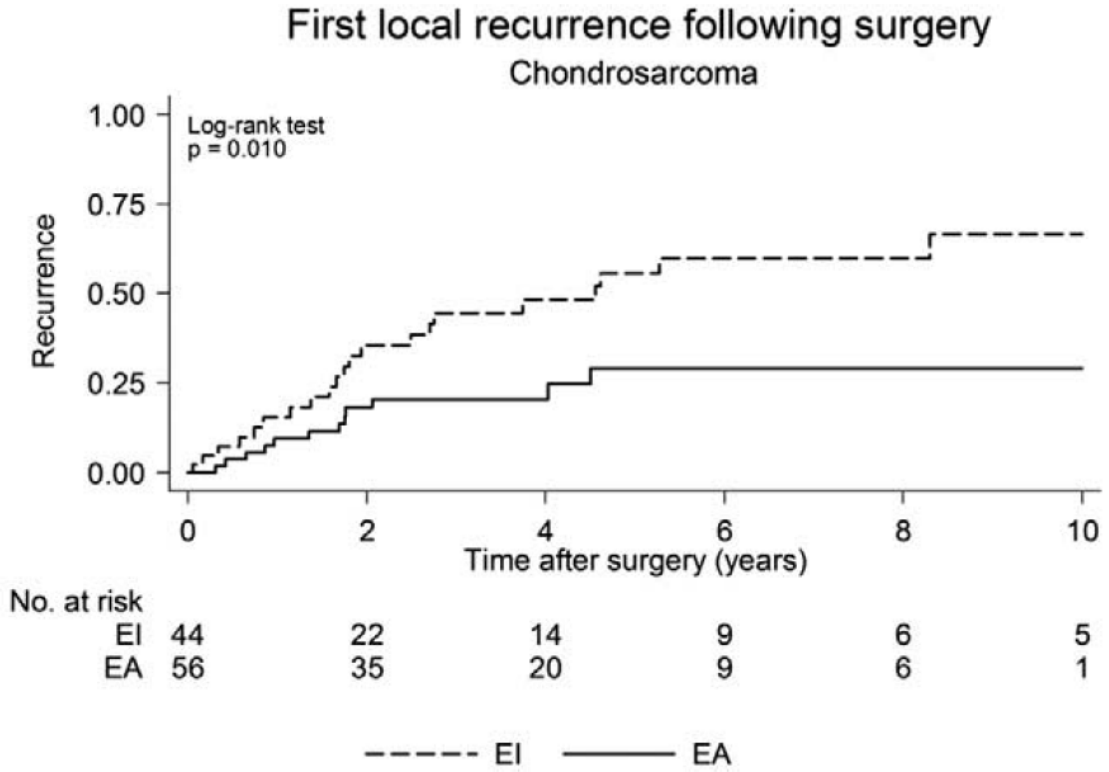
NOMS: Chondrosarcoma

Spine
SPINE Volume 41, Number 8, pp 678–685

CLINICAL CASE SERIES

Surgical Management of Spinal Chondrosarcomas

Charles G. Fisher, MD, MHSc,* Anne L. Versteeg, MD,† Nicolas Dea, MD,‡ Stefano Boriani, MD,§ Peter Pal Varga, MD,¶ Mark B. Dekutoski, MD,‖ Alessandro Luzzati, MD,** Ziya L. Gokaslan, MD,†† Richard P. Williams, MD, FRACS,‡‡ Jeremy J. Reynolds, MD, FRCS,§§ Michael G. Fehlings, MD, PhD, FRCSC,¶¶ Niccole M. Germscheid, MSc,‖‖ Chetan Bettegowda, MD,†† and Laurence D. Rhines, MD***



- Local recurrence
  - EA (21%) vs. EI (48%); **p=0.052**
  - RR of death 3.6 (**p=0.010**)
- Mortality
  - EA (25%) vs. EI (39%); **p=0.529**

NOMS: Chordoma

JNS SPINE

CLINICAL ARTICLE

J Neurosurg Spine 24:644–651, 2016

Mobile spine chordoma: results of 166 patients from the AOSpine Knowledge Forum Tumor database

