

Lower Limb & Partial Foot Amputations

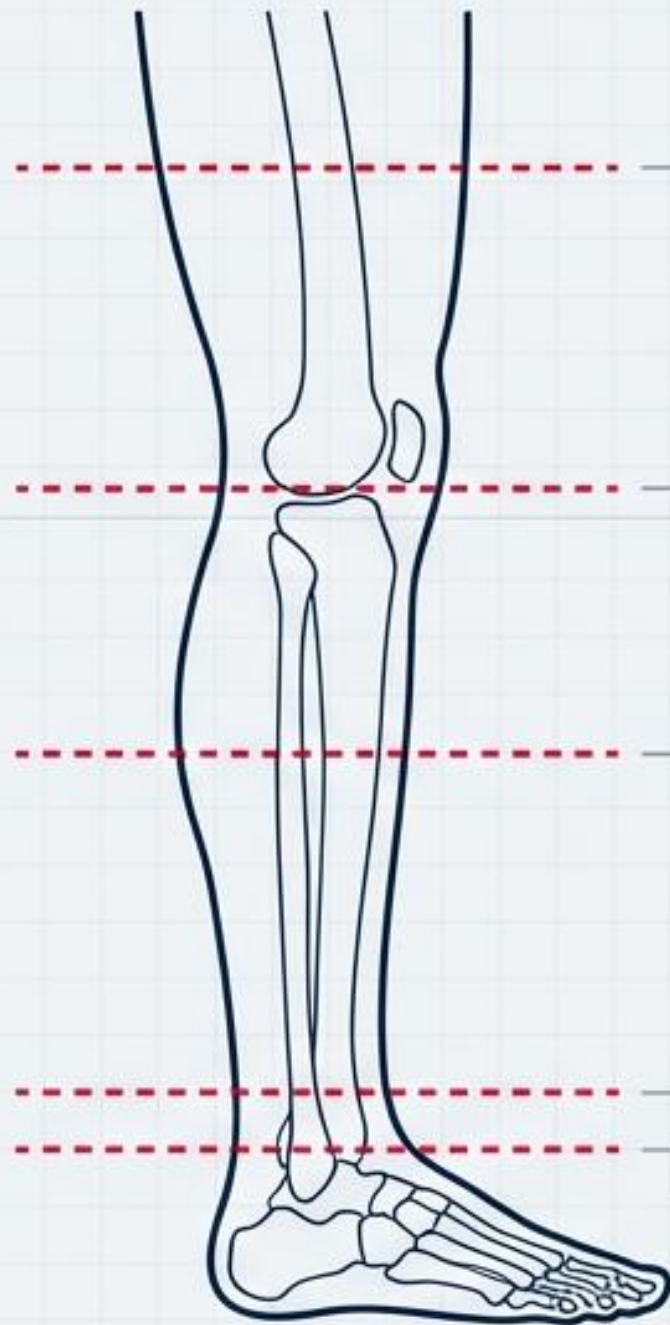
An anatomical atlas and clinical reference guide for surgical biomechanics.

**Second stage
Prosthetics I**

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Mapping the Five Levels of Lower Limb Amputation



Above-Knee Amputation (AKA)

Also called transfemoral amputation.
Removes limb above the knee joint.

Clinical Note: Requires significantly more energy for walking with a prosthesis.

Through-Knee Amputation

Also known as knee disarticulation.
Occurs through the knee joint without cutting the femur.

Below-Knee Amputation (BKA)

Also called transtibial amputation.
Preserves the femur and knee function.

Clinical Note: Most common major lower limb amputation. Offers better mobility and prosthetic control compared to AKA.

