Early Weightbearing After Operative Fixation Of Jones Fractures Does Not Delay Union

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Disclosures

I (and/or my co-authors) have something to disclose.

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Clinical Background

- Jones fractures of the proximal fifth metatarsal are predisposed to delayed union and nonunion due to a tenuous blood supply[1]
  - Nutrient artery arising from 4th metatarsal plantar artery responsible for retrograde supply to proximal 5th metatarsal diaphysis, joined by antegrade flow from proximal tuberosity → watershed region prone to poor healing when fractured[2,3]
- Solid intramedullary (IM) screw fixation is recommended to improve healing, traditionally followed by delayed weightbearing (DWB)
- However, early weightbearing (EWB) postoperatively may facilitate functional recovery
  - Often little to no basis for delaying weightbearing![4]
- Shift in clinical practice towards earlier weightbearing (within 2 weeks of surgery)

[1]Cheung *et al*., *Arch Trauma Res*, 2016
[2]Dameron, *JAAOS*, 1995
[3]Smith *et al*., *Foot Ankle*, 1992
[4]Trompeter, *BJJ*, 2020

Purpose

- Compare union rates and time to union after solid IM screw fixation of Jones fractures in patients treated with early weightbearing (EWB) protocol (initiation of unrestricted weightbearing within 2 weeks of surgery) to those treated with a delayed weightbearing (DWB) protocol (delay of unrestricted weightbearing beyond 2 weeks from surgery)
- Identify factors predictive of delayed or nonunion
- **Hypothesis**: no significant difference in union time or the rate of delayed union between EWB and DWB cohorts of Jones fractures treated with IM screw fixation

Methods

- *A priori* power analysis for sample size determination performed using mean ± SD time to union of 6.9 ± 2.3 weeks reported by Mologne *et al.*[1]
  - Assuming 2-week interval follow-up and a 10% rate of dropout, detection of a delay in the mean union time from 6.9 weeks to 8.9 weeks with 80% power with EWB would require 20 patients in each group at .05 α
- Patients with zone 2 fractures of the base of the 5th metatarsal (true Jones fractures as defined by Lawrence and Botte with extension of the fracture line into the articulation of the base of the 4th and 5th metatarsals) treated with IM screw fixation were eligible for inclusion in the study
- Delayed union based on statistical definition of outliers: using results from Mologne *et al.*[1], ≥ 75th percentile value + 1.5 × interquartile range [IQR] = 12.5 weeks

[1]Mologne *et al.*, *AJSM*, 2005

Patients

- Retrospectively identified cohort of patients who underwent operative treatment of base of the fifth metatarsal fractures from April 2012 through January 2018 as identified by current procedural terminology (CPT) code 28485
- 41 fractures in 40 patients (mean ± standard deviation (SD) age, 45.3 ± 17.9 years; median age (IQR), 45 (IQR, 32 to 62) years; range, 17 to 77 years)
  - 16 (40%) males (mean ± SD age, 34.5 ± 14.6 years; median (IQR) age, 34 (IQR, 19 to 46) years; range, 17 years to 61 years)
  - 24 (60%) females (mean ± SD age, 52.9 ± 16.2 years; median (IQR) age, 59 (IQR, 41.25 to 64.25) years; range, 17 years to 77 years)
- 20 fractures in 20 patients in EWB group, 21 fractures in 20 patients in DWB group

Follow-up

- Routine standardized radiographs obtained during visits 1, 3, 6, and 9 weeks postoperatively, and thereafter at subsequent visits until union
- Fracture healing defined as bridging callus on three of four cortices radiographically and lack of bony tenderness on physical exam

