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See one, do one, but never teach one? An analysis of resident teaching assist cases under various levels of attending supervision

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ABSTRACT

Background: Surgical training has traditionally relied on increasing levels of resident autonomy. We sought to analyze the outcomes of senior resident teaching assist (TA) cases performed with a structured policy including varying levels of staff supervision.

Methods: Retrospective review at a military medical center of TA cases from 2009 to 2014. The level of staff supervision included staff scrubbed (SS), staff present and not scrubbed (SP), or staff not present but available (NP). Operative variables were analyzed. An anonymous survey of residents and attendings at 6 military programs regarding experience and opinions on TA cases was distributed.

Results: 389 TA cases were identified. The majority (52%) were performed as NP. Operative times were shorter for NP cases ($p < 0.05$). Overall complication rate and length of stay were not different between groups ($p > 0.05$). Survey results demonstrated agreement amongst staff and residents that allowing selective NP was critical for achieving resident competence.

Conclusion: There were no identified adverse effects on intraoperative or postoperative complications. This practice is a critical component of training senior residents to transition to independent practice.

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Introduction

Surgical training has traditionally relied on gradually increasing levels of resident autonomy and independence. In the classic Halstedian training model this would culminate in senior or chief residents essentially functioning as junior attendings, including performing operative procedures with limited or no direct observational supervision. Because of multiple factors including concerns for patient safety, legal liability, decreased resident work hours, and insurance and billing requirements, this aspect of surgical residency is largely disappearing in the United States. However, data regarding patient outcomes, as well as perceptions of both surgical trainees and supervising physicians on this practice are lacking in the current surgical literature, with little scientific evidence to either support or refute this practice. The advent of work hour restrictions, and reduced perceptions of resident competency and confidence, has also decreased the ability to advance

autonomy throughout the training continuum. Studies in the literature regarding the overall impacts of surgical resident involvement on patient outcomes to this point have been limited and present conflicting conclusions. Published reviews have ranged from finding no adverse effect with resident involvement,^{1,2} to those finding either some improvement in patient care³ or a detrimental effect.^{4,5} This conflicting data and the current medico-legal landscape of medical practice in the United States has led to the decrease in graduated autonomy. The decrease in autonomy may be one of many factors which has led to the drastic increase in the amount of general surgery trainees applying for and pursuing additional fellowship training.⁶ This increase in pursuit of further subspecialization, as well as conflicting data in the literature, support the belief that current graduates of general surgery training are not prepared for independent practice and this belief appears to be common amongst graduates and faculty.^{7,8}

The readiness of a graduating surgical resident to immediately assume complete responsibility for patient care and for performing a wide variety of surgical procedures has become a growing concern among both residents and attending surgeons over the past decade of rapidly evolving training paradigms and restrictions.

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Historically it was a widely-accepted principle that a newly graduated surgeon was ready to assume independent practice and to perform complex surgical cases without supervision. A large part of this could presumably be attributed to the fact that the new graduate had already demonstrated their ability to handle this level of autonomy for the latter 1–2 years of their residency training, a practice which has essentially vanished from many modern training programs. In many instances, a graduating chief resident today may have never performed a surgical procedure from start to finish without an attending surgeon either scrubbed in or present in the operating room and providing direct observation and supervision. Although patient safety and outcomes is commonly cited as the primary concern driving these practices, there is little to no data to support this assumption. In addition, there is seemingly little discussion about the equally concerning scenario of a newly graduated surgeon now performing his or her first truly independent cases without backup or support. Among military training programs, this is of particular concern due to the very real possibility that a newly graduated surgeon very likely could be deployed to a forward surgical unit where they may have little to no assistance from more senior surgeons, and will be faced with taking care of severely injured battlefield casualties.

Like most institutions, our military surgical residency training program has consistently sought to balance these concerns regarding patient outcomes and surgical quality with the need for resident involvement and some degree of senior resident autonomy, particularly in the operating room. To this end, we have developed and maintained a highly-structured program of graduated autonomy that culminates in senior residents being allowed to perform highly select cases under varying levels of attending supervision, including the attending being immediately available but not present in the operating room. To better facilitate this model and the ability of senior residents to perform true teaching assist (TA) cases, we created an Acute Care Surgery team responsible for all urgent surgical consults, and led by a chief resident and with staff surgeon oversight. The purpose of this study was to examine and analyze our experience with this model, and in particular to analyze and compare patient outcomes following operative procedures performed by chief residents in the TA role with varying levels of direct staff supervision. We also sought to capture staff and resident surgeon opinions regarding the impact and perceived importance of this program of graduated autonomy.