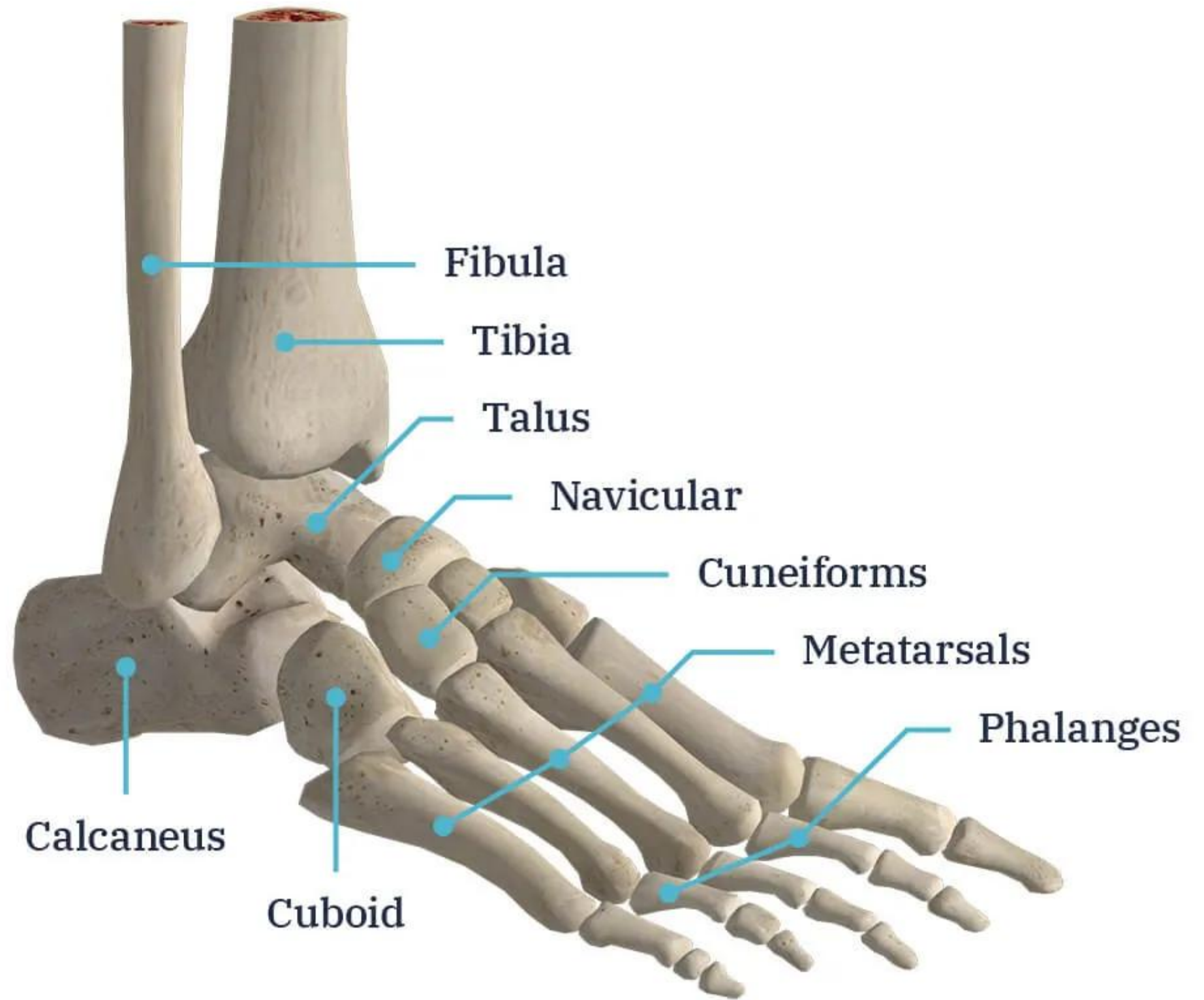
Ankle-Level (Syme's Amputation)

Removal of the foot at the ankle joint while actively preserving the heel pad for weight-bearing.

