Ankle Arthritis Management: Fusion versus Arthroplasty

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Disclosures

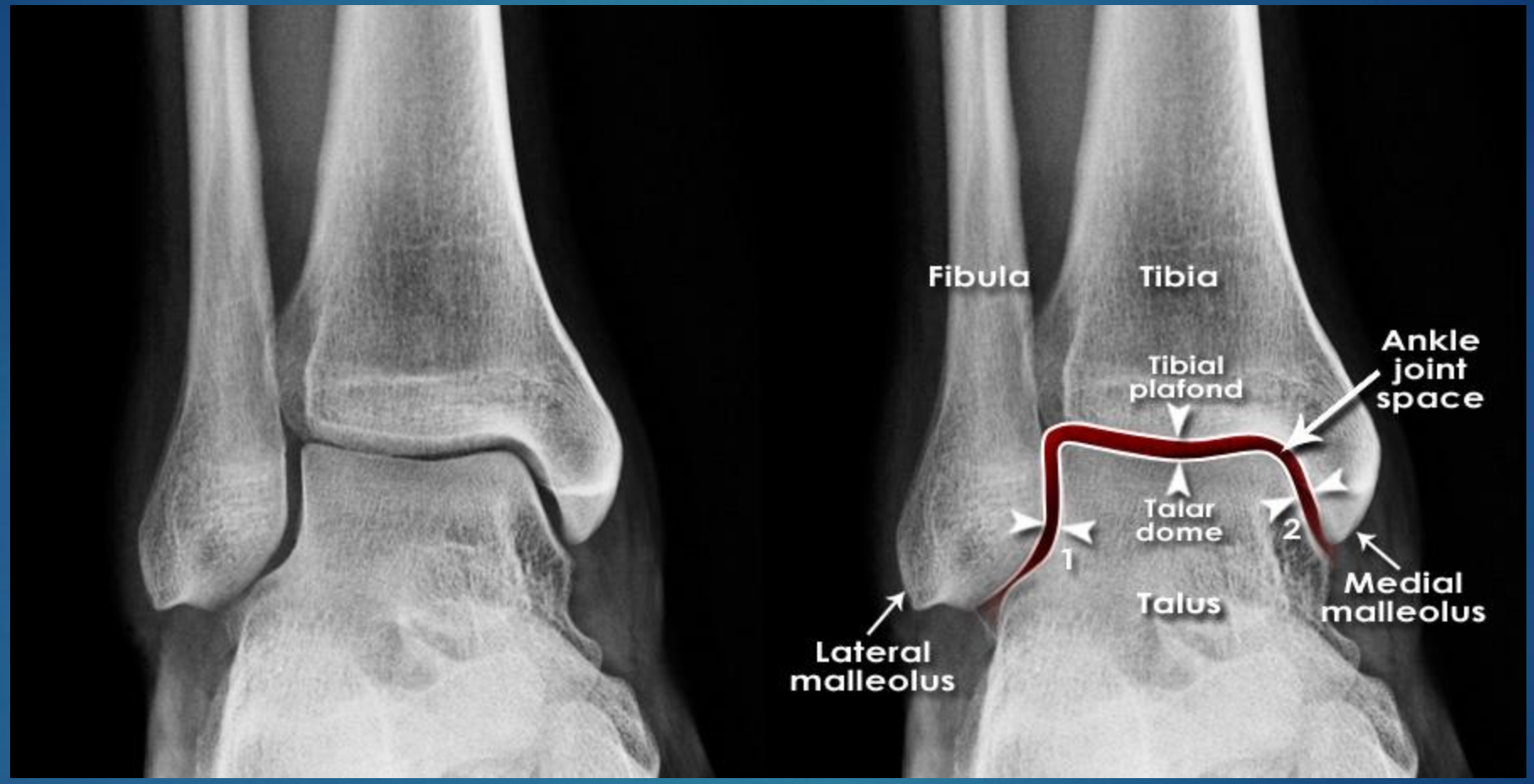
- I have no relevant financial relationships with ineligible companies to disclose.

