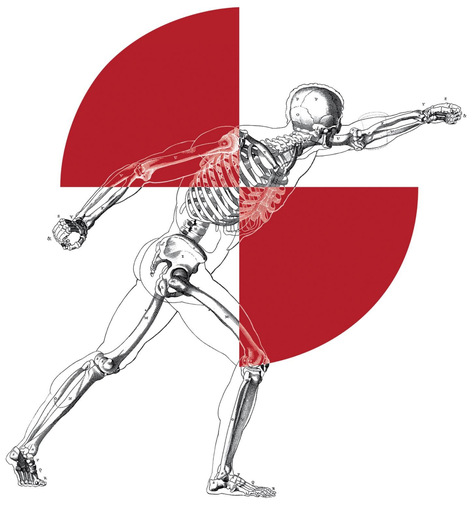

Investigating Deviations from Expected Fracture Patterns in Human Tibiae Loaded in 4-point Bending

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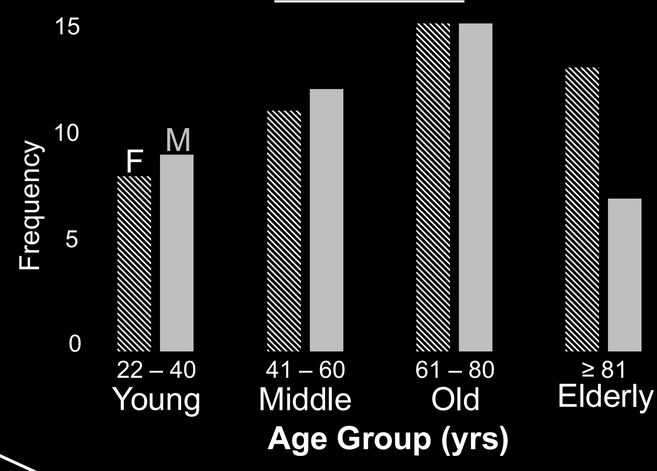
INTRODUCTION

- Pedestrian impacts commonly result in tibia fractures;[1] however, biomechanical data remain limited. Long bones, *e.g.,* tibiae, loaded in bending are generally expected to result in wedge fractures (FXs).[2]
- **Objective:**
  Explore potential trends in deviations from expected fracture patterns (*i.e.,* wedge) in human tibiae loaded to failure in 4-pt bending

METHODS & RESULTS

Loading Conditions
Lateral-Medial *or* Posterior-Anterior
6m/s *or* 2m/s

N = 90 tibiae



Tibia Length (mm)
Short (n=45): 296 – 366
Long (n=45): 369 – 423

FX Classifications[3]
Wedge
Simple
Multifragmentary

38% | 62%

n=34
≥1FX
22/34 Female
22/34 Old *or* Elderly
20/34 Short

n=32
>1FX (40 – 60 % length)
22/32 Male
21/32 Young *or* Middle
18/32 Long

n=24
1FX (40 – 60 % length)
15/24 Female
17/24 Old *or* Elderly
13/24 Long

n=2
< 40 % length
2/2 Short
2/2 1FX

n=16

< 40%
1FX n=1 6m/s LM
Male, Elderly, Long

40 – 60%
n=15
9/15 Female
12/15 Old *or* Elderly
11/15 Short

n=18

> 60%
1FX n=2 6m/s LM
2/2 Female
2/2 Old *or* Elderly

40 – 60%
1FX n=16
11/16 Female
7/16 Old *or* Elderly

1FX
n=5
4/5 Male
5/5 Old *or* Elderly
4/5 Short

2FX
n=5 LM
3/5 Female
5/5 Old *or* Elderly

≥4FX
n=2 6m/s
2/2 Female *and* Elderly
1/2 Long *and* Female

3FX
n=3
3/3 Female
3/3 Young *or* Middle
2/3 PA

6m/s
n=14
11/14 Female
7/14 Young *or* Middle

2m/s
n=2
2/2 Male
2/2 Young *or* Middle
2/2 PA

2m/s
n=1 LM
Male, Old, Short

6m/s

LM
n=2
1/2 Male
2/2 Short

2m/s
n=1
Female, Old, Short

PA
n=2
2/2 Male
1/2 Long

6m/s
n=4
2/4 Male *and* Long

PA
n=4
1/4 Male
3/4 Young *or* Middle

LM
n=10
2/10 Male
6/10 Old *or* Elderly

DISCUSSION & CONCLUSION

- Unexpectedly, 38% of tibiae did not result in wedge fractures. Atypical fractures were most common among old and elderly females with short tibiae. However, atypical fractures were observed across all demographics and loading conditions.
- Quantifying complex interactions among demographic, morphological, and microstructural variables along with the integration of computational modeling will be essential to better understand fracture outcomes in future work.

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