

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

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Purpose of the Study

Surgical stabilization of rib fractures (SSRF) is indicated in trauma patients with flail chest or multiple displaced rib fractures. Pre-operative CT review via standard desktop viewer (standard) is used to plan a surgical approach tailored to patient anatomy. Virtual reality (VR) can also visualize CT scans with extensive manipulability and precise representation of patient anatomy, but VR for SSRF planning has not been studied. This study evaluates VR for SSRF pre-operative planning by comparing surgical decision-making and injury assessment against standard review.

Methods Used

Five trauma surgeons reviewed de-identified pre-operative CT scans of five SSRF patients treated at a Level 1 Trauma Center (2021-2024). 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]). Surgeons assessed scans in standard (including 3D reconstructions when available) and VR modalities in a randomized and counterbalanced order. They 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.

Summary of Results

Poisson and linear regression were used to compare modalities. VR enabled surgeons to identify significantly more displaced fractures per patient than standard (mean (SD) [range]; VR: 4.6 (3.8) [1-15]; standard: 2.9 (1.7) [1-8], $P = 0.03$). 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 ($P = 0.14$). 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

First-time VR use allowed surgeons to identify more displaced fractures than standard CT modalities without affecting total fracture counts, surgical plans, or review times. Coupled with their favorable impressions of VR, these findings highlight the technology's strong potential for SSRF planning and the need for continued investigation of its clinical application.