A dedicated robotic bedside physician assistant significantly enhances trainee console operating time in general thoracic surgery

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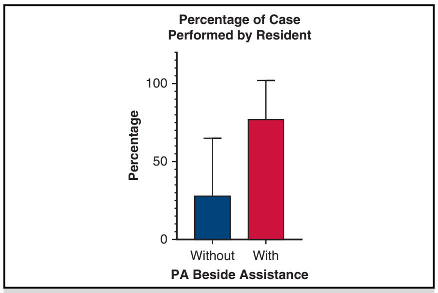
ABSTRACT

Objective: As trainees rotate through thoracic subspecialties within their curricula, a crucial portion of their robotic training consists of actual console operating time. The more time spent on the surgeon console, the greater the development will be through the course of their training. Implementing a physician assistant at the bedside may increase the operative console time for the trainee and develop robotic skills in a more expeditious rate. The objective was to evaluate the impact a designated robotic physician assistant can have on trainee console learning opportunity.

Methods: Operating room data collected consisted of all robotic general thoracic surgical cases that trainees participated in with and without a physician assistant present. Metrics regarding case efficiency included anesthesia ready-to-incision, incision-to-console, and raw resident console times. By using PRISM software, a nonparametric *t* test was used to analyze each averaged data group compared between when a physician assistant was present and not present.

Results: The mean resident console time without and with a physician assistant assist was 45.8 minutes and 80.9 minutes, respectively ($P < .0001$). The average portion of a case performed by a trainee similarly without and with a physician assistant present was 28.0% and 77.1%, respectively ($P < .0001$). Case efficiency metrics between physician assistant presence cohorts showed no difference.

Conclusions: Thoracic surgical trainees have increased opportunity for robotic skill development within a fellowship or resident program curriculum when a designated robotic physician assistant is present in the operating room. These findings are significant for the improvement of residency and fellowship robotic training models moving forward by incorporating robotic-specialized physician assistants in academic institutions. (JTCVS Open 2023;16:1070-3)



Percent of case performed by trainee without and with a PA bedside-assist present.

CENTRAL MESSAGE

Implementing a PA at the bedside may increase the operative console time for the trainee and develop robotic skills in a more expeditious rate.

PERSPECTIVE

By implementing a designated and trained robotic PA as the bedside-assist role, the trainees may relinquish those necessary duties that were once limiting their primary learning objectives as surgeons.

Since the first published robotic lobectomy for lung cancer in 2002, general thoracic surgery proves no different as recorded robot-assisted surgery (RAS) cases span nearly the entire spectrum of the specialty today.[1,2] Minimally invasive approaches may be appealing to the general thoracic surgeon because they have demonstrated less surgical pain, decreased postoperative complications, and hospital length of stay when compared with their open counterparts.[3] Additionally, the surgeon's wellness should be considered, because a minimally invasive approach can be practiced with fewer postural injuries over one's career.[4]

The expanding adoption of RAS in general thoracic surgery naturally calls for a plan to train surgical trainees as proficient robotic console surgeons. As trainees rotate through thoracic subspecialties within their respective curricula, a large portion of their robotic training consists of web-based courses, simulator modules, and dry/wet lab practice.[5] Because of the nature of the da Vinci surgical system (Intuitive Surgical), a minimum of 1 sterile bedside assistant and 1 nonsterile console surgeon are both required to

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Abbreviations and Acronyms
PA = physician assistant
RAS = robot-assisted surgery

complete a robot-assisted operative case safely and effectively. Traditionally, trainees at some institutions have assumed the role of the sterile bedside-assist to their attending surgeon counterpart at the console. This renders these trainees unavailable to learn alongside the attending surgeon at the dual console and severely limits their potential development on a complex surgical system. Likewise, reversing the roles, attending surgeons performing sterile bedside-assist are limited in aiding and teaching at the console, and unable to quickly intervene before an errant maneuver is made by the resident. It can be argued, like in any other operative learning, actual recorded operating experience proves to be one of the highest priorities for improving surgical skill and decision-making on the robotic system. Although understanding the entirety of the surgical system and its nuances is crucial toward overall proficiency, it should never be at the expense of actual operative time in the console. The more time spent on the surgeon console themselves, the greater the resident/fellow development will be through the course of their training programs. The required bedside-assist role poses a barrier to this complete robotic development of upcoming trainees.

A dedicated bedside physician assistant (PA) may increase the operative console time for the learner and relieve trainees from bedside assist to operating the console in a more expeditious rate. A specialized advanced practice provider, such as the PA, promotes consistent and frequent encounters with the robotic system resulting in an acquaintance with its nuances that may affect RAS case efficiencies through familiarity of the nuanced troubleshooting and setup. The objective of this study was to evaluate the impact that a designated robotic PA bedside first-assist can have on trainee console learning opportunity.