*Ziya L. Gokaslan, MD,[1] Patricia L. Zadnik, BA,[1] Daniel M. Sciubba, MD,[1] Niccole Germscheid, MSc,[2] C. Rory Goodwin, MD, PhD,[1] Jean-Paul Wolinsky, MD,[1] Chetan Bettegowda, MD, PhD,[1] Mari L. Groves, MD,[1] Alessandro Luzzati, MD,[3] Laurence D. Rhines, MD,[4] Charles G. Fisher, MD, MHSc,[5] Peter Pal Varga, MD,[6] Mark B. Dekutoski, MD,[7] Michelle J. Clarke, MD,[8] Michael G. Fehlings, MD, PhD,[9] Nasir A. Quraishi, FRCS,[10] Dean Chou, MD,[11] Jeremy J. Reynolds, MBChB,[12] Richard P. Williams, MD,[13] Norio Kawahara, MD,[14] and Stefano Boriani, MD[15]

- Local recurrence
  - EA (16%) vs. EI (46%); **p<0.001**
- Mortality
  - EA (22%) vs. EI (38%); **p=0.023**
  - On MV analysis, **p=0.249**

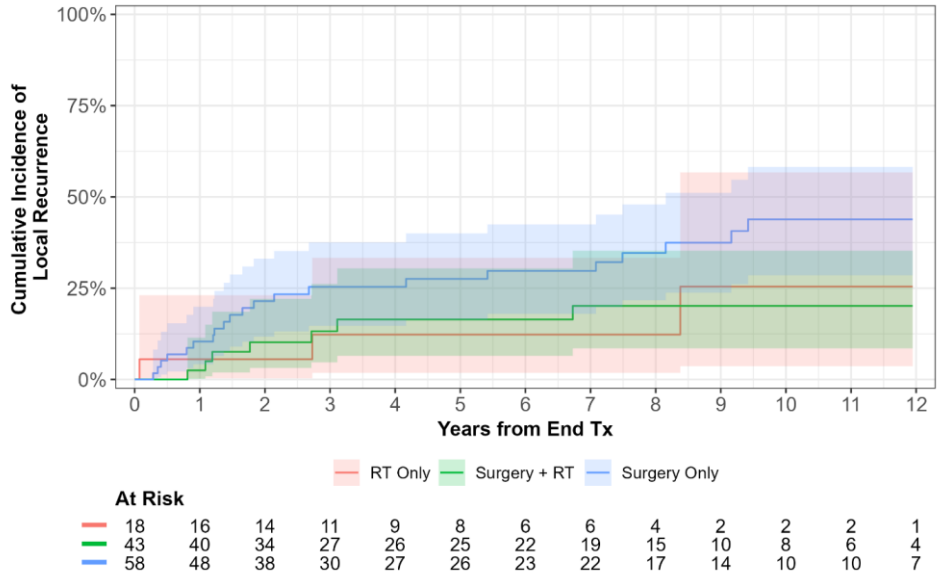
Definitive RT

- SRS (24 Gy x 1): LRFS5 = 90%
- Protons: 62–90% at 5–7 years
- Carbon ion: LRFS5 = 88%

Spine J. 2026 Jun 9:S1529-9430(26)00169-5. doi: 10.1016/j.spinee.2026.06.009.
Online ahead of print.

Long-Term Outcomes of Sacral and Sacrococcygeal Chordomas: A 30-Year Single-Center Experience Comparing Three Treatment Modalities

Takashi Hirase [1], Jessica A Lavery [2], Yoshiya Yamada [3], Mark H Bilsky [4], Max Vaynrub [1], Patrick J Boland [5]



- 10-year LR
  - Resection + RT (20%) vs RT (25%)

Characteristic	1-Year Incidence	2-Year Incidence	5-Year Incidence	10-Year Incidence
Treatment				
Surgery Only	10% (4.2%, 20%)	21% (12%, 33%)	28% (16%, 40%)	44% (29%, 58%)
Surgery + RT	2.5% (0.19%, 11%)	10% (3.2%, 22%)	16% (6.5%, 30%)	20% (8.5%, 35%)
RT Only	5.6% (0.34%, 23%)	5.6% (0.34%, 23%)	12% (1.8%, 33%)	25% (3.7%, 57%)

NOMS: Mechanical Instability

- Neurologic
  - Degree of ESCC
  - Myelopathy
- Oncologic
  - Radio/Chemosensitivity
  - Wide resection advantageous for LR/OS
- **Mechanical Instability**
  - **SINS criteria**
- Systemic Disease
  - Survival Nomograms: SORG, PathFX

