

VIRTUAL LAPAROSCOPIC HIATAL HERNIA SIMULATOR (VLAHHS) FOR CRURAL REPAIR DEMONSTRATES EVIDENCE OF SKILL ACQUISITION AND TRANSFER

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Background

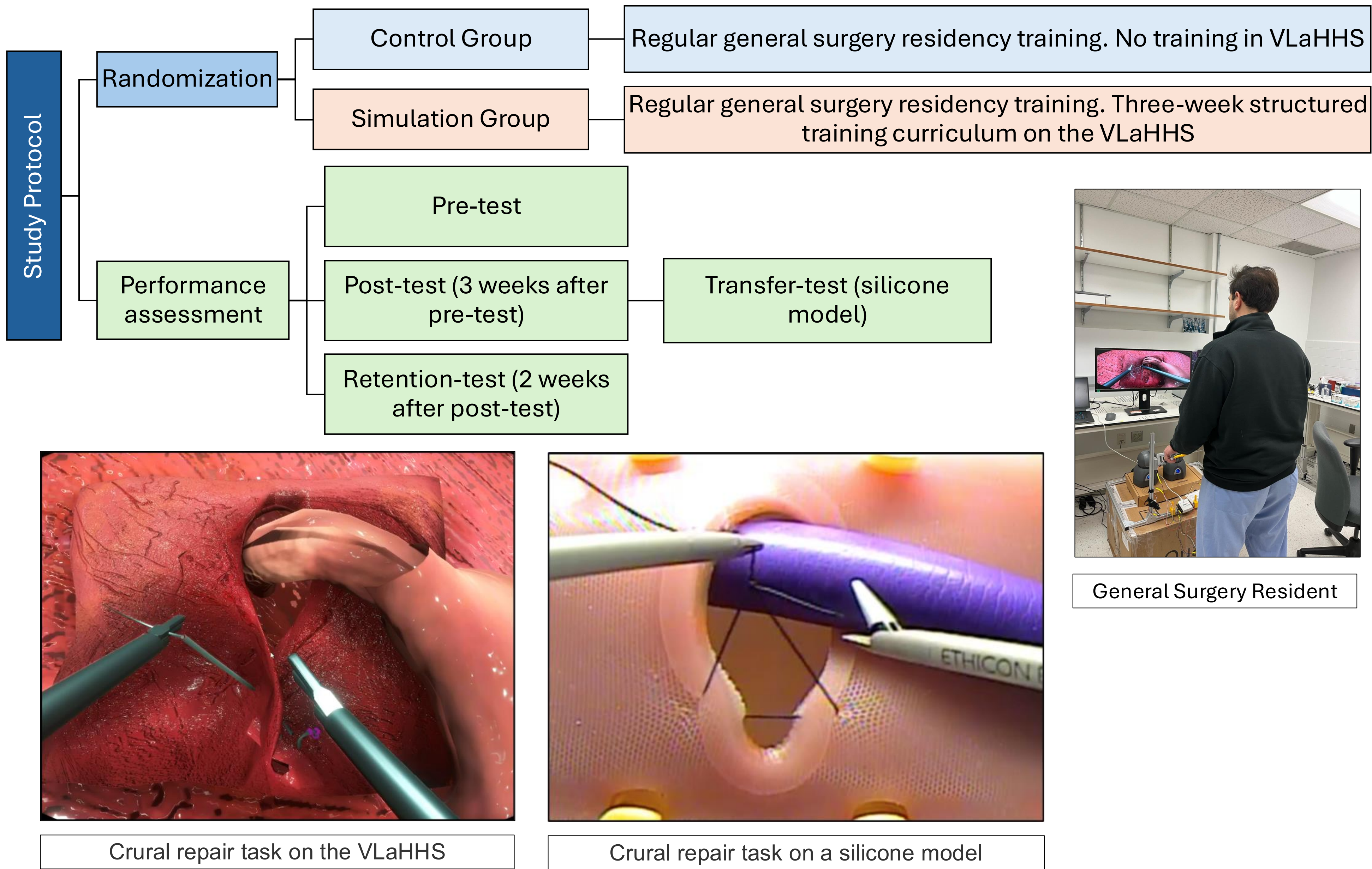
Laparoscopic hiatal hernia repair (LHHR) is a widely performed foregut procedure and is considered a technically complex with a long learning curve towards proficiency, requiring advanced surgical training due to its complexity. Proficiency in LHHR is critical, as recurrence rates can reach up to 50%, particularly in paraesophageal hernias. Despite the increased adoption of surgical simulation, validated tools for assessing advanced laparoscopic procedures remain limited. To address this, our group has developed The Virtual Laparoscopic Hiatal Hernia Simulator (VLaHHS) to provide a safe platform for both training and objective performance assessment.

Objective

This study aimed to evaluate the predictive validity of VLaHHS by assessing skill acquisition, retention and transfer for a laparoscopic hiatal hernia repair.