MATERIAL AND METHODS

Operating room data from July 2019 to July 2022 were retrieved from a prospectively maintained robotic database within a single institution. The da Vinci xi robotic system was used in all cases. Institutional review for this research was considered exempt from formal review because no patient identifiers were required. The data cohort consisted of all general thoracic surgical cases that trainees participated in with and without a PA present. Trainees were defined as a surgical resident of any postgraduate year or cardiothoracic fellows. Throughout the data collection timeframe, 6 different postgraduate surgical residents and 9 different cardiothoracic fellows operated on the consoles. Only 2 attendings and 1 PA were involved throughout the study. The categories measured within these parameters were minutes of raw trainee console time and percentage of trainee console time in an entire surgical case. These categories will evaluate the impact that the robotic bedside PA role would have on trainee robotic console opportunity. Types of cases included wedge resection, segmentectomy, lobectomy, sympathectomy, esophagectomy (transhiatal), mediastinal mass resection, thymectomy, and tracheobronchoplasty. Because of varying case lengths among surgery types, percentage of case operating time was an important consideration to accurately compare cohorts. Additional categories measured were minutes of anesthesia ready-to-incision and minutes of incision-to-console times. These will evaluate the impact the PA role would have on operating room and case time efficiencies.

By using PRISM software, a nonparametric t test was used to analyze each averaged data group compared between when a PA was present and not present. Cases without trainees present were excluded.

RESULTS

The mean trainee console time without (n = 112) and with (n = 74) a PA assist presence was 45.8 ± 6.4 minutes and 80.9 ± 6.7 minutes, respectively (Figure 1, $P < .0001$). When analyzing available total operating room time, the average percent robotic portion of a case performed by a trainee similarly without (n = 98) and with (n = 75) a PA assist presence was 27.94% ± 36.97% and 77.08% ± 24.96%, respectively (Figure 2, $P < .0001$).

Evaluating the impact on initial surgical setup efficiencies, mean anesthesia ready-to-incision without (n = 114) and with (n = 99) a PA bedside-assist presence was 23.0 ± 11.6 minutes and 22.0 ± 9.2 minutes, respectively (Figure 3, $P = .72$). Additionally, incision-to-console time without (n = 114) and with (n = 100) a PA bedside assist presence was 16.3 ± 17.0 minutes and 17.4 ± 20.5 minutes, respectively (Figure 4, $P = .43$).

DISCUSSION

Thoracic surgical trainees require many platforms of learning to reach proficiency in RAS, arguably, none of which are more important than the application of real-time surgical cases with their attendings. Although learning the bedside role in robotic surgery is crucial in molding a well-rounded understanding of this surgical tool, the majority of the patient's care takes place at the surgeon console. This is where the surgical trainee must assumedly spend as much time as possible to become well acquainted with the tool's interface, his/her coordination, and surgical procedure nuances that otherwise may differ to its open/video-assisted thoracoscopic surgery approach counterparts.

When mean trainee console time and mean percentage of surgical case performed by a trainee without a PA present at the bedside was compared with both categories with a PA present, they were found to be statistically significant between the 2 comparable cohorts. With the PA's presence in a surgical case, raw trainee surgeon console times (Figure 1) and percentage of surgical case (Figure 2) were observed significantly higher when compared with the cases where no PA was present.

By implementing a designated and trained robotic PA as the bedside-assist role, the trainees may relinquish those necessary duties that were once limiting their primary

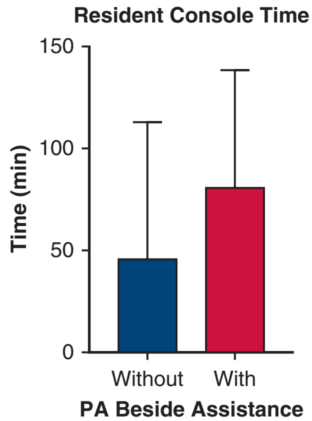

FIGURE 1. Average time (minutes) of RAS case performed by trainee at the console without (n = 112) and with (n = 74) a PA bedside-assist present ($P < .0001$). *PA*, Physician assistant.

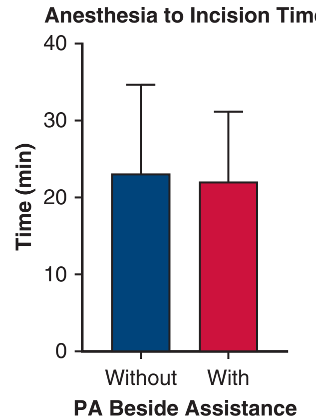

FIGURE 3. Average time (minutes) from "anesthesia ready" to recorded incision in RAS cases without (n = 114) and with (n = 99) a PA bedside-assist present ($P = .72$). *PA*, Physician assistant.

learning objectives as surgeons. It is important to recognize that not all thoracic cases are of equal length or complexity. The mean percentage of case performed by the trainee at the surgeon console allowed for reasonable comparison between varying case lengths and complexities.