Materials and methods

This study was reviewed and approved by the local Institutional Review Board, and was determined to not require patient or resident consent. Our facility is a military tertiary care referral center, a Washington state certified Level 2 trauma center, and one of 6 U.S. Army Graduate Medical Education Committee approved residency training programs for general surgery. The program accepts 4 residents per year group, and offers a 6-year training program including one mandatory year of surgical research. Prior to the time period examined in this study, graduates from our institution regularly exceeded the minimum requirements for teaching assist (TA) cases set forth as a requirement for graduation, but the numbers had shown a downtrend in total TA case experience. This was one of multiple factors that led to a reorganization and creation of an Acute Care Surgery service, composed of a chief resident, one junior resident and one to two interns. Lower complexity and severity cases performed on this service are routinely performed utilizing the TA model, with the chief resident encouraged to direct the flow of the procedure and to lead one of the junior residents/interns through the critical steps and anatomy. This service also operates

under the guidance of a written policy of requirements for staff supervision and operating room presence that is reviewed annually by the residency program director, and reviewed and approved by the Director of Medical Education for the institution.

To identify cases for use in this analysis we utilized the American College of Graduate Medical Education (ACGME) case log database for each graduating chief resident from our institution over a six-year span (2009–2015). Using this data, each graduates case long was screened for cases logged as the TA. Once all cases were identified, the case performed was then cross-referenced through our electronic case booking system, as well as the electronic medical record (EMR). To confirm that it had been a TA case and to delineate the level of staff supervision. The electronic brief operative report for every case performed at our center includes fields for identifying the presence and degree of staff supervision, including whether the staff surgeon was present and scrubbed (SS), staff was present and not scrubbed (SP), or staff was not directly present in the operating room but available (NP). Each case and full operative report was additionally screened to verify the level of staff involvement as SS, SP or NP. If there was any conflict, the detailed operative report was used as the final determinant of the staff supervision level. If the involvement of staff was unable to be ascertained after searching the above records, the case was excluded from our analysis.

Operative variables were recorded including operative time, estimated blood loss (EBL), intraoperative complications, intraoperative requirement for blood transfusion, conversion from laparoscopic to open surgery, and any other noted adverse event. Data from the immediate postoperative course for each patient was obtained from the inpatient electronic medical record and discharge summary, including patient total hospital and ICU length of stay (LOS) and any identified early post-operative complications. Complications included laboratory/imaging diagnosis or chart notation of any infection, ileus, unplanned intubation, ward transfer to the intensive care unit (ICU), anastomotic leak or stricture, unplanned return to the operating room, or need for any additional interventional procedures. For each case the outpatient medical record was also reviewed and any of the above complications diagnosed after the initial inpatient stay was recorded. In addition, any readmission or re-intervention within 30 days of the procedure was recorded.

Additionally, we sought to elicit the opinions and assessments of both resident and attending surgeons regarding operative autonomy and the impact on both patient outcomes and resident readiness for independent practice. We sent an IRB-approved anonymous survey to PGY-4 and PGY-5 residents and attending surgeons at all 6 U.S. Army general surgery residency training programs (Supplemental Digital Content). Questions were asked evaluating the practice of resident autonomy in the operating room, which cases were deemed appropriate for residents to perform with minimal supervision, and the perceived necessity and importance of graduated autonomy on the progression of surgical skill throughout training. Specific questions were asked regarding opinions of the safety and importance of the varying levels of direct staff supervision of chief residents during operative cases. Standard descriptive and univariate statistical comparisons were performed. Comparison of the 3 groups of staff supervision were performed using one-way analysis of variance (ANOVA) with post-hoc testing or Kruskal-Wallis H test for continuous variables, and chi-square testing for categorical variables. Survey data was analyzed using simple descriptives, and comparison of resident versus attending responses was done using chi-square or Fisher's exact testing. Statistical significance was set at a P-value less than 0.05 and all statistical analysis was performed using SPSS version 24 (IBM corporation, Chicago, IL).

Results

After identifying all eligible cases via the ACGME database, each case was screened via the EMR to ensure all necessary data was contained for each entry. After exclusion criteria were applied, a total of 389 eligible TA cases were eligible for further analysis. Table 1 shows the amount of cases in each category of staff presence within the operating room. Cases performed as NP comprised 52%, while 48% were performed with staff presence as either SP or SS in the operating room. Laparoscopy was the most common modality versus open surgery, with a rate of 64% ($n = 249$). The most common cases performed were laparoscopic appendectomy and cholecystectomy. Table 2 shows the cases performed by each level of attending involvement. Preliminary analysis demonstrated no difference in demographics or outcomes between the two categories where staff was present (SS and SP), thus these two groups were combined and compared to the staff not directly present group (NP). Table 3 illustrates the main operative variables by staff involvement collected for statistical analysis.