Outline

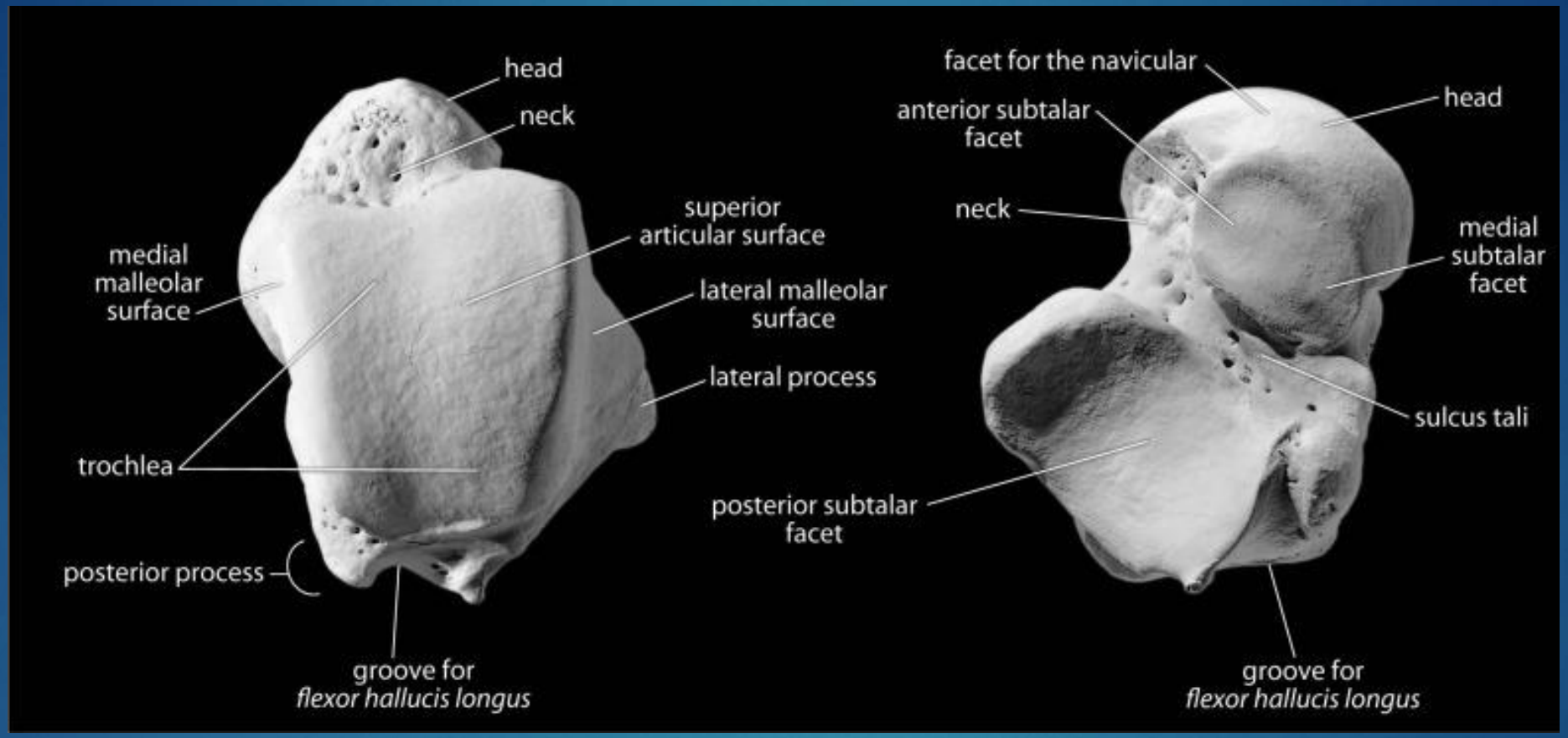
- Anatomy
- Epidemiology
- Nonsurgical Tx
- Surgical options
- Fusion
- Arthroplasty
- Revisions and custom
- Current trends
- My approach

Anatomy[1]

- Ankle is highly congruent hinge joint – tibia, talus, fibula = Mortise
- Movement is primarily sagittal plane, average 15-20 degrees ER
  - Variable motion axis based on lower limb alignment
  - Coupled movements with the foot involving Chopart and Subtalar
    - DF – ER – Pronation
    - PF – IR – Supination
- Very small joint given the forces it handles
  - Around 13cm^2 talus cartilage surface area – knee is ~120
  - Up to 5x BW with walking, about 10-15 x BW with running