SINS
0-6: stable
7-12: potentially unstable
>13: unstable

Component	Description	Score
Location	Junctional Mobile (C3-6, L2-4) Semirigid (T3-10) Rigid (S2-5)	3 2 1 0
Pain	Yes* Non-mechanical pain No	3 1 0
Bone Lesion	Lytic Mixed Blastic	2 1 0
Alignment	Subluxation De novo deformity Normal	4 2 0
Vertebral Body	>50% collapse <50% collapse >50% VB involved None of above	3 2 1 0
Posterior elements	Bilateral Unilateral None	3 1 0

NOM**S**: Systemic Disease

- Neurologic
  - Degree of ESCC
  - Myelopathy
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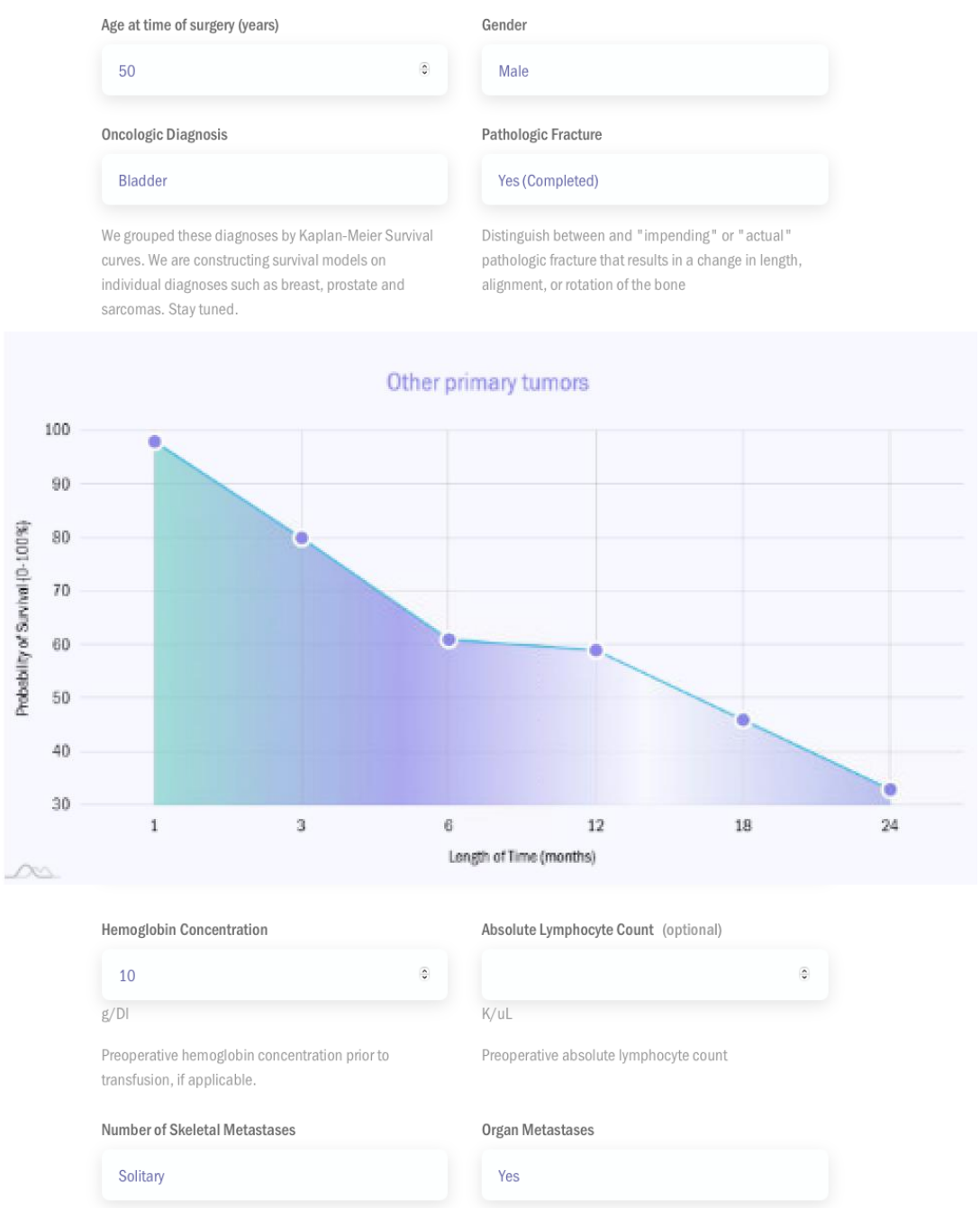
  - Wide resection advantageous for LR/OS
- Mechanical Instability
  - SINS criteria
- **Systemic Disease**
  - **Survival Nomograms: SORG, PathFX**



