

The Utility of Early Acquisition of Gravity Stress Radiographs in Weber B Ankle Fractures; a Time and Cost Efficiency Analysis

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INTRODUCTION: Isolated Weber B ankle fractures with a symmetric mortise and less than 1 mm difference between the medial clear space (MCS) and superior clear spaces (SCS) present a challenge in deciding between nonoperative care and open reduction internal fixation (ORIF). To inform this decision, many surgeons incorporate gravity stress radiographs (GSVs) due to their increased sensitivity for detecting subtle rotational instability tied to deep deltoid ligament incompetence—findings often missed on non-weightbearing (NWB) radiographs. Although the utility of GSVs remains debated, particularly relative to weightbearing (WB) views which may better reveal lateral talar congruity under physiologic load, limited literature exists on the cost-effectiveness and usefulness of the routine acquisition of GSVs by a large proportion of surgeons who treat such fractures. This study assesses whether early GSV acquisition during the initial radiographic assessments can streamline care through reducing repeated imaging, lowering radiation exposure, and reducing financial burden on the healthcare system.

METHODS: We conducted a retrospective study on adults ≥ 18 y/o with Weber B ankle fractures with symmetric mortises, treated at three tertiary hospitals within a single academic system between 2015 to 2025. Cases were patients with symmetric mortises who had GSV in their radiographic assessments and were managed with ORIF (n=62) or closed treatment (n=42). We included a matched control group (n=104) of patients who were managed without GSVs. Collected variables included demographics, orthopedic visit count, time to treatment, preoperative X-rays, estimated radiation exposure, and technician time. On GSVs, MCS, SCS, and the fibular displacement percentage were measured. Univariate two-group analyses used t-tests or Mann-Whitney U tests based on normal distribution of the data (Shapiro-Wilk test). Logistic regression modeled the association of radiographic measures (SCS, MCS-SCS, fibular displacement) with treatment decisions. Preoperative visit counts were modeled with a Poisson GLM (IRRs) and OLS regression (β -coefficients), both adjusting for group, age, sex, and BMI. Significance was set at $P < 0.05$.

RESULTS: GSV-based measurements demonstrated strong diagnostic discrimination between operative and nonoperative management, with both increased MCS-to-SCS difference (OR 6.20, 95% CI 2.80–13.70, $P < 0.01$) and greater fibular displacement (OR 1.11, 95% CI 1.04–1.19, $P < 0.01$) independently predicting selection for ORIF (AUC-ROC=0.92). Patients who underwent closed treatment after GSV acquisition required fewer preoperative orthopedic visits than those who never received a GSV (IRR=0.63, 95% CI 0.43 to 0.94, $P = 0.02$; $\beta = -0.48$, 95% CI -0.78 to -0.17 , $P < 0.01$), representing a 37% reduction in visit rate or approximately 0.5 fewer visits per patient. Obtaining GSV as part of the initial NWB orthopedics-ordered panel resulted in lower total radiation exposure prior to intervention (median 0.02 vs 0.04 mSv, $P < 0.01$) compared to delayed or same-day standalone GSV acquisition. Panel-format GSV acquisition, regardless of timing, further reduced radiology technician time in obtaining the gravity stress image (median 10 vs 25 minutes, $P < 0.01$).

DISCUSSION AND CONCLUSION: Our findings demonstrate that early, panel-based acquisition of gravity stress radiographs may not only enhance diagnostic accuracy in the management of symmetric Weber B ankle fractures but also deliver substantial operational and value-based benefits. This approach might also streamline clinical decision-making, reduce redundant imaging, lower total radiation exposure, and minimize both patient and institutional burden through decreased technician time and fewer preoperative visits. Importantly, while there remains significant debate among surgeons regarding the effectiveness of ordering GSVs, for those who consistently utilize GSVs in this clinical context, our results may provide a practical, cost-saving protocol to optimize workflow and resource allocation. We suggest further research is warranted to examine the financial and clinical consequences of routinely obtaining the GSV as a fourth view on initial orthopedics-ordered films, particularly for Weber B fractures with a symmetric MCS.

Table 1. Multivariable Logistic Regression Model Assessing Impact of Gravity Stress Radiograph Acquisition on Operative Management (ORIF) in Symmetric Weber B Ankle Fractures. Odds ratios reflect the probability of each outcome when the likelihood of the reference outcome (ORIF) is constant.

Variable	n	OR	95% CI	P Value
GSV on First Orthopedics-Ordered NWB Panel (Yes/No)	62/42	6.20	(2.80, 13.70)	<0.01*
GSV Ordered Separately but on Same Day as Initial Panel Orthopedics-Ordered NWB Panel (Yes/No)	25/79	1.11	(1.04, 1.19)	<0.01*
GSV Ordered as Panel Format (Yes/No)	10/94	1.02	(0.98, 1.06)	0.32

Abbreviations: ORIF, Open Reduction Internal Fixation; GSV, Gravity Stress View Radiograph; NWB, Non-Weightbearing; OR, Odds Ratio; CI, Confidence Interval. *P values are derived from a test for Poisson regression coefficients. P=0.05 was considered statistically significant.

Table 2. Multivariable Logistic Regression Model Assessing Impact of Gravity Stress Radiograph Acquisition on Operative Management (ORIF) in Symmetric Weber B Ankle Fractures. Model Fit Using Age, Sex, and BMI.

Variable	B Coefficient	Standard Error	Test statistic (z)	95% Confidence Interval	P Value
Closed Treatment Weber B Fracture with GSV Obtained	0.03	0.20	0.25	(-0.43, 0.50)	0.802*
ORIF Treatment Weber B Fracture with GSV Obtained	1.00	0.14	6.93	(0.70, 1.30)	0.00

Abbreviations: ORIF, Open Reduction Internal Fixation; GSV, Gravity Stress View Radiograph; BMI, Body Mass Index. *P values are derived from a test for Poisson regression coefficients. P=0.05 was considered statistically significant.

Table 3. Multivariable Ordinary Least Squares Regression Model of Predictors for Preoperative Orthopedic Visit Counts in Symmetric Weber B Ankle Fractures. Model Fit Using Age, Sex, and BMI.

Variable	B Coefficient	Standard Error	Test statistic (z)	95% Confidence Interval	P Value
Closed Treatment Weber B Fracture with GSV Obtained	-0.48	0.15	-3.10	(-0.78, -0.17)	0.002*
ORIF Treatment Weber B Fracture with GSV Obtained	0.002	0.13	0.02	(-0.26, 0.26)	0.99

Abbreviations: Fr, Fracture; GSV, Gravity Stress View Radiograph; BMI, Body Mass Index. *P values are derived from a test for OLS regression coefficients. P=0.05 was considered statistically significant.

Table 4. Impact of Gravity Stress Radiograph Acquisition Timing and Format on the Time of Work for Radiology Technicians in Symmetric Weber B Ankle Fractures.

Variable	n	Median	IQR	P Value
GSV on First Orthopedics-Ordered NWB Panel (Yes/No)	62/42	10	0	<0.001*
GSV Ordered Separately but on Same Day as Initial Panel Orthopedics-Ordered NWB Panel (Yes/No)	25/79	25	13	0.002*
GSV Ordered as Panel Format (Yes/No)	10/94	10	0	<0.001*

Abbreviations: GSV, Gravity Stress View Radiograph; NWB Panel, non-weightbearing radiograph panel. *Mann-Whitney U Test, P=0.05 was considered significant.