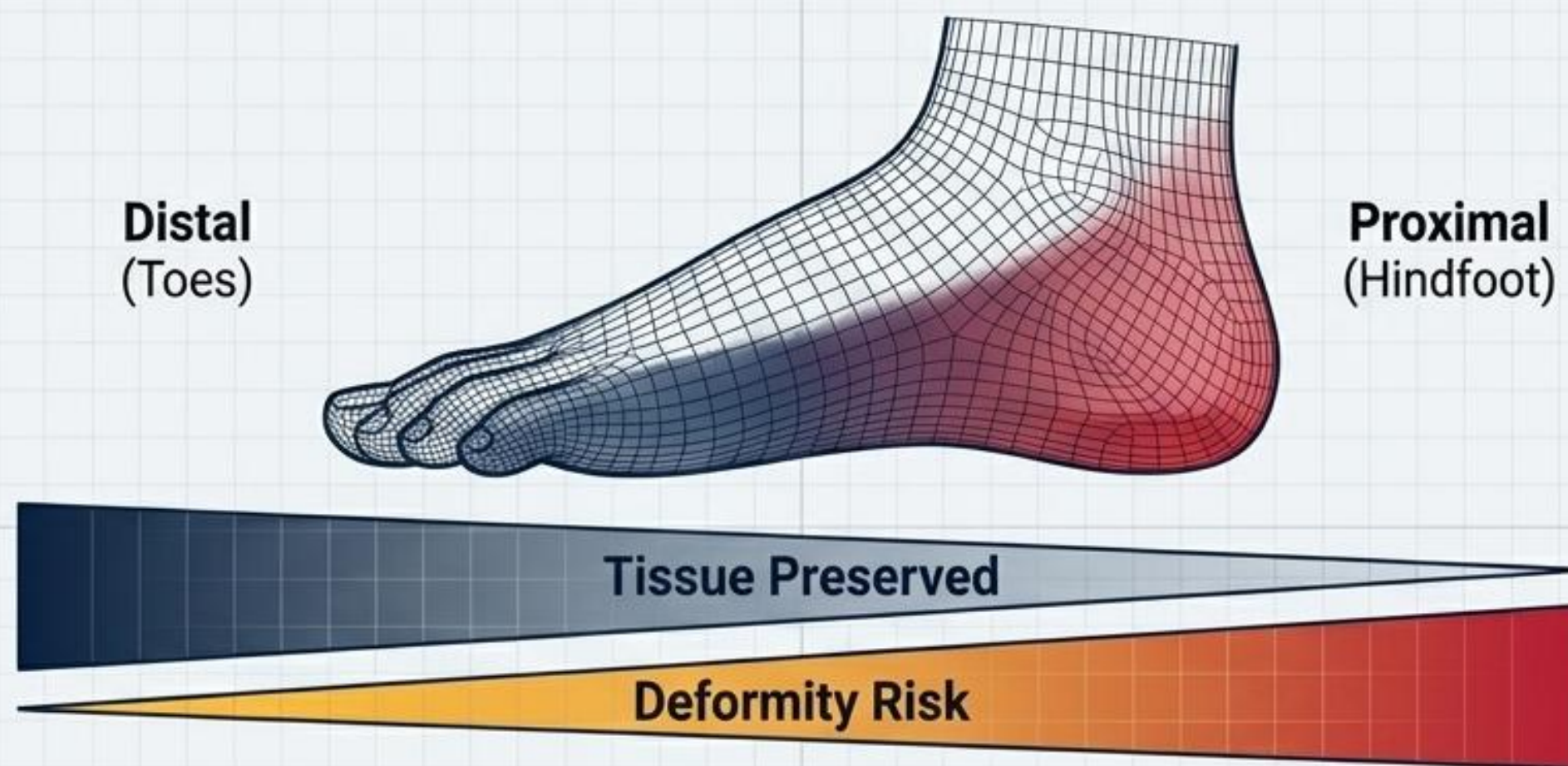
Partial Foot Amputations

Preserves part of the foot. Used when tissue damage is limited. (Focus of the following clinical panels).