Statistical Methods

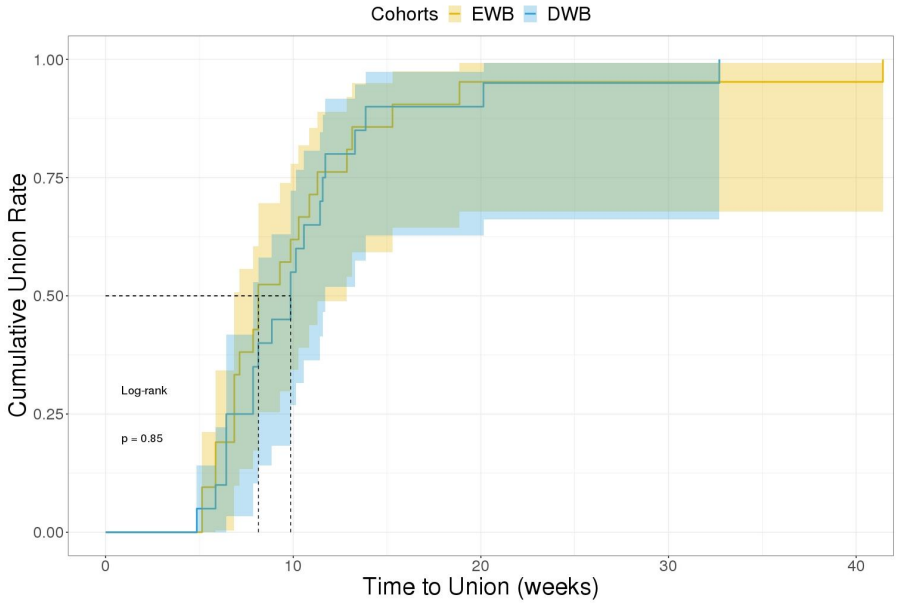
- Measures of central tendency reported as mean ± SD and median (IQR) for interval and continuous data and compared with the Student *t* test, the Mann-Whitney *U* test, or or the Kruskal-Wallace test, depending on normality as assessed with the Shapiro-Wilk test and the number of independent variables
  - Dunn's post hoc tests when the Kruskal-Wallace test was significant
- Counts and percentages reported for categorical data; distributional differences were assessed with Fisher's exact or χ^2 tests
- Kaplan-Meier survival analysis conducted with the cumulative union rate plotted against time to union for EWB and DWB cohorts
- Univariable logistic regression analyses conducted to examine the relationship between multiple factors and the development of delayed union

Results

- No significant differences between EWB and DWB groups with respect to age, sex, weight, body mass index (BMI), laterality, current smoking status, time from presentation to surgery, screw size, or non-steroidal anti-inflammatory drug (NSAID) use
- Overall mean ± SD and median (IQR) times to union were 10.85 ± 7.01 weeks and 9.29 (6.86–11.57) weeks, respectively (range, 4.86 weeks to 41.42 weeks)
- All fractures went on to clinical and radiographic union
- Total of 9 delayed unions (22%), all of which went on to heal without subsequent surgery

Union Times by Cohort

- Mean ± SD time to union was 10.89 ± 6.21 (range, 4.86 to 32.71) weeks in the EWB group and 10.81 ± 7.85 (range, 5.14 to 41.43) weeks in the DWB group
- Median (IQR) time to union was 9.86 (7.50 to 11.61) weeks in the EWB group and 8.14 (6.86 to 11.29) weeks in the DWB group
- No significant difference in mean ($P = .970$) or median ($P = .629$) time to union between groups (Figure 2).



Delayed Unions

- 4 (20.0%) delayed unions among 20 fractures in EWB group
- 5 (23.8%) delayed unions among the 21 fractures in the DWB group
- No significant difference in rate of delayed union between EWB and DWB cohorts (OR, 0.8; 95% CI, 0.13 to 4.53; $P > .999$)
- Lower relative risk of delayed union lower among EWB cohort (RR, 0.95; 95% CI, 0.52 to 1.17), but difference not significant ($P = .769$)

Identification of Risk Factors

Univariable Logistic Regression Analysis for Risk of Delayed Union

	B	SE	OR	95% CI	*P* value
Time to weightbearing	0.020	0.016	1.02	0.99–1.06	.211
Age	0.059	0.028	1.06	1.01–1.13	**.031**
Male sex	-2.079	1.118	0.13	0.01–0.80	.063
Weight	0.004	0.017	1.00	0.97–1.04	.802
BMI	0.009	0.049	1.01	0.90–1.11	.860
Time to surgery	-0.007	0.011	0.99	0.96–1.01	.520
Chronic injury	-0.393	1.167	0.68	0.03–5.06	.736
Current tobacco use	0.629	1.288	1.88	0.08–22.16	.625
Screw diameter	0.182	0.718	1.20	0.29–5.21	.800
NSAID use	1.378	0.877	3.97	0.81–29.48	.116

Abbreviations: B, coefficient; CI, confidence interval; OR, unit odds ratio; SE, standard error.

Conclusions

- EWB within 2 weeks of solid IM screw fixation of Jones fractures does not increase time to union or delayed union risk
- Age may be a risk for delayed union
- EWB protocols may allow better functional recovery without compromising outcomes by increasing the risk of delayed union
    - Large, prospective, randomized studies are needed
    - May also clarify the impact of other variables such as age

Thank you!