Assessment of Skills Using a Validated Fracture Model: Limiting Bias by Video Capture

Matthew Putnam MD, Julie Adams MD, Joan Bechtold PhD, Ann Van Heest MD
University of Minnesota Department of Orthopaedic Surgery

Bottom Line: Aims and Outcomes

1. We examined the possible role of program independent video-based scoring of resident surgical ability and have shown it is possible to capture de-identified video images and deliver these to independent graders.

2. We delineated tools to enable widespread implementation of this competency evaluation program. This method can be standardized and repeated at other institutions.

Background

Earlier work that we completed quantified the loads seen by DRFX during rehabilitation. This enabled us to set a construct fixation strength target (Yield (400N) and Stiffness (80 N/mm)) for our Distal Radius Fixation skills testing program. We have published and presented results from this work. Notably, we have shown: 1) residents have imperfect skill retention; 2) Grading Bias exists when faculty are more familiar (through teaching exposure) with a resident (Figure 1a); 3) Biomechanical testing coupled with direct observation of the specimen can compensate for examiner bias (Figure 1b).

However, based on our experience, each biomechanically-based competence proof has significant direct costs (and unaccounted indirect costs – faculty time, etc.). To reduce costs and bias (blind grader student relationship) we sought, with this grant, to initiate review and grading of de-identified surgical video images by independent external examiners (three [two institutions]).

Methods

1. A “standard” fracture is created using a jig (Figure 2) that predictably removes a section of metaphyseal bone. The resection is verified by image intensifier making certain that the experimental fracture is “fixable” (Figure 3).

2. Students complete fracture repair in a simulated OR setting within 60 minutes. They use a Distal Radius Plating system and have access to fluoroscopy (Figure 4).

3. The fracture repair is visually examined at the time of biomechanical testing. Fixation screws prominent inside a joint and/or a major nerve transected during dissection are graded as a “fail” (Figure 6). Thus, measurable endpoints exist and can be determined by examination methods (observation and machine [Figures 6 and 7]).

5. We captured 15 minutes of uninterrupted procedure video starting 10 minutes into the procedure (Figure 8). These videos plus pre-and post-op fluoroscopic images (AP and Lateral) and post-op specimen images are to be reviewed by the 3 independent examiners as well as the 6 internal examiners.

Findings to Date

We have shown that internal program grading relative to surgical skill has the potential for Bias and does not correlate well with Unbiased assessment (Biomechanics Testing or visual review of specimen fixation). This year’s testing again found that a resident could pass the exam (based upon grading by local faculty) and yet fail by unbiased assessment (Figure 6 [screw in joint]). We await completion of the grading exercise by external graders. As the relationship between local graders and unbiased testing is effectively negative, we remain optimistic that external graders will at minimum identify those students certain to pass and certain to fail. However, the data is still pending.

Recommendations

Unbiased assessment of a resident’s mechanical skill is essential if such tests are to become standardized and used to determine resident progression. As practiced at our institution, we believe this distal radius fracture test model is ready to be employed as a standard. If video review by independent graders proves to have a positive correlation with unbiased fracture construct assessment, it will have a role in further validating the resident’s skill acquisition. We recommend that a network of programs collaborate to administer this testing model in their programs and test examine enforcement of passing criteria.

Acknowledgements

We are grateful to the following manufacturers who provided in-kind equipment donations:

Acumed: Synthes
Arthrex: Trime
DePuy-Biomet: Zimmer
Stryker

References


Contact Information

Matthew D. Putnam, M.D., Professor
University of Minnesota
Dept. of Orthopaedic Surgery
Email: mdpm@umn.edu