**image of the bones
of the foot**



The Core Clinical Trade-Off: Preservation vs. Stability



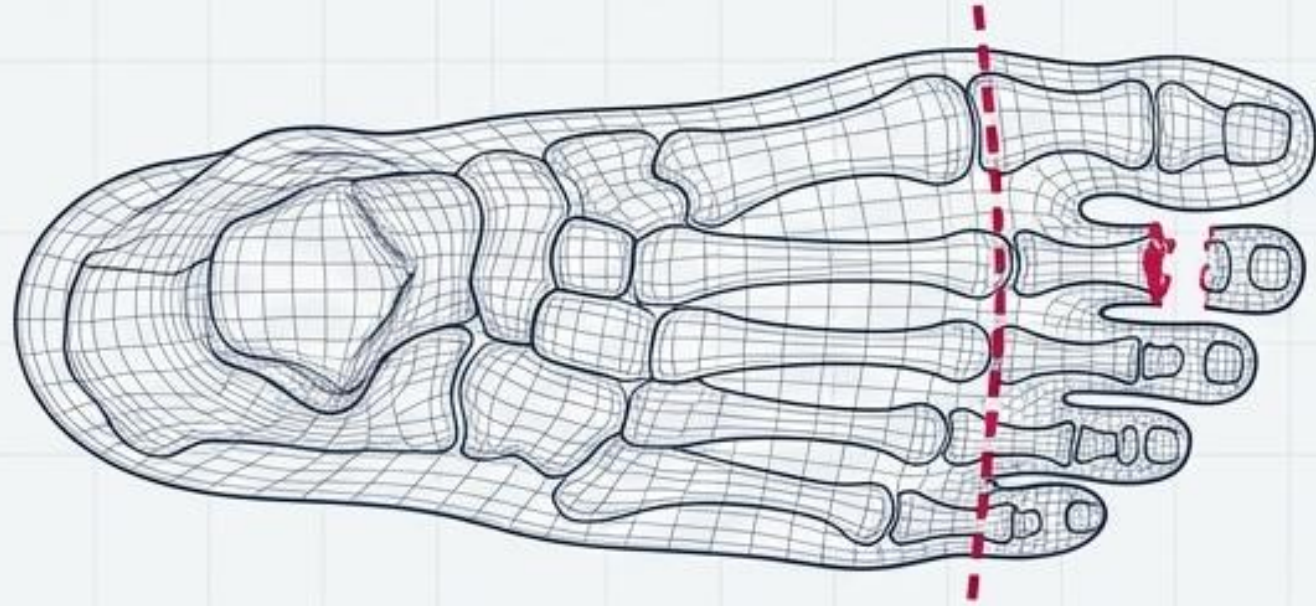
Distal Amputations

- **Tissue Preservation:** Maximized.
- **Prosthetic Need:** Low to none.
- **Goal:** Maintain natural push-off and gait mechanics.

Proximal Amputations

- **Biomechanical Stability:** Significantly compromised.
- **Deformity Risk:** High (severe muscle imbalances).
- **Goal:** Retain heel weight-bearing capability while prioritizing infection and necrosis control.

1. Toe Amputation



Functional Impact

- Minimal overall effect if a single minor toe is removed.
- ⚠ **Warning:** Loss of the great toe significantly compromises balance and push-off power during normal gait mechanics.

Indications

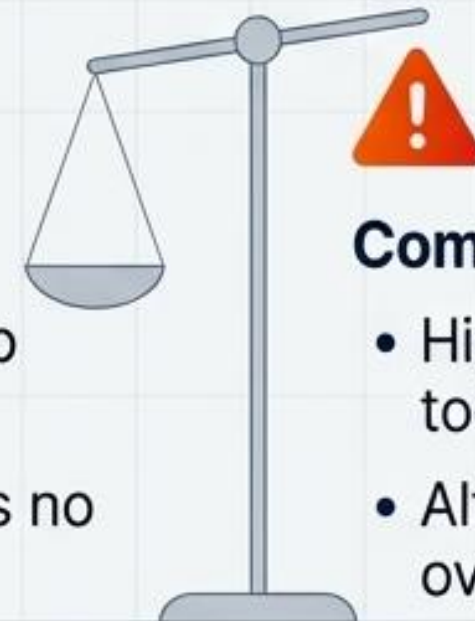
- ✓ Diabetic foot ulcers
- ✓ Localized infection (e.g., osteomyelitis)
- ✓ Trauma or gangrene

Pros vs. Complications



Advantages:

- Maximum limb preservation.
- Often requires no prosthesis.