NOMS Framework

- **Neurologic**
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  - Myelopathy
- **Oncologic**
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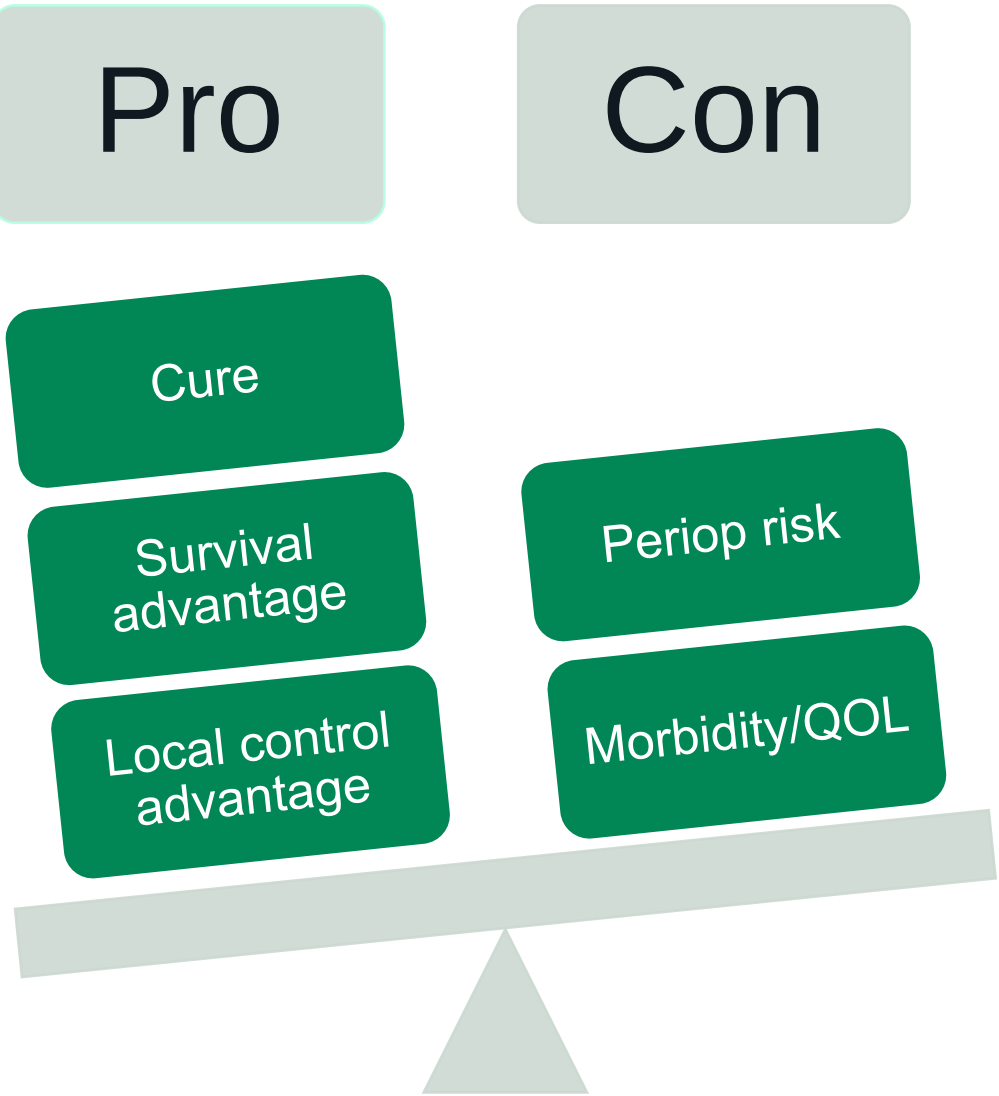
- **Decompression – How?**