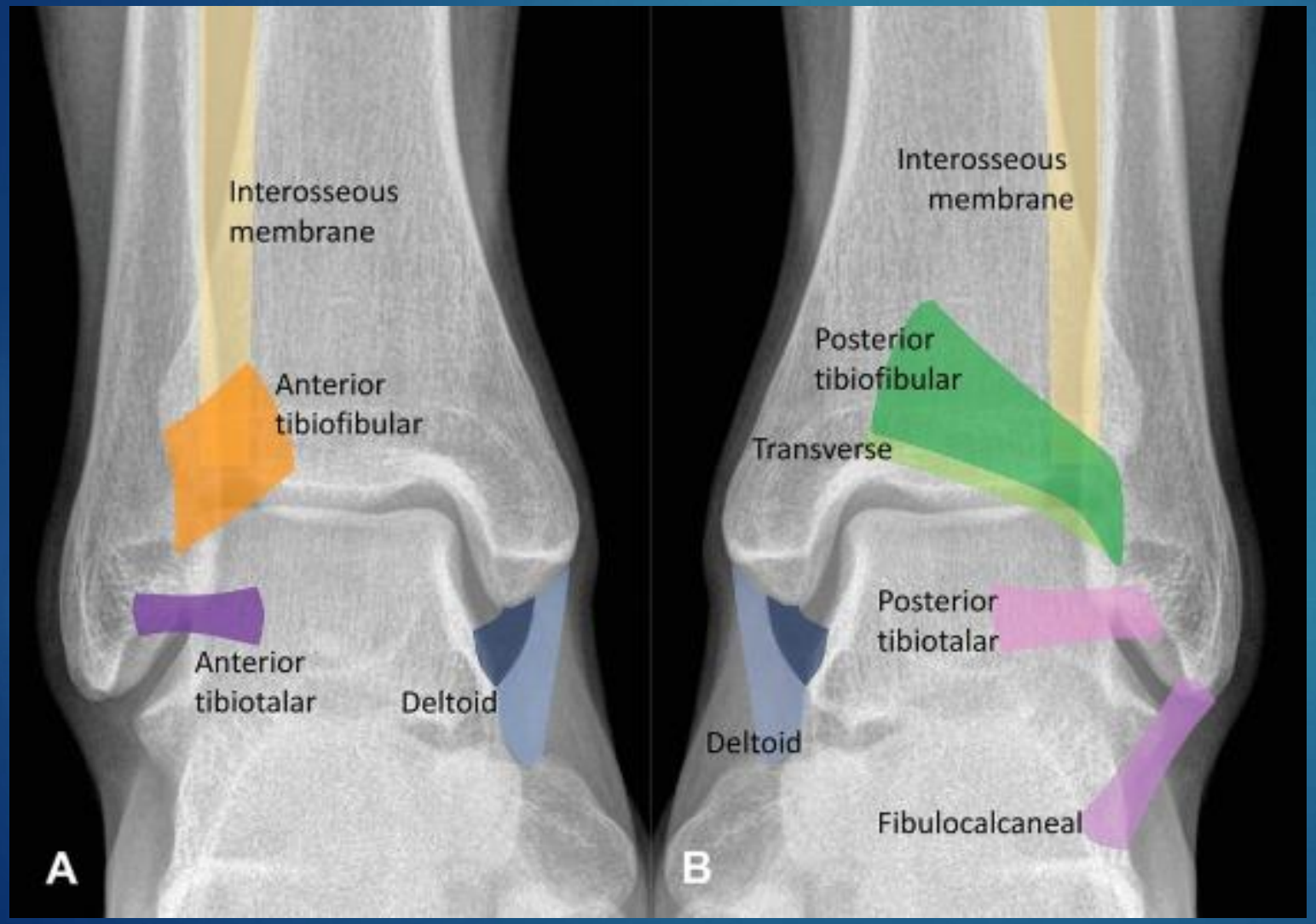

Fibula
Tibia
Tibial plafond
Ankle joint space
Talar dome
1
2
Talus
Medial malleolus
Lateral malleolus


Weight Bearing
L
CBN



- Talar dome is wider anterior…more stable in DF
- Central Sulcus…adds to congruity

Complex ligamentous structure



Lateral
- ATFL
- CFL
- PTFL

Medial – Deltoid[2]
- Superficial
- Deep
- 5 components…

Syndesmosis
- AITFL
- PITFL
- IOM

Ankle Arthritis[3]

- Etiology:
  - Post-traumatic (70%+) – fractures, sprains, OCDs
  - Primary osteoarthritis – often varus tilt
  - Secondary – deformity, inflammatory, infectious, Charcot, AVN, etc.