As shown in Fig. 1, operative times were statistically significantly shorter for NP cases with a mean of 69 min, versus 89 min for SP and SS cases ($p < 0.05$). EBL was not significantly different between groups at 20 cc for NP and 37 cc for SP/SS cases ($p > 0.05$), and no patients in the NP group required an intraoperative or postoperative transfusion. There were no intraoperative complications or adverse events in the NP group. Mean LOS was also similar between groups, at 3 days for NP vs 3.8 days for SP/SS cases ($p > 0.05$). There were no significant differences in overall complication rates between levels of staff presence (3% for NP versus 4% with SP or SS, $p = 0.7$). There were no unplanned returns to the OR or need for reoperation within 30 days among the NP group, and there were no postoperative deaths among the entire cohort.

To better gauge attending and resident opinions regarding TA cases and the level of autonomy/staff supervision, an anonymous survey was sent to PGY4/5 residents and supervising staff at our facility, and also to all 6 Army general surgery training programs. A total of 12 responses from residents and 23 responses from staff physicians were obtained. Questions ranged from what level autonomy in the operating room was deemed appropriate, what cases residents should be allowed to perform autonomously, assessment of resident and faculty belief of the importance of graduated responsibility, to the expected level that a senior resident should be able to perform various procedures. Respondents were also asked to estimate the impact on key outcome measures (OR time, EBL, etc) with the NP versus SP/SS approach. The results are shown in Figs. 2 and 3. Fig. 3 demonstrates that for all categories other than operative time, the majority of staff and residents were in agreement that this approach had no negative impact on these key factors. Both groups felt that the minimal level of readiness for TA autonomy was the PGY-4 year. The groups were also given a list of common cases, and attending surgeons were asked to rate the ability of chief residents to perform the case without staff directly present. Similarly, the chief residents were asked which cases they had previously performed utilizing the NP approach. These results are shown in Fig. 3. Notably, the trend for attending surgeons correlates with the trend that chief residents report they have

Table 1
Staff involvement in cases analyzed.

Level of Staff Presence	n	Percentage of Total
NP	202	52%
SP	67	17%
SS	120	31%

NP- Staff Not Present, SP- Staff Present but not scrubbed, SS- Staff Scrubbed.

Table 2
Cases performed and level of staff involvement.

	NP	SP	SS
Laparoscopic Appendectomy	78	32	16
Laparoscopic Cholecystectomy	42	24	38
Abscess Drainage	24	3	9
Open Inguinal Hernia Repair	6	2	7
Umbilical Hernia Repair	22	0	2
Laparoscopic Inguinal Hernia Repair	2	2	3
Ventral Hernia Repair	3	0	2
Port	2	0	1
Laparoscopic Sleeve Gastrectomy	1	0	7
Laparoscopic Gastric Bypass	0	0	5
Open Tracheostomy	0	2	1
Thyroidectomy	0	0	1
PEG Placement	1	0	1
Pericardial Window	0	0	1
Exploratory Laparotomy	4	0	4
Laparoscopic Pyloromyotomy	0	0	1
Diagnostic Laparoscopy	1	1	2
Hartman's Procedure	0	0	1
Lower Extremity Fasciotomy	0	0	1
Soft Tissue Excision	7	1	1
Port Removal	1	0	1
Breast Biopsy	3	0	2
Mastectomy	1	0	0
Ileostomy Takedown	0	0	1
Split Thickness Skin Graft	1	0	0
Laparoscopic Colectomy	1	0	1
Laparoscopic Gastrostomy	0	0	1
Thoracoscopic Decortication	0	1	0
Open Colectomy	0	0	3
Panniculectomy	2	0	4

Table 3
Operative and postoperative variables by attending involvement.