- **Resection – At what cost?**

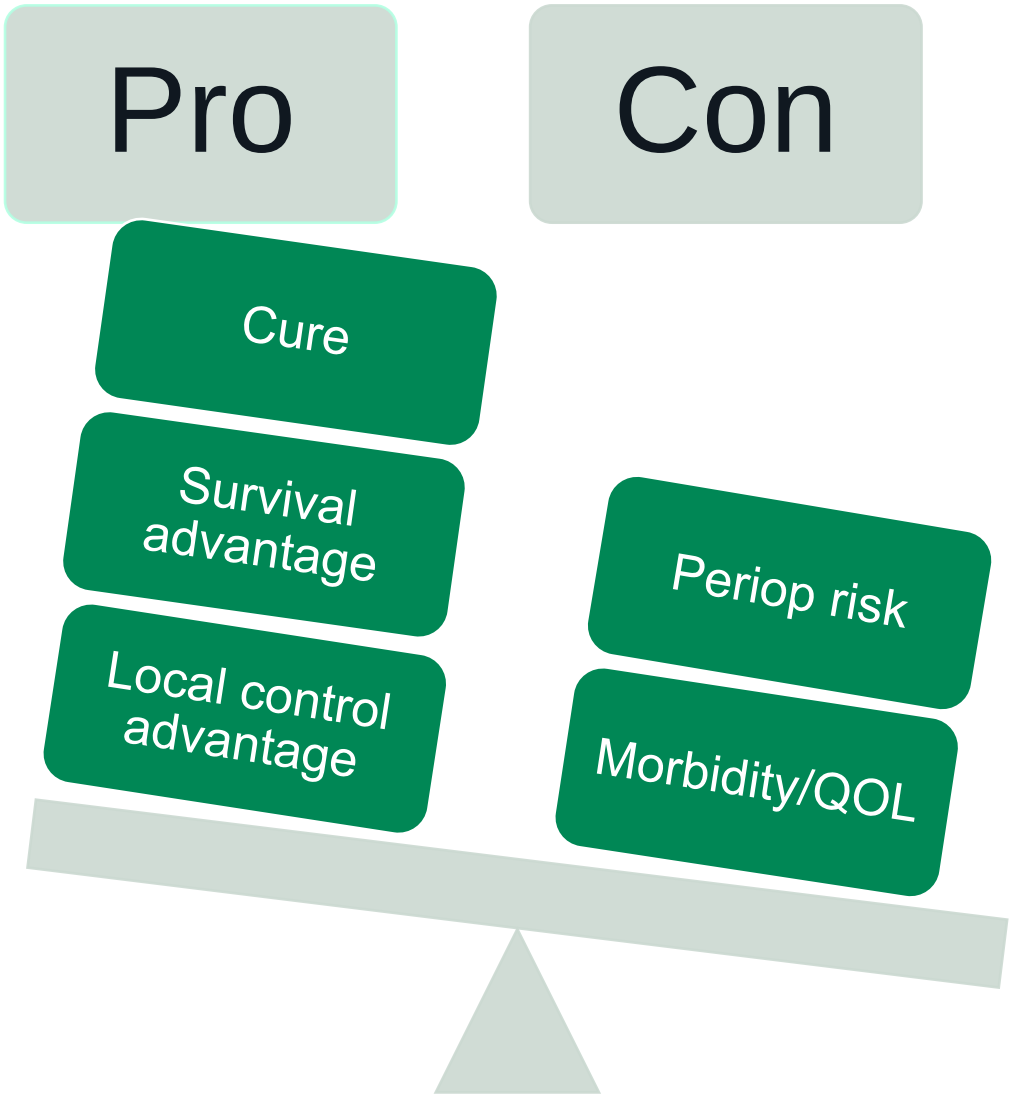
- **Stabilize**

- **Palliative only considerations**

En Bloc Resection?



Should We Consider Alternatives?