- Epidemiology
  - Around 30/100k/year
  - Less common than hip (~88/100k/year) and knee (~240/100k/year)
  - Presentation tends to be younger compared to hip and knee

Nonsurgical care

- NSAIDS – oral and topical
- Injections
  - Corticosteroid
  - PRP, HA, Stem cells – limited supporting evidence[4]
- Stretches and PT – preserve motion
- Bracing – OTC and custom
  - Arizona – historical gold standard
  - PTB AFO w/ PDE (IDEO, REAKTIV, EXOSYM, etc)
  - Rocker bottom shoe

Surgical options – Joint preservation

- Debridement/cheilectomy
  - Arthroscopic or open approach
  - Best for anterior wear and impinging spurs
- Deformity correction
  - Supramalleolar osteotomy[5]
  - Foot deformity correction[6]
  - Best for mild wear and deformity patterns
- Distraction Arthroplasty[7]
  - Limited indications
  - Mild arthritis, no deformity, good motion
  - High revision rate within 5 years

Ankle Arthrodesis

- Historical gold standard salvage option
  - Open approach
  - Arthroscopic
  - MIS
- Outcomes
  - Reliable pain relief
  - Low reoperation rate
- Limitations
  - Gait alteration/motion loss[8]
  - Progressive wear of essential joints[9]
  - Nonunion rate ~5-10%[10]
  - Prolonged NWB[11]

Ankle Arthroplasty

- Introduced in the 1970s…
- Modern designs:
  - Ongrowth/ingrowth
  - Mobile vs fixed bearing
  - Advanced polyethylene
  - PSI/3D printing
  - Revision systems and custom
- Motion preserving
  - Allows more normal gait
  - Offloads essential joints – concomitant ST arthritis?[12,13]

Ankle Arthroplasty

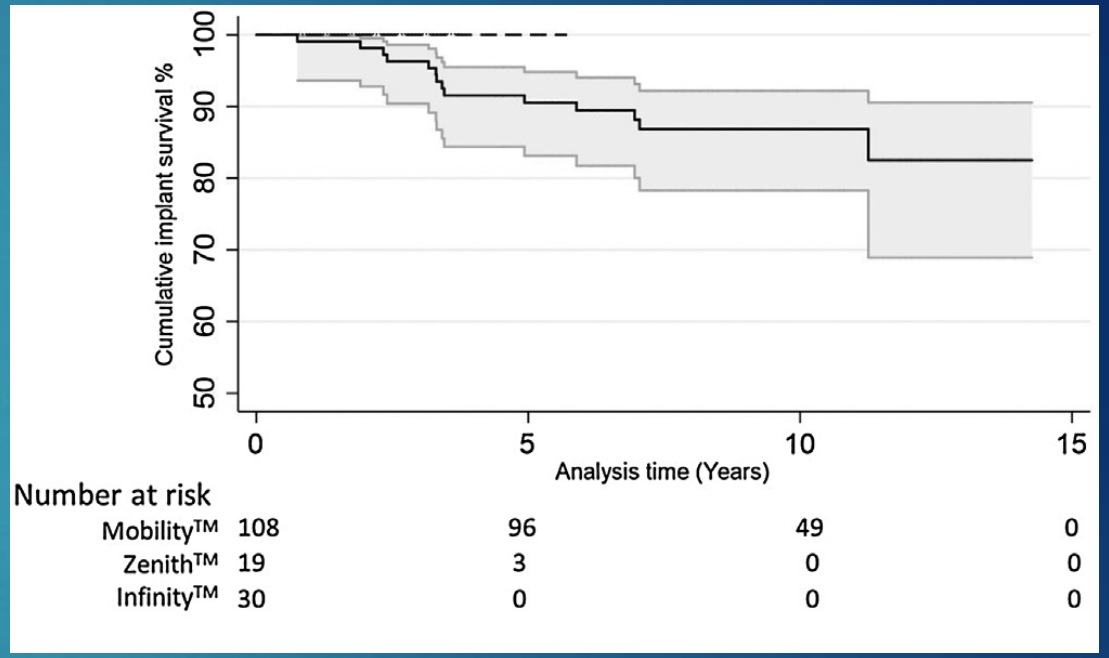
- Contraindications
  - Young Age
  - Morbid obesity
  - Neuropathy
  - Severe deformity
  - Active Infection
  - Poor soft tissues/bone stock
- Approaches
  - Majority of implants designed for anterior approach
    - Wound issues can be a challenge – anteromedial extensile[14,15]
  - One current implant with lateral approach via fibular osteotomy
  - Conversion of fusion to arthroplasty is possible, but outcomes mixed[16]