Methods

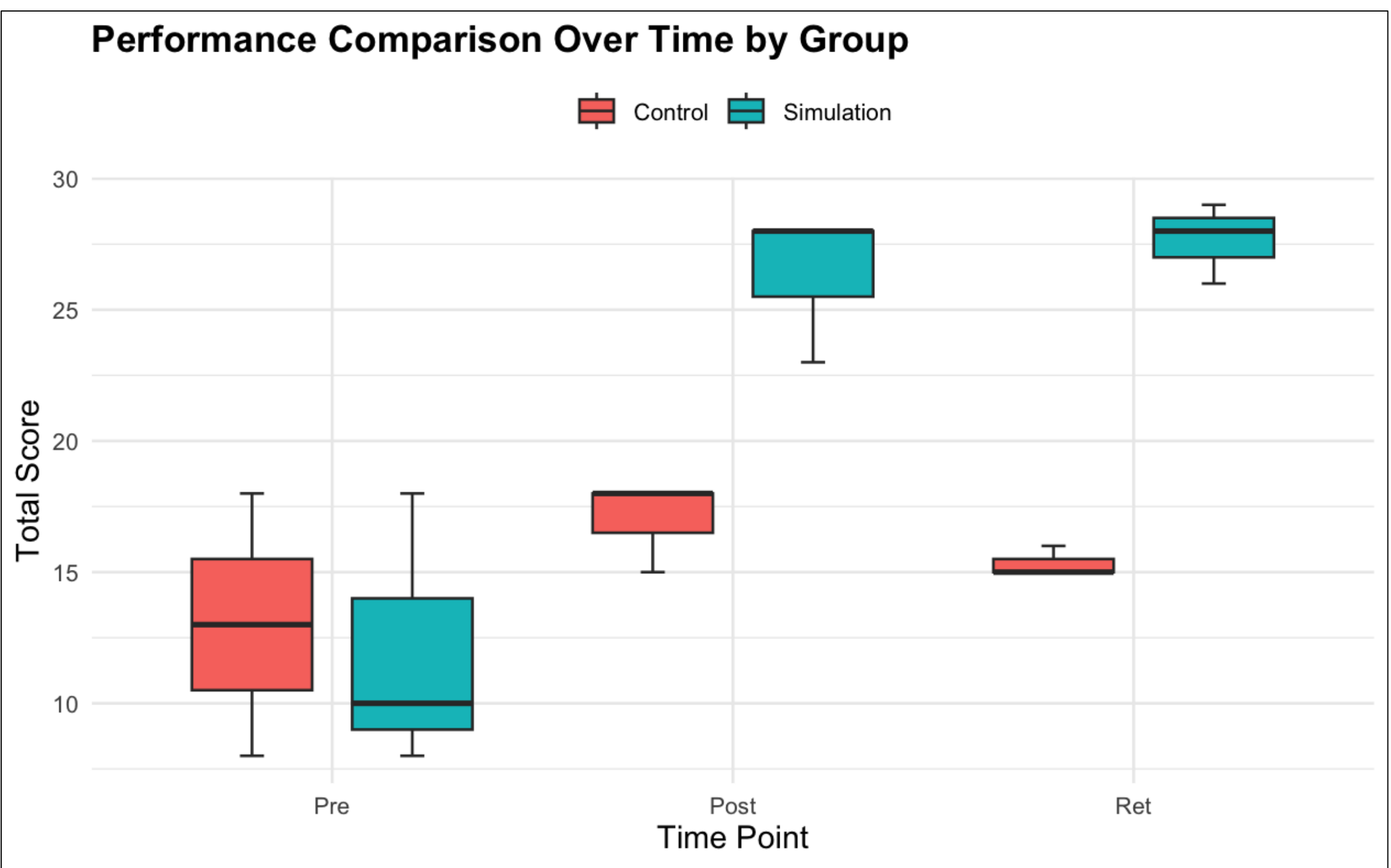
In this IRB-approved study, general surgery residents from all academic years were recruited and randomized into simulation or control groups.



The crural repair task involved virtually suturing a hiatal hernia defect closed on the VLaHHS. The simulator automatically captured objective performance metrics. Transfer test scoring from video review used OSATS and validated TSM. A 2 (Group: Control vs Simulation) x 3 (Time: Pre, Post, Ret) mixed ANOVA analyzed total scores with Bonferroni corrected pair-wise comparisons. Transfer test performance was compared using one-sided Wilcoxon Rank Sum Test. Effect sizes were reported using Cohen’s d.

Results

Six residents completed the study (Simulation: one PGY-1, two PGY-3; Control: one PGY-2, two PGY-3). Mixed ANOVA showed significance effects of Group ($p = 0.019$), Time ($p = 0.001$) and Group x Time interaction ($p = 0.013$). Post hoc analysis showed that the Simulation group outperformed the Control at both post ($p = 0.008$) and retention tests ($p < 0.001$), while no difference was observed at baseline ($p = 0.82$). On the transfer test, the Simulation group achieved higher OSATS score ($d = 1.43$, $p = 0.038$). TSM total score also favored the Simulation group with a large effect size ($d = 1.51$, $p = 0.05$).



Conclusion

VLaHHS training led to significant improvements in skill acquisition and retention, and these skills transferred effectively to a validated crural repair model. The results confirm the simulator’s predictive validity and support its integration into advanced laparoscopic training curricula to enhance proficiency in hiatal hernia repair.



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