

Introductions and Objectives

Robotic hiatal hernia repairs (RHHR) have a high rate of anatomic recurrence often leading to symptomatic recurrence. Technical suturing skills and their impact on recurrence of symptoms has not been studied. This project examines the application and generalization of the End-to-End Assessment of Suturing Expertise (EASE) tool, previously validated for quantifying suturing skill in robot-assisted prostatectomies. Further, we evaluate the association of EASE skills with patient symptom recurrence.

Methods

Four surgeons contributed surgical video from 52 total robotic cases, 48 (92%) of which included crural closure and 33 (63%) with fundoplication. Two blinded and trained reviewers independently assessed the initial 20 videos using EASE under supervision of expert surgeons and conducted three consensus building sessions.

For each stitch, 7 skills (Fig. 1) were rated as 3=ideal, 2=intermediate, 1=fail. These videos yielded 898 stitches, translating to 7211 skill scores. GERD-HRQL surveys were collected at regular follow-up appointments. Recurrence of symptoms was defined as a GERD-HRQL score ≥ 10 .

A Poisson regression model with generalized estimating equations (GEE) was used to account for the hierarchical data structure when testing the association, after adjusting for age, sex and baseline medication use.

Figure 1: EASE Scoring Criteria for Seven Suturing Skills

Sub-Skill	Criteria	Success Threshold
Needle Repositions	Each discrete pass of needle	2 passes or less
Needle Hold Ratio	Needle grasped inside of acceptable range	Halfway to 3/4 distance from tip
Needle Hold Angle	Angle between needle tip and driver	Between 90°-135°
Depth of Needle Hold	Depth of needle body in driver jaws	Distal 1/4 of driver jaws
Driving Smoothness	Smooth, continuous motion of needle drive	Maximum 1 re-adjustment & 1 re-grab of needle
Wrist Rotation	Rotation of wrist during needle drive	Complete rotation of wrist following curve of needle
Wrist Rotation	Rotation of wrist during needle withdrawal	Complete rotation of wrist following curve of needle

Results

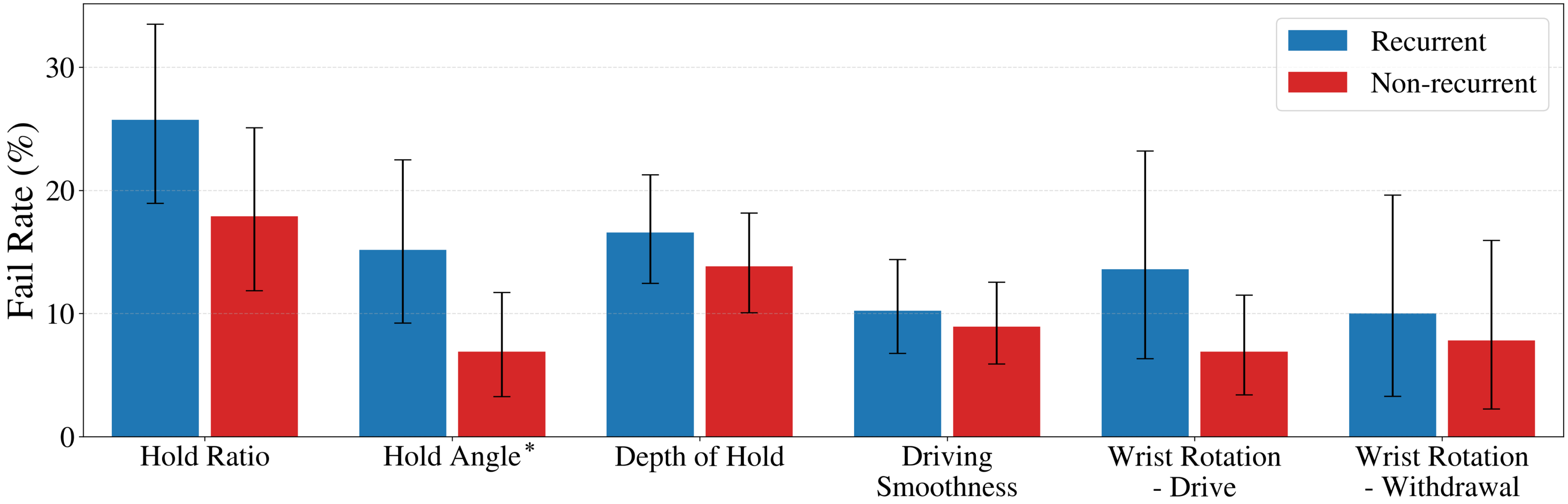
Median (IQR) follow-up was 150 days (45.5-363 days). Inter-rater reliability was high between the two annotators with prevalence-adjusted and bias-adjusted Kappa (PABAK) ranging from 0.74 to 0.92. Failure rates of suturing skill assessment were adjusted for age, sex, and baseline medication.

Results

Table 1: Demographics

	Recurrent	Non-Recurrent	p-value
Number	17	31	
Age	57 (40-68)	67 (56-74)	0.03
Height (m)	1.7 (1.6-1.7)	1.7 (1.6-1.7)	0.96
Weight (kg)	82 (67.1-94.8)	78.3 (66.5-91.6)	0.84
BMI	28.2 (24.8-31.6)	28 (25.1-33.5)	0.78
Pre-Op GERD	13 (3-25)	14 (4-18)	0.47
Max Post-Op GERD	14.5 (5.5-19.5)	3 (2-5.5)	<0.01

Figure 2: EASE Failure Rates as Predictors of Recurrence after Robotic Hiatal Hernia Repair



Conclusions

This pilot study showed that superior suturing skill scores can be reliably utilized to quantify suturing skills during RHHR and are associated with reduced rate of symptom recurrence. Future work will explore if this is a causative relationship.