Zeus Robot Assisted Thoracoscopic Brachytherapy: ZEUS vs. VATS vs. Manual Seed Implantation
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1. Introduction
Interstitial brachytherapy is becoming an accepted treatment option for patients at high risk for lung cancer surgery. Robotic surgery has the potential to deliver brachytherapy seeds into tumours while keeping surgeons at a safe distance from the radioactive source. Our aim was to compare the error, effort, and time needed to place seeds next to a target using a manual method, video-assisted thoracoscopy (VATS), and the ZEUS robot.

2. Methods
A brachytherapy seed injector was developed and attached to one of the ZEUS robotic arms. Four different people inserted dummy brachytherapy seeds into clear agar-gelatin cubes containing a 1.6 mm stainless steel ball target. Two orthogonal radiographs were taken of each agar cube and corresponding distances were measured in triplicate using Image J visualizing software.

3. Results
The seed placement error was quantified as the median distance between the centre of the seed and the target using the Pythagorean Theorem. Comparisons were made using an analysis of variance, t-tests, and Kruskal-Wallis as appropriate.

4. Conclusion
The manual technique is the most accurate, least traumatic (requiring less needle punctures), and the fastest method of inserting seeds into tumours. However, ZEUS robot assisted brachytherapy seed insertion is feasible and has the potential to achieve results equal to manual seed insertion.