Complications:

- High risk of adjacent toe deformities.
- Altered gait mechanics over time.

2. Ray Amputation



Indications

- ✓ Infection spreading deeper into the metatarsal
- ✓ Tumors
- ✓ Severe trauma

Functional Impact

- Reduces overall foot width, which directly impacts lateral stability.
- ⚠ **Warning:** Loss of the first ray (big toe + 1st metatarsal) triggers major gait disturbances and loss of primary leverage.

Pros vs. Complications



Advantages:

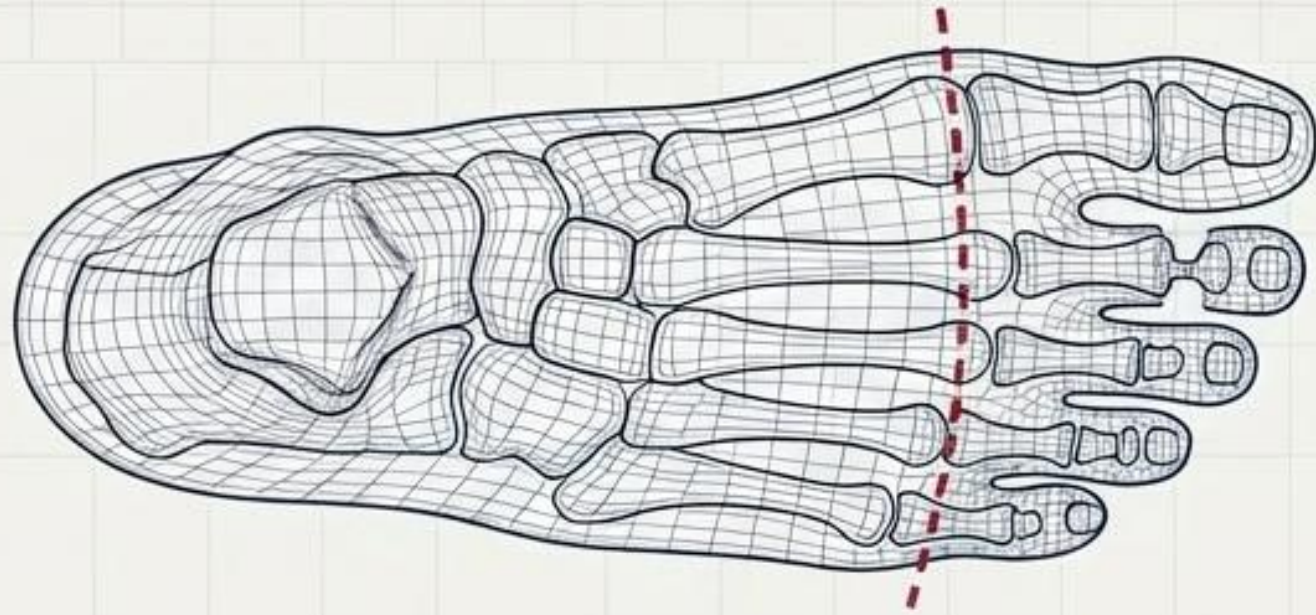
- Superior infection control compared to simple toe amputation.
- Successfully prevents localized recurrence.



Complications:

- Creates structural foot imbalance.
- Drastically increases pressure loads on the remaining intact metatarsals.

3. Transmetatarsal Amputation (TMA)



Functional Impact

- Total loss of push-off power.
- Significantly shortened foot lever arm, permanently altering normal walking mechanics.