Arthroplasty Outcomes

- Pain relief
  - 95% or more report significant improvement
  - Pain relief and function improve up to 2 years
  - Able to resume low impact exercises[17]
  - Early motion and weight bearing
  - Motion preserving, can improve motion in some
- Complications
  - Fracture
  - Periarticular cysts
  - Talus collapse/aseptic loosening
  - Stiffness/Ankylosis
  - Infection
  - Wound Healing issues
  - Polyethylene wear/failure
  - Instability

Arthroplasty Survivorship

- Survivorship – all implants ~ 90% at 10 years[18,19]
  - Zimmer TM – 100% at 6 years[20]
  - Infinity – 91% at 9 years[21]
  - Salto mobile – 93% at 10 years[22]
  - InBone II – 98% at 5 years[23]
  - STAR – 90% at 10 years, 73% at 15 years[24]
- Mobile vs Fixed – fixed maybe better on paper, but mobile works well if properly balanced[25]
- Younger cohort generally less implant longevity[3]



Revisions

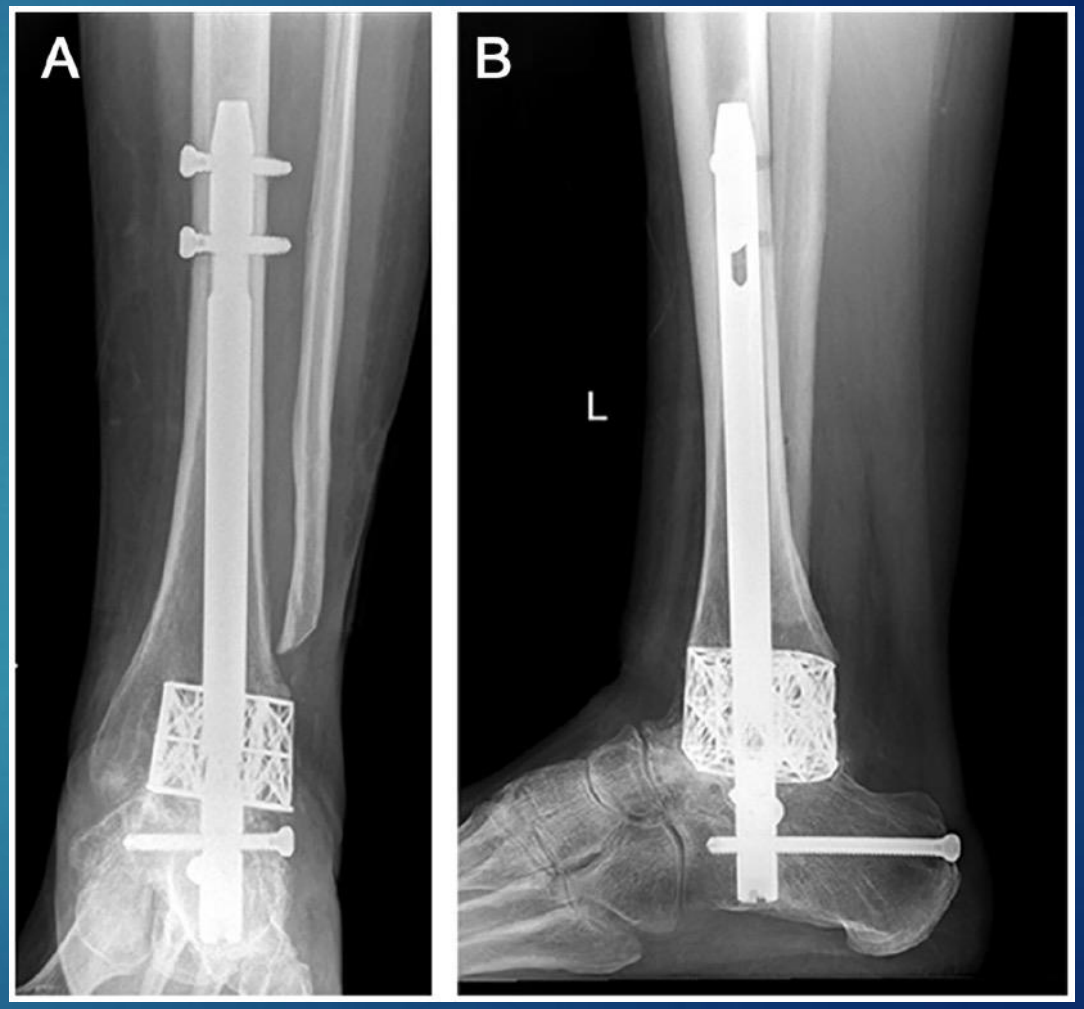
- Revision TAR outcomes are generally poorer[26]
  - Invision survivorship – 81% at 4 years[27]
  - Tibial implants tend to fail earlier, revision more successful
  - Talar implant failure and combined failure = worse outcome
- Revision surgery is never as easy, pain relief is less reliable
  - Poor bone stock, scar tissue, increased wound issues, nerve injuries, etc
- Modular implant systems
  - Everything to tackle most revision challenges in one set
- Custom implants – for the most challenging problems…

