Virtual Reality (VR) Offers Potential Utility as SSRF Pre-Operative Planning Tool

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BACKGROUND

Surgical stabilization of rib fractures (SSRF) is indicated in trauma patients with flail chest or multiple displaced rib fractures. [1,2]

Optimal outcomes are achieved with fixation of all a patient's broken ribs and muscle-sparing of surrounding structures, but limitations arising from a patient's unique anatomy may restrict repair.

Pre-operative CT review via standard desktop viewer (standard - *figure 1*) is used to plan a surgical approach tailored to patient anatomy. [3]

Virtual reality (VR - *figure 2*) can also visualize CT scans with extensive manipulability and precise representation of patient anatomy, but VR for SSRF planning has not been studied.

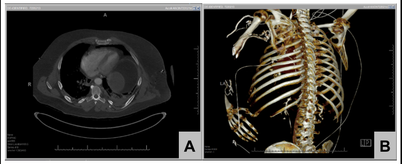

Figure 1. RibFracture_7 Chest CT with Standard Modality - (A) axial view; (B) bony reconstruction

This study evaluates VR for SSRF pre-operative planning by comparing surgical decision-making and injury assessment against standard review.

STUDY QUESTION

Does using VR to review pre-operative CT scans in rib fracture patients where surgical fixation is indicated…

change the assessment of injury & planned surgical approach? *

**when compared to standard modality*

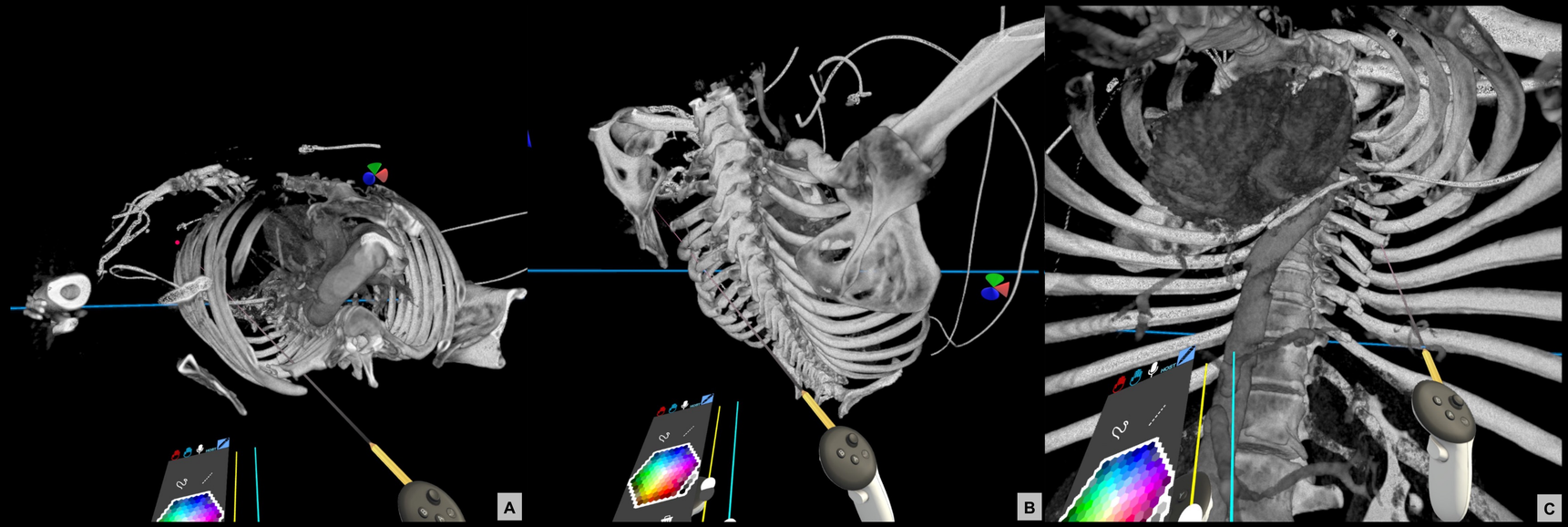

Figure 2. RibFracture_7 Chest CT with Virtual Reality - (A) cross sectioning; (B) posterior view; (C) internal view

METHODS

Five trauma surgeons reviewed de-identified pre-operative CT scans of five SSRF patients treated at a Level 1 Trauma Center (2021-2024).

Preparation

- Patients were randomly selected from the UCHealth Trauma Registry to reflect diverse demographics and injury severity (mean (SD) [range]; age: 61 yrs (11.8) [44-75]; ISS: 18.2 (11.2) [9-36])].
- The patients' de-identified CT pre-op scans were then uploaded to standard modality (Philips desktop viewer) and to VR software (Perspectus)

Data Collection

- Surgeons assessed scans in standard and VR modalities in a randomized and counterbalanced order (*figure 3*).
- Reported rib fracture locations, degree of displacement, and planned surgical approach.
- Responses were recorded via standardized survey and compared between CT modalities.
- Review time for each modality was also recorded.
- Following scan review, surgeons completed an exit survey with Likert-type items to assess overall perceptions of VR and its potential clinical application.

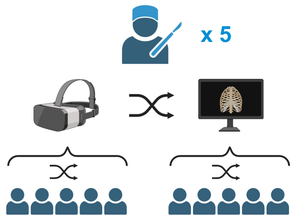

Figure 3. Data Collection Visual Graphic

RESULTS

Poisson and linear regression were used to compare modalities (Table 1).

Using VR, surgeons identified significantly more displaced fractures per patient than when using the standard modality (P = 0.03). No significant differences were observed in total fracture counts or number planned for repair across modalities. Mean review time was 1.43 min shorter with VR than standard [95% CI: -0.47-3.34 min], though not statistically significant (P = 0.14).

TABLE 1. Rib Fracture Diagnosis and Repair Plan for Different Modalities

	Standard Mean (SD) [Range]	VR Mean (SD) [Range]
No. Fractures Per Pt- Total	10.4 (5.3) [3-21]	11.6 (6.7) [4-22]
Non-Displaced	3.3 (2.2) [1-8]	3.7 (3.2) [1-9]
Displaced	2.9 (1.7) [1-8] *	4.6 (3.8) [1-15] *
Severely Displaced	5.4 (3.9) [1-15]	5.5 (3.2) [1-11]
No. Fractures Indicated for Repair	5.0 (2.7) [2-12]	5.6 (3.6) [2-14]
Review Time Per Scan (Min.)	8.02 (3.29) [3.72-17.95]	6.58 (3.41) [2.17-16.40]

* statistically significant difference between VR and standard (P < 0.05)

In exit surveys, surgeons reported favorable impressions of VR and interest in its clinical application, with 60% indicating 'always' when asked how often they could see themselves using VR for SSRF planning.

CONCLUSIONS

During their first-ever use of VR, surgeons identified **more *displaced* fractures** than with the standard CT viewing modality they routinely use.

Despite being new to the technology, VR use **did not alter total fracture counts, operative plans, or review times**.

Surgeons showed **strong enthusiasm for clinical integration**, suggesting VR could become a valuable adjunct for SSRF planning.

These results support **continued investigation of VR** for pre-operative assessment in rib fixation surgery.

Some responses from the surgeons-

"I could see it becoming standard"

"It's so much easier to see what's going on and so much easier to count ribs"

"When can we start using the VR on all rib fracture patients- that thing was sweet"

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