Perceptions of Resident Autonomy: A Comparison between Resident and Faculty with Objective Real-Time Robotic Console Data

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BACKGROUND

Graduated responsibility and the progression toward operative autonomy is a complex multifactorial process, and the ultimate goal of surgical training[1]. Perceptions of achieving autonomy confers a resident's readiness for practice by their attendings and instills confidence to enter independent practice by the trainee. However, the degree of resident autonomy achieved in the operating room is perceived differently by residents and attendings[2, 3]. In general, residents perceive less autonomy in their operative experiences compared to their attendings.

Much of the recent work in the space of resident autonomy has investigated the differences in perceptions based on validated but ultimately subjective systems like the Zwisch Model[4, 5]. Real-time data collected on the robotic dual console system provides an objective measure of operative autonomy by delineating which surgeon has control of the robot throughout the operation (Figure 2). Unlike in traditional open and laparoscopic surgeries where autonomy perception gaps have been described, the perception of resident autonomy has not been as widely explored for robot-assisted surgeries.

RESULTS

Six attendings and nineteen residents, seven of which were female, participated in the study. 222 surveys and 154 unique cases were included. Attendings overestimated autonomy while residents accurately estimated operative autonomy when compared against the objective robot-generated timeline. Overall, residents perceived performing less of the case than the attendings perceived, irrespective of the robot-generated timeline data. However, there was no significant difference among female resident and attending perceptions, while male residents perceived completing significantly less of a case than their attendings perceived.

An attempt was made at calculating differences in perceptions for key steps of the procedure. There was however too many missing data to reliably perform such an analysis. This was the result of inconsistent instrument transitions on the robot timeline making key step time stamps unreliable.

Table 1.

	Resident vs. Robot[a]		Attending vs. Robot[a]		Resident vs. Attending	
Outcome	**Difference %[b] (95% CI)**	**p[c]**	**Difference % (95% CI)**	**p**	**Difference % (95% CI)**	**p**
Overall	1.6 (-1.8 to 4.9)	0.357	7.1 (3.8 to 10.5)	<.001	-5.6 (2.2 to 8.9)	0.001
Biological Sex						
Male	-0.9 (-5.0 to 3.2)		7.5 (3.4 to 11.6)		-8.4 (-12.5 to -4.3)	
Female	6.1 (0.6 to 11.6)		6.5 (0.9 to 12.0)		-0.4 (-5.9 to 5.2)	
Case Type						
Gastric Sleeve	1.0 (-4.7 to 6.7)		9.4 (4.2 to 14.6)		-8.4 (-14.5 to -2.3)	
Roux-en-Y Gastric Bypass	0.0 (-8.1 to 8.1)		1.6 (-5.1 to 8.2)		-1.6 (-11.6 to 8.5)	
Hiatal Hernia Repair	1.7 (-5.3 to 8.7)		5.4 (1.3 to 9.5)		-3.6 (-9.0 to 1.8)	
Ventral Hernia Repair	2.5 (-10.7 to 15.7)		10.0 (-4 to 26)		-7.5 (-16.7 to 1.7)	
Inguinal Hernia Repair	3.4 (-7.9 to 14.7)		9.6 (-2.3 to 21.5)		-6.1 (-17.4 to 5.2)	

[a.] Robot data was calculated from the Intuitive ® Da Vinci surgical robot dual console system.
[b.] Difference % is calculated as the difference of the former subject minus the later in each comparison group. For example, in the "Resident vs Robot" group the overall Difference of 1.9% reflects the residents perceiving a 1.9% greater case autonomy (% of the total time of the case completed) than the robot demonstrated.
[c.] Statistical significance for overall difference set at $p < 0.05$.

DISCUSSION

Key Findings:

1) *Attendings overestimate the degree of autonomy they provide residents when compared against the objective robotic timeline data.*
2) *Female residents received less autonomy based on the robotic timeline data than they or their attendings had perceived. This objective difference in female perceptions of autonomy compared to reality is consistent with prior reported gender disparities[6].*
3) *Male residents were more likely to perceive autonomy consistent with the robotic timeline data.*

Subjective and holistic evaluation of resident competency will always have a role in surgical training and determination of readiness for independent practice. However, the use of the robotic platform with its objective timeline of operative performance provides an interesting constituent of overall surgical trainee's readiness for independent practice. Likewise, the robotic timeline may supplement the long-pursued development of standardized curriculum in fundamentals of robotic surgery.

METHODS

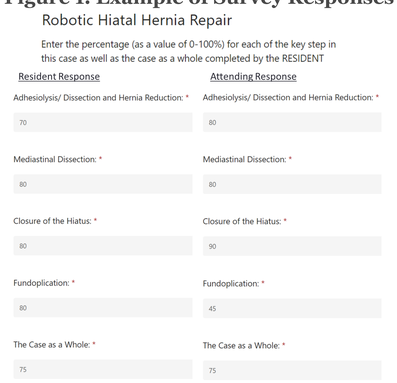
Six types of robot-assisted operations completed by residents and attendings in the general surgery and urology training programs at a single institution were studied. Resident perception, attending perception, and objective timeline data of resident operative autonomy were compared. The operations included in this project were sleeve gastrectomy, Roux-en-Y gastric bypass, ventral hernia repair, inguinal hernia repair, hiatal hernia repair, and prostatectomy, and only those completed on the dual-console system were included.

At the conclusion of one of the included cases, both the attending and resident scanned a common QR code taking them to an online survey. Both participants reported what they perceived to be the percentage of the whole case completed by the resident as well as the percentage of key steps in the case completed by the resident (Figure 1). For example, the key steps to a hiatal hernia repair included adhesiolysis, mediastinal dissection, closure of the hiatus, and fundoplication. Additional demographic and subjective perception questions were also obtained in the survey.

The real, objective percentage of resident operative autonomy was then extracted from each case timeline delineating which surgeon controlled the robot throughout the case on the dual console system (Figure 2). Transition between key steps was determined by transition of robotic instruments also recorded on the case timeline.

Gender differences were also measured.

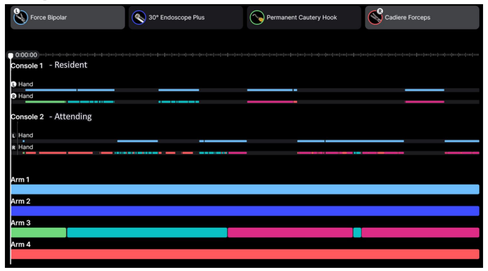
Figure 1. Example of Survey Responses


Robotic Hiatal Hernia Repair

Enter the percentage (as a value of 0-100%) for each of the key step in this case as well as the case as a whole completed by the RESIDENT

Resident Response	Attending Response
Adhesiolysis/ Dissection and Hernia Reduction: *	Adhesiolysis/ Dissection and Hernia Reduction: *
70	80
Mediastinal Dissection: *	Mediastinal Dissection: *
80	80
Closure of the Hiatus: *	Closure of the Hiatus: *
80	90
Fundoplication: *	Fundoplication: *
80	45
The Case as a Whole: *	The Case as a Whole: *
75	75

Figure 2. Intuitive Da Vinci ® Case Timeline



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