Custom implants

- Total Talus Replacement – AVN and failed prior TAR
  - Can replicate native contralateral talus
  - Fusion ingrowth surfaces can be added
  - Can add talus dome for TAR
- Even for standard primary TAR!
  - PSI cutting guides
  - 3D printed metal structures to replicate microscopic bone structure

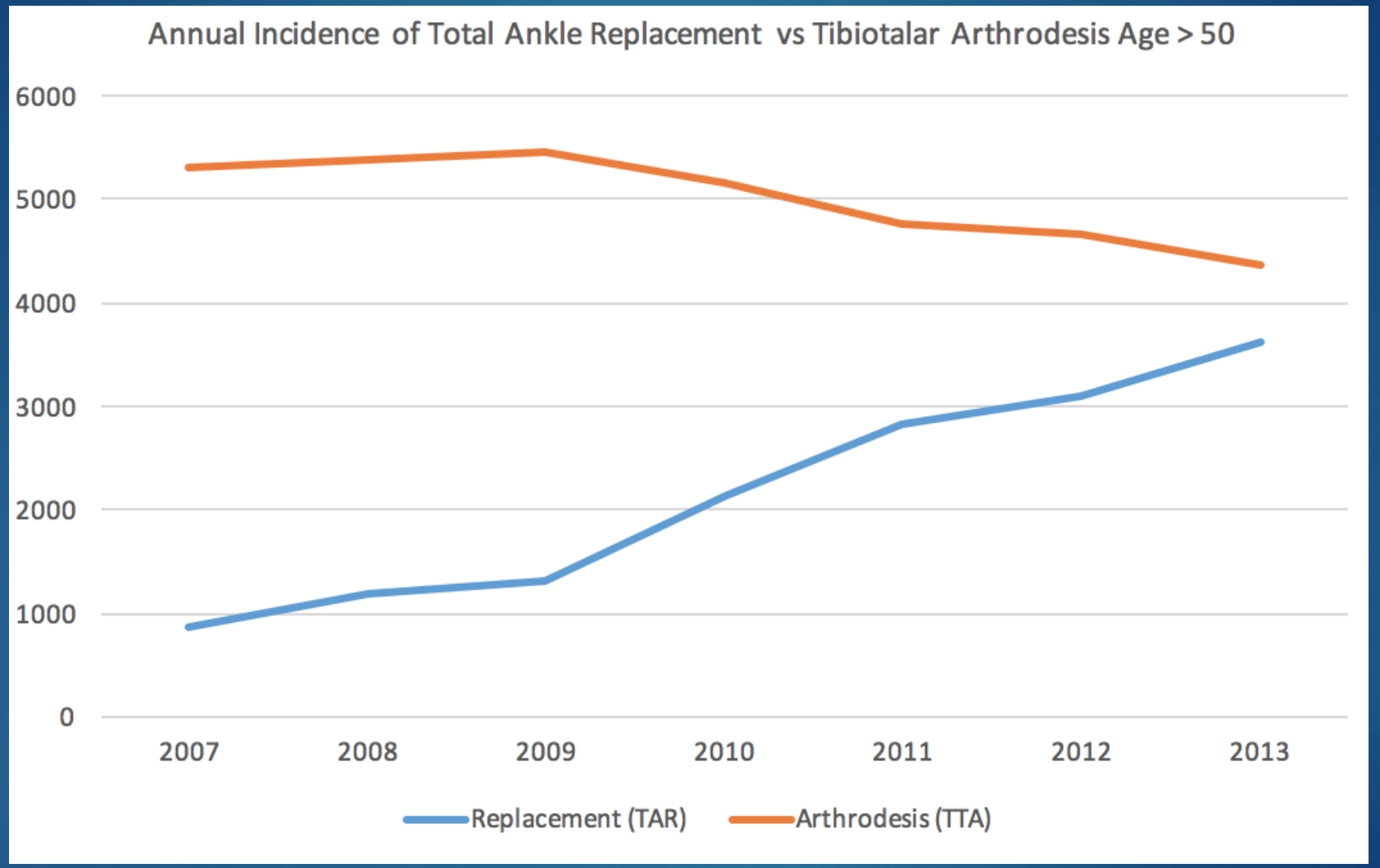
Custom fusion implants

- Failed TAR creates a new challenge
  - Bone Loss, fractures
  - Soft tissue damage
  - Infection
  - Instability
- Custom fusion implants for TTC
- High complication rate but useful option to avoid amputation[28]



Current Trends

- Significant increased use of TAR over last 2 decades[29,30]
  - Complication rates and revisions rates have not increased at the same pace[31]
  - Research has focused on risk stratification to predict/improve outcomes
  - Implant technology has improved significantly
  - PSI has contributed to increased number of surgeons performing
  - Revision systems and custom implants help with challenges
- Rates of ankle fusion not significantly changed
- Latest data shows similar annual rates of TAR and AA.


Annual Incidence of Total Ankle Replacement vs Tibiotalar Arthrodesis Age > 50
6000
5000
4000
3000
2000
1000
0
2007
2008
2009
2010
2011
2012
2013
Replacement (TAR)
Arthrodesis (TTA)

