Optimal Nail Diameter to Medullary Canal (ND/MCD) Ratio in Diaphyseal Tibia Fractures Treated with Intramedullary Nailing

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Background

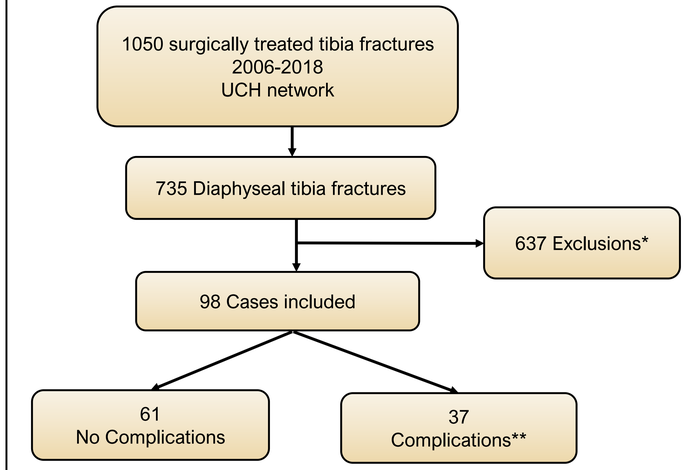
- Up to 17% of tibia fractures result in delayed union or nonunion[1]
  - Chronic pain
  - Prolonged disability
  - High medical costs
- Factors most predictive of delayed union remain unknown[2]

Purpose

Among patients with diaphyseal tibia fractures treated with intramedullary nailing (IMN):

- What are the **risk factors for delayed union or nonunion?**
- Does **the nail diameter to medullary canal (ND/MCD) ratio predict outcomes?**

Methods



**Exclusion criteria: follow-up <12 months, additional lower extremity fractures, additional hardware, non-diaphyseal and pathologic fractures*

Methods

FIGURE 1. ND/MCD ratio measured at the isthmus with a digital caliper in PACS Web.

$\frac{ND}{MCD} = \frac{11}{11.8} = .93$

Results

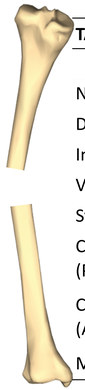


TABLE 1. Fracture complications (N=37*)

	N	
Nonunion	23**	62.2%
Delayed union	4	10.9%
Infection	16	43.2%
Valgus deformity	1	2.7%
Symptomatic hardware	1	2.7%
Compartment syndrome (Prior to IMN)	5	13.5%
Compartment syndrome (After IMN)	1	2.7%
Multiple complications	15	40.5%

**11/37 initially treated at OSH*
***9/23 initially treated at OSH*

Results

TABLE 2. Factors Associated with Development of a Complication

	Complication N=37		No Complication N=61		P Value
Sex, N (%)					
Male	26	40.6%	38	59.4%	0.4214
Female	11	32.4%	23	67.6%	
Current Drug/Alcohol Use, N (%)					
No	19	31.7%	41	68.3%	0.0944
Yes	18	48.6%	19	51.4%	
Current Smoker, N (%)					
No	23	37.7%	38	62.3%	0.9895
Yes	14	37.8%	23	62.2%	
Concomitant Head Injury, N (%)					
No	11	28.9%	27	71.1%	0.1523
Yes	26	43.3%	34	56.7%	
Fracture Type, N (%)					
Open	21	75.0%	7	25.0%	<.0001
Closed	16	23.2%	53	76.8%	
Fracture Location, N (%)					
Distal	18	30.5%	41	69.5%	0.0687
Mid/Proximal	19	48.7%	20	51.3%	
Age at injury, mean (stdev)	41.4	17.3	45.5	15.4	0.2328
BMI, mean (stdev)	26.6	6.3	27	5.3	0.6964
ND/MCD ratio, mean (stdev)	0.8	0.1	0.9	0.1	0.0425

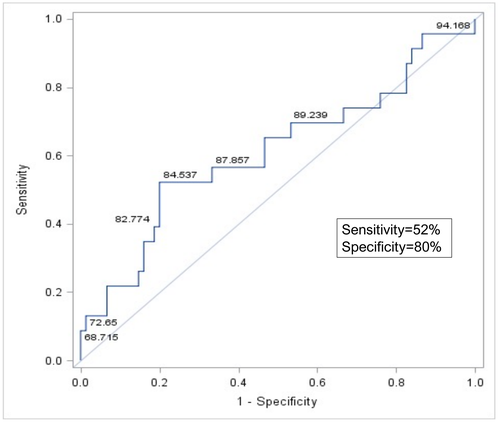
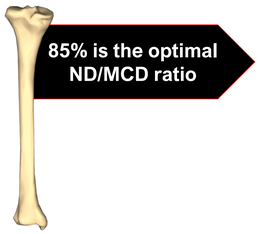


FIGURE 2. Receiver Operating Curve of ND/MCD ratios differentiating between nonunion vs. union outcomes.



Significance

- A large proportion of patients with tibia fractures smoke (38%) and have comorbidities (54%).
- Patients who sustain open fractures and those with lower ND/MCD ratios are at higher risk for complications.
- ND/MCD ratio of <85% should be avoided as it may lead to nonunion development.

References

1. Coles, C.P. and M. Gross, *Closed tibial shaft fractures: management and treatment complications. A review of the prospective literature.* Can J Surg, 2000. **43**(4): p. 256-62.
2. Schemitsch, E.H., et al., *Prognostic factors for predicting outcomes after intramedullary nailing of the tibia*. J Bone Joint Surg Am, 2012. **94**(19): p. 1786-93.

Disclosures

None of the authors have any relevant disclosures or conflicts of interest in regards to this research.