The impact on efficiency measures in the operating room was evaluated through mean anesthesia ready-to-incision time and incision-to-console time compared between with and without PA cohorts. Anesthesia ready-to-incision time captured the impact a PA would have on the patient positioning and case detail setup efficiency (Figure 3). Incision-to-console time captured the impact a PA would have on the entry, optimal port placement, and robotic docking efficiency. Neither category observed statistical significance between with and without PA cohorts. This result can be due to the already efficient division of thoracic surgery within the institution under observation for this study. The surrounding operating room staff and anesthesia personnel have created a lean surgical flow in this specific division, leaving few opportunities for improvement within these parameters. The case efficiency is independent of the presence of a robotic PA. Furthermore, these results provide evidence that the addition of a robotic PA did not interfere with the already incredibly lean surgical flow at the institution where these data were collected. Other surgical divisions and institutions may witness statistical significance in operating room efficiency metrics between these 2 cohorts. Further research should be conducted to study the robotic PA's effect on case efficiency beyond the thoracic division of this study.

Study Limitations

Limitations of this study include a small sample size, the retrospective analysis of prospectively ascertained data, and using a single institution with a single PA experience, which may not be widely generalizable. In addition, data were not

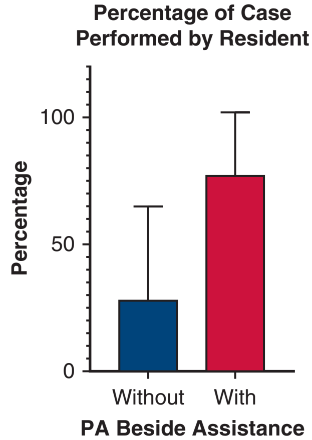

FIGURE 2. Average percent of RAS case performed by trainee without (n = 98) and with (n = 75) a PA bedside-assist present ($P < .0001$). *PA*, Physician assistant.

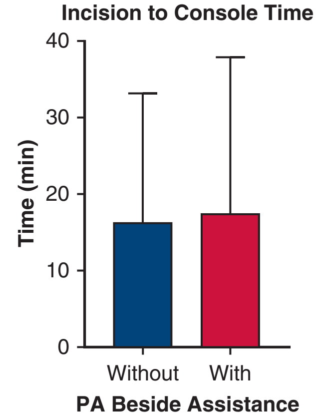

FIGURE 4. Average time (minutes) from recorded incision to recorded surgeon console start in RAS cases without (n = 114) and with (n = 100) a PA bedside-assist present ($P = .43$). *PA*, Physician assistant.

stratified by case, because the metrics evaluated were solely chosen to reflect improvement in trainee experience, not ability. Costs were not analyzed, because a modest reduction in operating time might not justify the need of a robotic PA bedside assistant, as resident experience is invaluable when compared with few advanced practice provider salary costs.

The combination of these results suggests that the presence of a designated trained robotic PA in robot-assisted thoracic surgery significantly improves the development of residents and fellows in their respective training programs. These findings are significant for the improvement of residency and fellowship robotic training models moving forward. By incorporating robotic-specialized PAs in institutions, trainees receive higher-quality training on robotic surgical systems.

Despite these advantages of the PA, it remains imperative that trainees remain competent in all aspects of bedside assisting: eye-to-hand coordination, troubleshooting problems and errors, and facile opening/closure for optimal port placement while reducing operative times. As time progresses and robotic technology continues to be incorporated into medical school and early surgical training, cardiothoracic fellows entering their final years of training can focus on console rather than bedside-assist time, strengthening the PA role need.

Furthermore, the experienced robotic PA lends a valuable teaching resource to those trainees learning the bedside earlier in their programs and attending surgeons new to the robot alike. The robotic PA can teach robotic bedside nuances to junior trainees in real time during cases while also offering common troubleshooting guidance to attendings learning the robotic approach.

PAs may be the personnel of choice when compared with other medical professionals for several proposed reasons. The PA's training and scope of practice allow him/her to actively engage in complex surgical procedures. Infrequent, emergency conversions due to critical errors or unforeseen changes in a patient's condition rely heavily on the capability and leadership capacity of the surgeon's bedside assistant. Finally, the flexibility of the PA's scope allows him/her to specialize in the operating room as well as with inpatient care, which is appealing to any hiring model for diversity in production output. However, more research comparing the PA with alternative medical professions in the bedside role may help institutions determine the most appropriate use.

CONCLUSIONS

This study was conducted and results were concluded under the assumption that the robotic development of a surgical resident or fellow is directly correlated with the amount of time spent at the surgeon console. However, future studies should evaluate the impact that opportunity has on robotic testing outcomes through quantitative robotic skill development metrics in these trainees.

Conflict of Interest Statement

S.C.Y. and C.L. are speakers for Intuitive Corporation. All other authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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Key Words: console, curriculum, physician assistant, robotic surgery, surgical trainee