Projected growth of TAR[32]

- 2017 there were 5315 primary TAR performed, up 564% compared to 2005
  - Linear regression modeling suggests by 2030 we could see another 800% increase in primary ankle arthroplasty
- 2017 there were 1170 revision TAR, up 155% from 2005
  - Technology and surgeon experience have improved ultilization without as large of an increase in revisions and complications

Projections and Epidemiology of Total Ankle and Revision Total Ankle Arthroplasty in the United States to 2030

Jason A. Shah; Andrew M. Schwartz; Kevin X. Farley; Karim Mahmoud Khamis, MB BCh; Ahmed K. Attia, MD; Sameh (Sam) A. Labib, MD; Rishin J. Kadakia, MD

Category: Ankle Arthritis; Ankle

Keywords: Ankle Arthroplasty; Ankle Arthritis; Ankle Fusion

Introduction/Purpose: Total ankle arthroplasty (TAA) utilization is increasing in the United States. As the incidence of this procedure grows, it is important for providers to understand the future projections for ankle arthroplasty and more importantly revision total ankle arthroplasty (rTAA).

Methods: The national inpatient sample (USA) was queried from 2005 to 2017 for all TAA and rTAA. Poisson and linear regression analyses were performed to project annual incidence of TAA and rTAA to 2030, with subgroup analyses on septic rTAA.