Morbidity

Mobile Spine

- Overall complication 13–73.7%
  - 71% for C1-2
- Infection rate 13.7%
  - Prior surgery
  - Plastics
  - Dual approach
  - Multi-level
- Complication-related death 0–7.7%

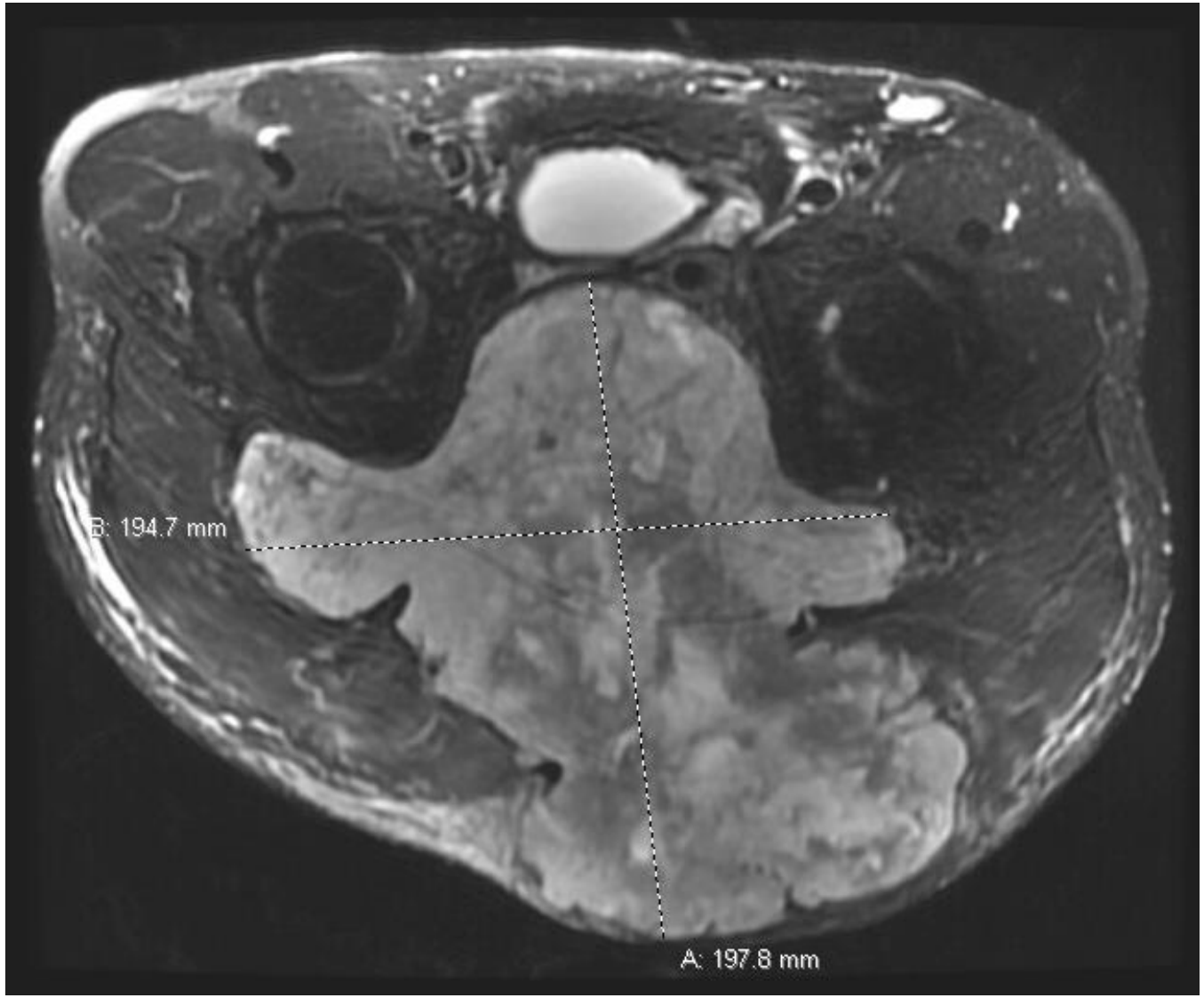
Spine
SPINE Volume 41, Number 20S, pp S212–S217

Optimizing the Adverse Event and HRQOL Profiles in the Management of Primary Spine Tumors

Nicolas Dea, MD, MSc, FRCSC,* Raphaële Charest-Morin, MD, FRCSC,† Daniel M. Sciubba, MD,‡ Justin E. Bird, MD,§ Alexander C. Disch, MD, PhD,¶ Addisu Mesfin, MD,|| Áron Lazáry, MD, PhD,** Charles G. Fisher, MD, MHSc, FRCSC,†† and Christopher Ames, MD‡‡