Indications

- ✓ Forefoot gangrene
- ✓ Severe diabetic foot infection
- ✓ Ischemia

Pros vs. Complications



Advantages:

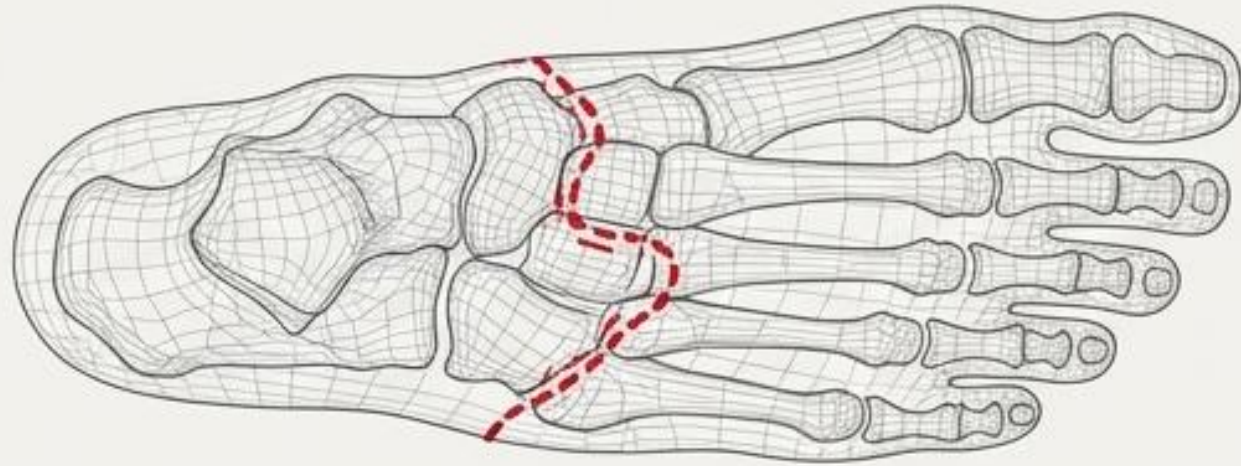
- Preserves the hindfoot, allowing for independent weight-bearing.
- Better overall mobility than proximal (leg) amputations.



Complications:

- High risk of Equinus deformity (Achilles tendon dominance pulls heel up).
- Skin breakdown at the stump.
- Strictly requires proper footwear or orthotics

4. Lisfranc Amputation



Indications

- ✓ Extensive midfoot infection
- ✓ Midfoot trauma
- ✓ Non-healing forefoot wounds

Functional Impact

- Significant, permanent loss of foundational foot stability.
- Major muscle imbalances immediately occur as crucial forefoot tendon attachments are severed.

Pros vs. Complications

+ Advantages:

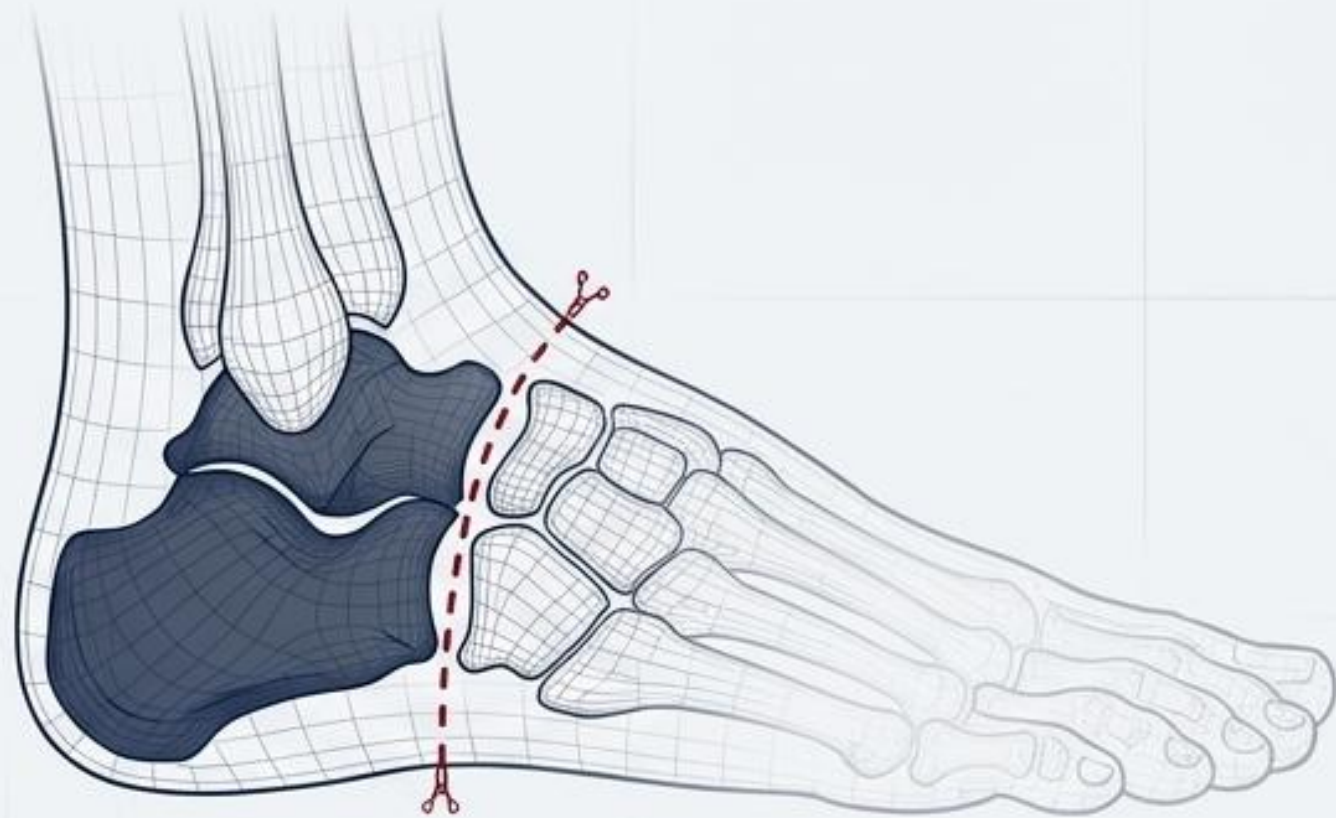
- Preserves more leg length than proximal amputations.
- Maintains some structural midfoot anatomy.



Complications:

- High risk of equinovarus deformity (foot pulls down and inward).
- Extreme difficulty in fitting functional prosthetics.
- High incidence of skin ulceration.

5. Chopart Amputation



Functional Impact

- Severe, systemic muscle imbalance.
- Total loss of dorsiflexors (the muscles that lift the foot), meaning the remaining foot inevitably points downward.

Indications

- Extensive, catastrophic forefoot and midfoot damage
- Major trauma or tumors

Pros vs. Complications



Advantages:

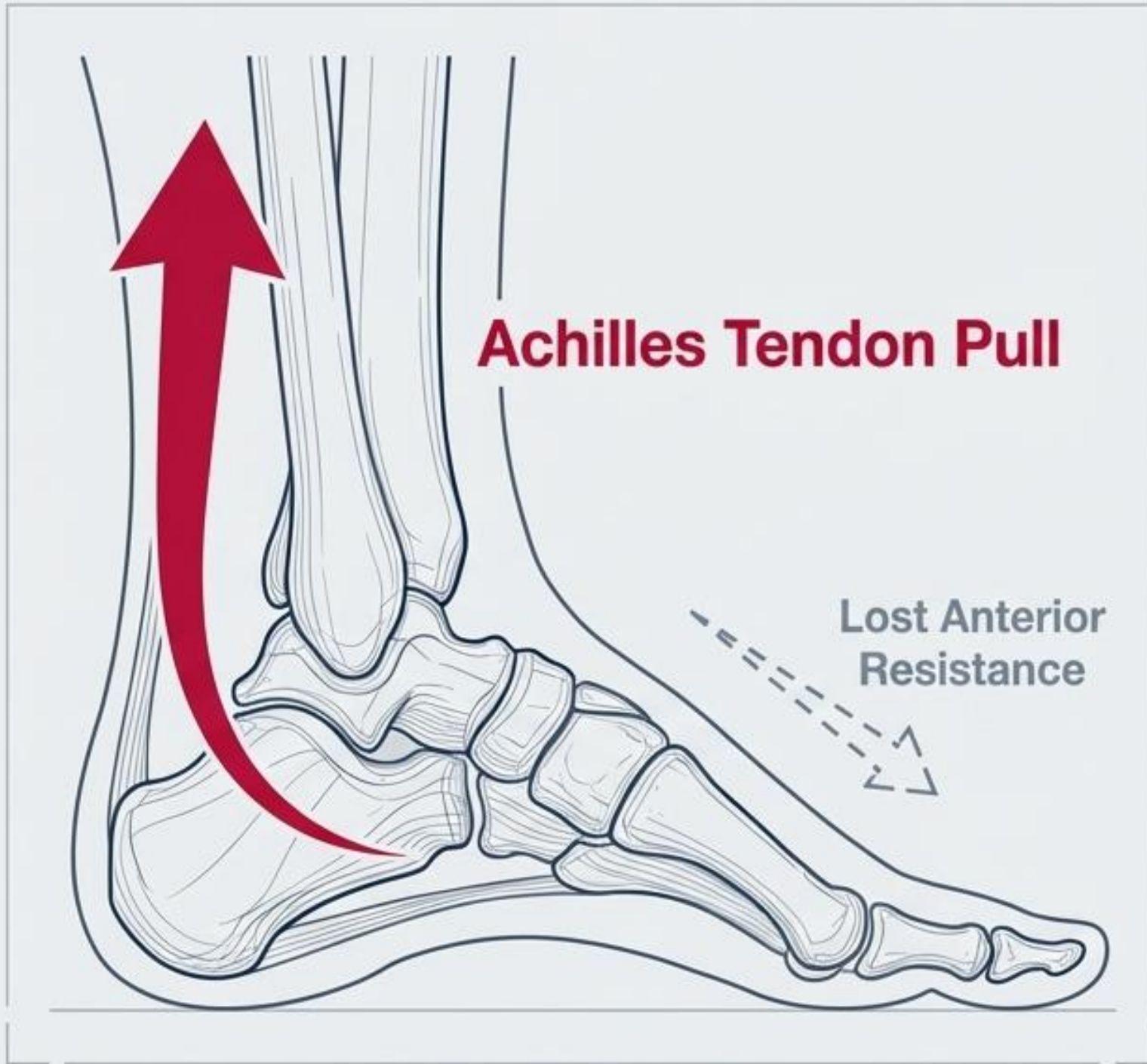
- Retains the heel pad, allowing for direct distal weight-bearing capabilities.



Complications:

- Equinus deformity is very common and severe.
- Virtually impossible to walk without heavy orthotic and prosthetic support.
- Yields poor functional outcomes if not aggressively managed post-surgery.

The Biomechanical Synthesis: Understanding Equinus Deformity



Biomechanical "Tug-of-War"



The Natural Balance

In an intact foot, anterior tendons (dorsiflexors) pull the foot up, perfectly balancing the massive upward pull of the Achilles tendon on the heel.



The Post-Amputation Imbalance






In TMA, Lisfranc, and especially Chopart amputations, the crucial anterior forefoot and midfoot leverage points are physically removed.



The Result

The Achilles tendon completely dominates the biomechanical "tug-of-war." The heel is violently pulled up, forcing the remaining foot surface to point severely downward (Equinus). This leads to localized pressure ulcers and necessitates aggressive orthotic management.

Clinical Reference Matrix: Partial Foot Amputations

Amputation Level	Anatomy Removed	Gait Disturbance	Deformity Risk	Prosthetic/Orthotic Need
Toe	Phalanges	Minimal (unless great toe)	Low (adjacent toes)	None to Minimal <input checked="" type="checkbox"/>
Ray	Toe + Metatarsal	Moderate (width loss)	Imbalance risk	Custom footwear often sufficient
Transmetatarsal (TMA)	Forefoot (Metatarsal shafts)	High  (loss of push-off)	High (Equinus) 	Requires proper footwear/orthotics
Lisfranc	Forefoot (at Tarsometatarsal)	Severe 	Very High (Equinovarus) 	Difficult to fit prosthetics
Chopart	Forefoot + Midfoot	Total loss of native leverage 	Inevitable (Equinus) without intervention	Absolute requirement for walking