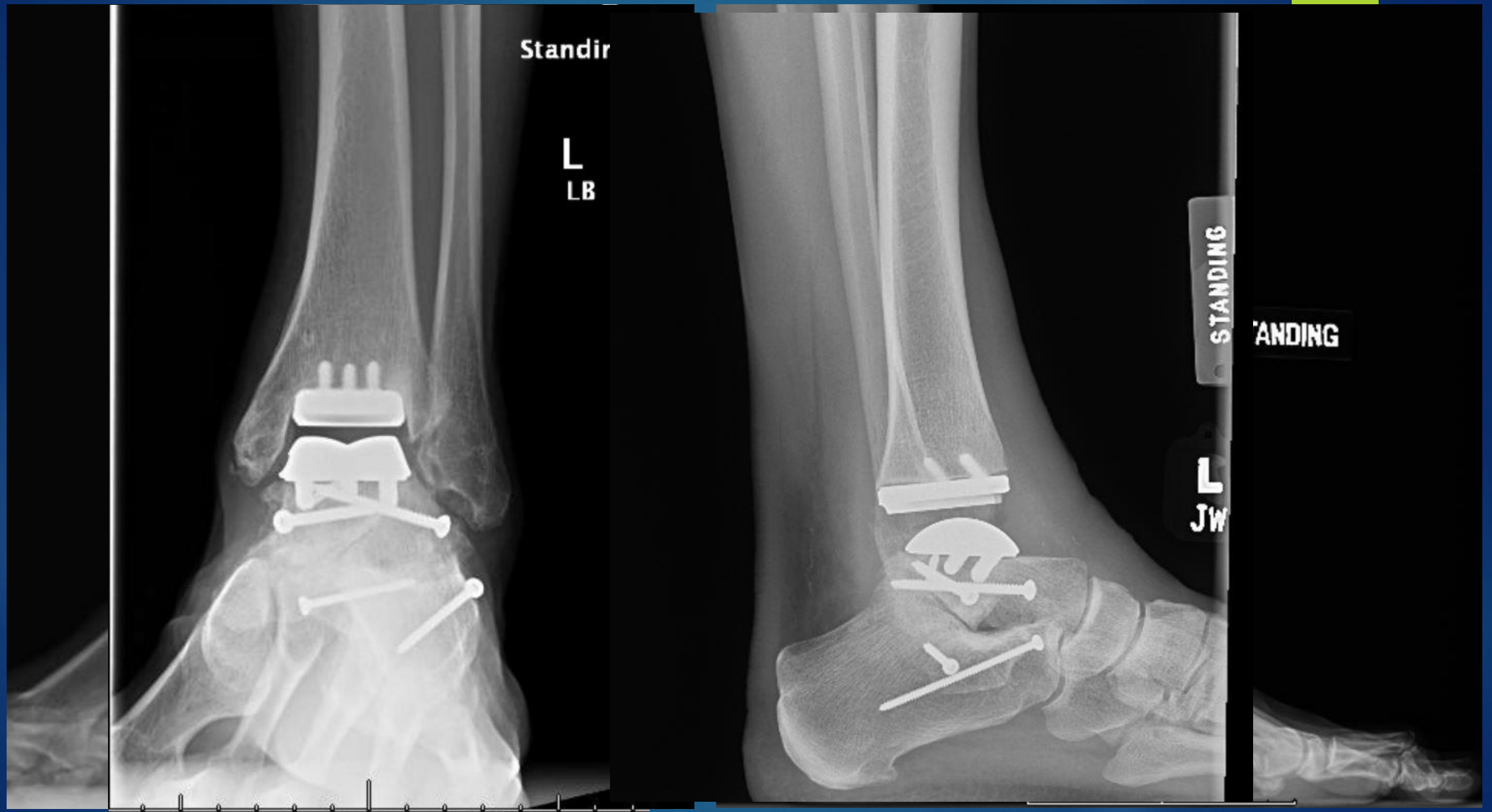
Results: There were 5315 TAAs performed in 2017, a 564% increase when compared to the TAAs performed in 2005. From 2017 to 2030, the incidence of TAAs is projected to increase from 110% to 796%. There were 1170 rTAAs performed in 2017, 155% increase when compared to rTAAs performed in 2005. There was a 256% increase in the incidence of septic rTAAs from 2005 to 2017 with a projected increase between 22% and 120% by 2030.

Conclusion: The incidence of both TAAs and rTAAs are projected to significantly increase over the next decade. Given the known risk factors of TAA and rTAA, these findings reinforce the need for thoughtful consideration when selecting patients for TAA.

Foot & Ankle Orthopaedics, 7(4)
DOI: 10.1177/24730114215S00937

My current approach

- Maximize conservative care, shared decision making – TAR vs AA
  - Neuropathy, poor soft tissues, very young – AA
  - Nicotine use precludes surgery
- Infinity w/ flat cut talus – PSI Prophecy Protocol
  - primary TAR with 15* or less of coronal deformity, good bone, younger patients
- Inbone w/ flat cut talus
  - primary TAR with worse deformity, older patient, softer bone, heavier patients, etc
  - Simple revision TAR with adequate bone stock
- Invision system/custom implants – bigger revisions
- Some foot deformity can be corrected simultaneously. Bigger reconstructions will stage first, TAR 3-6 months after index


Standir
L
LB
STANDING
'ANDING
L
JW
Bit overlay(s) present

Conclusions

- Ankle arthrodesis and arthroplasty are effective terminal surgery options for pain relief in patients with tibiotalar arthritis.
- Technology has advanced significantly, outcomes are more predictable, and known complications are easier to avoid.
- I expect the implant to survive for at least 10 years, barring any early complications. I explain to patients that data is still in progress, and implants might last 15+ years.
- When given the option for both surgeries, patients are overwhelmingly choosing arthroplasty to maintain motion and relatively normal gait.
- Arthroplasty is no longer the future…it is very much the present…and it will continue to evolve and improve

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Questions? Thanks!