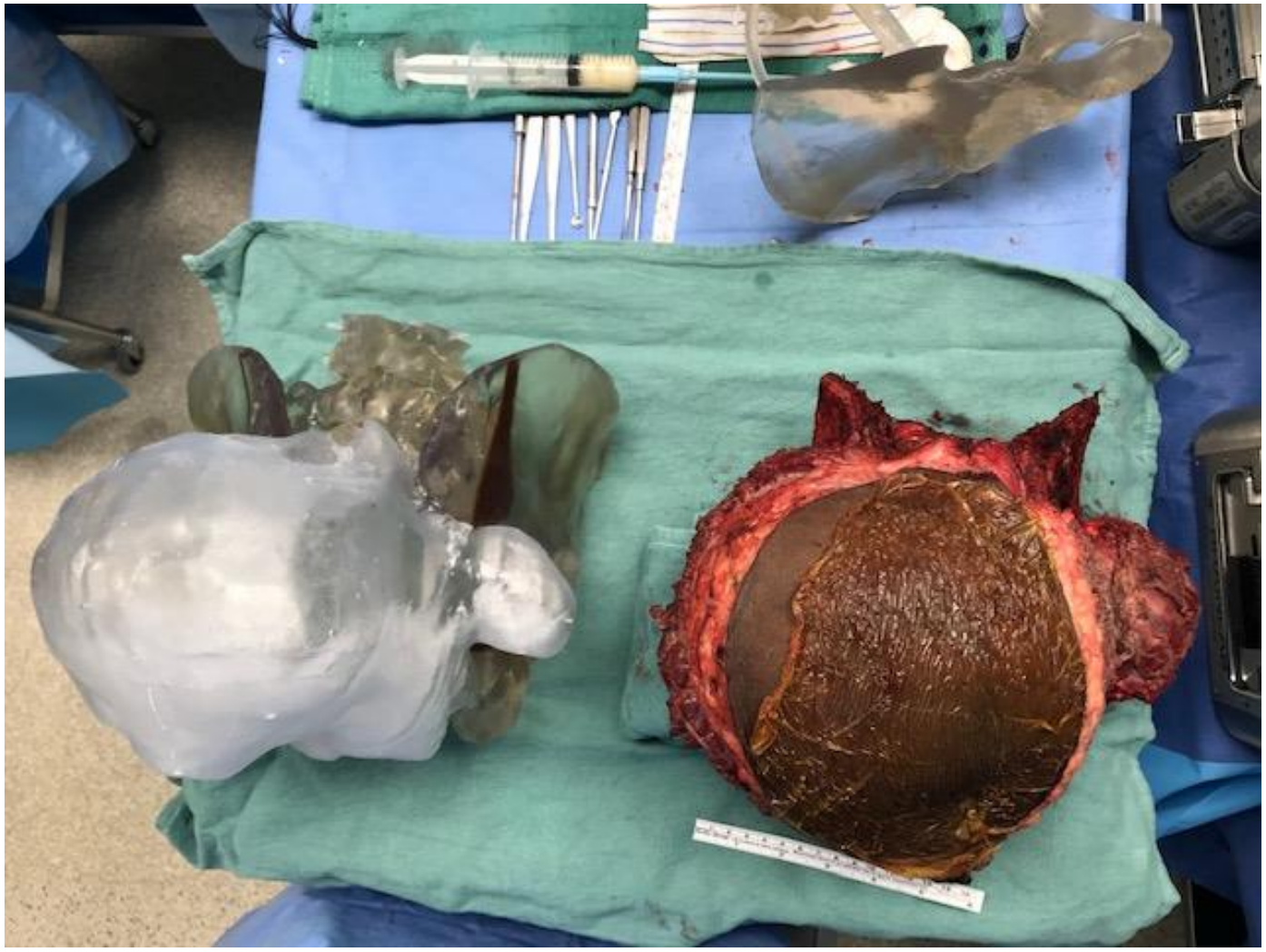
Sacrum

- Overall complications up to 100%
- Wound complication 36% (majority need re-op)
  - Albumin < 3.0
  - OR time > 6 hours
  - Prior surgery
  - Prior RT
- Complication-related death 0–27%


B: 194.7 mm
A: 197.8 mm

20 hours, 5 L blood loss

Anesthesia Start	Fri Jun 12, 2020 0810
In Room/Procedure Room	Fri Jun 12, 2020 0810
Anesthesia Ready	Fri Jun 12, 2020 0822
Procedure Start	Fri Jun 12, 2020 0925
Incision	Fri Jun 12, 2020 1020
Procedure End	Sat Jun 13, 2020 0437
Patient OUT of Room	Sat Jun 13, 2020 0513
Patient to ICU	Sat Jun 13, 2020 0513
Anesthesia End	Sat Jun 13, 2020 0530




Spin: 1
Tilt: 0
A

Sacral Chordoma: Surgery, RT, or Both?

113 patients · 30 years · Single institution (1994–2024)

Surgery + RT

n = 40 (35%)

Reference — Best OS

85%

30-day complications

Surgery Alone

n = 55 (49%)

HR 2.01 (95% CI 0.96–4.20) vs Surg+RT

55%

30-day complications

Definitive RT

n = 18 (16%)

HR 3.73 (95% CI 1.15–12.1) vs Surg+RT

5.6%

30-day complications

The Multidisciplinary Team

Primary spinal malignancy: no single specialty has the complete picture

- **Spine Surgery**
  - Instability, decompression, biopsy tract planning
- **Medical Oncology**
  - Systemic therapy selection, staging, response assessment
- **Radiation Oncology**
  - Modality (EBRT vs SBRT vs proton), dose constraints
- **Interventional Radiology**
  - Percutaneous biopsy, embolization
- **Pathology**
  - Expert bone tumor pathologist essential — not all labs are equal
- **MSK Radiology**
  - Staging MRI, PET/CT, response assessment

NOMS Framework

- **Neurologic**
  - Degree of ESCC
  - Myelopathy

  → **Decompression – How?**
- **Oncologic**
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  → **Resection – At what cost?**
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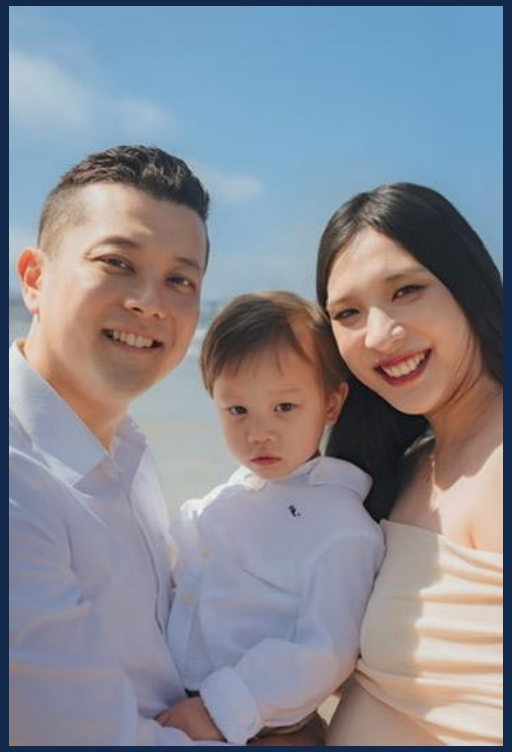
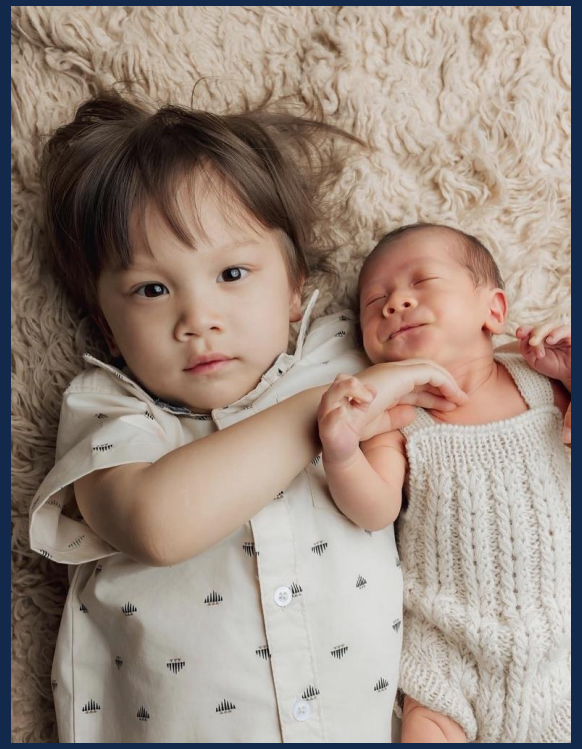


Thank You

Questions & Discussion

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