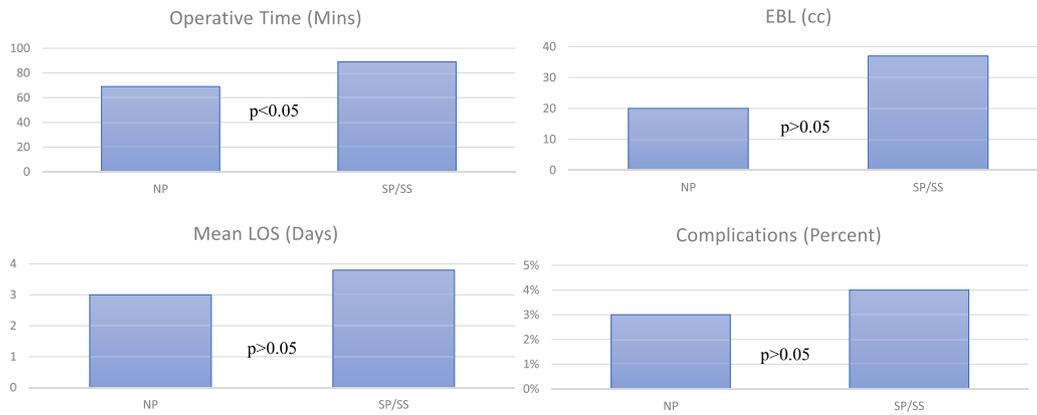
	n	Mean	Standard Deviation	95% CI
EBL				
NP	202	20.9 cc	145.5 cc	0.76–41.1 cc
SP	67	11.3 cc	22 cc	5.9–16.7 cc
SS	119	51.7 cc	192 cc	16.9–86.7 cc
Operative Time				
NP	202	69.7 min	42.2 min	63.9–75.6 min
SP	67	73.6 min	55.8 min	60.1–87.1 min
SS	119	98.7 min	64.9 min	86.9–110.5 min
LOS				
NP	202	3 days	6.2 days	2.1–3.8 days
SP	67	2.3 days	2.5 days	1.8–2.9 days
SS	119	6.3 days	6.3 days	3.4–5.8 days

EBL- Estimated Blood Loss, LOS- Length of Stay.

performed as a TA. Finally, the overwhelming majority of attending and resident respondents (>90%) felt that allowing selective NP was critical for achieving chief resident competence and confidence prior to graduating.

Discussion

The decline of autonomy in the operating room during general surgery training has spurred a variety of concerns. Arguably the most worrisome being that current graduates are not prepared to enter practice and perform basic general surgical procedures safely on their own.⁹ Of interest, these concerns have been demonstrated among both attendings and among residents at all levels of surgical training, and have become amplified since the major changes in residency training following work-hour restriction implementation. This worry has sparked a variety of research into ways to more efficiently and safely train general surgeons in the current work hour restriction era. Several studies have looked at patient



A: Operative time in NP versus SP/SS Cases. B: Comparison of EBL in NP versus SP/SS Cases. C: Mean LOS in NP vs SP/SS cases. D: Complication Rates in NP versus SP/SS cases.

Fig. 1. A: Operative time in NP versus SP/SS Cases. B: Comparison of EBL in NP versus SP/SS Cases. C: Mean LOS in NP vs SP/SS cases. D: Complication Rates in NP versus SP/SS cases.

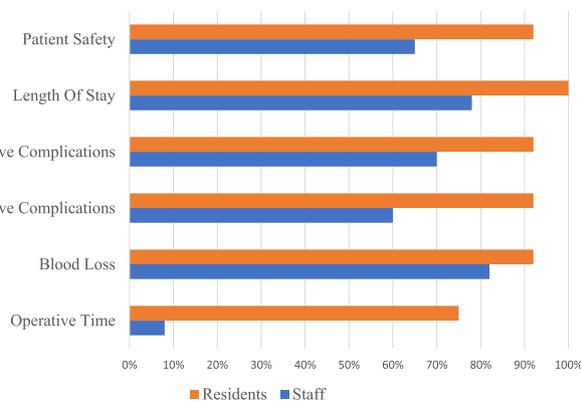


Fig. 2. Comparison of Staff and Resident agreement that the NP approach has no impact on the factors listed.

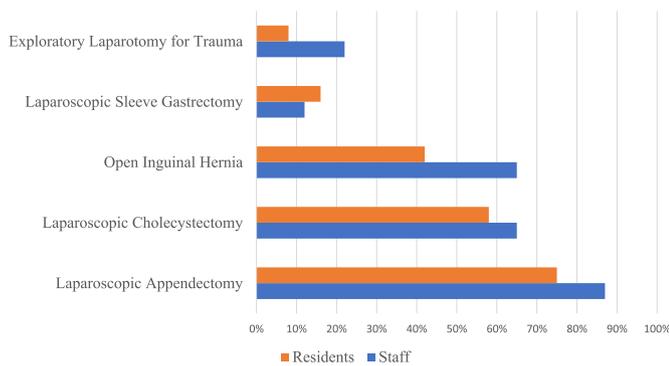


Fig. 3. Comparison of staff and resident opinions of ability to perform select cases utilizing the NP approach.

outcomes after resident involvement within their care, however few have looked directly at intraoperative variables. Laparoscopic appendectomy is viewed by many to be one of the most basic and common procedures performed, and recent data suggests there is no difference in patient length of stay, blood loss or postoperative complications if this is performed autonomously by senior general surgery residents.¹⁰ The retrospective data that we have gathered further supports this data, indicating that the practice of relative

autonomy on select procedures in the operative room is not only of educational benefit, but also safe for patients and not associated with any identified adverse outcomes.

The current literature regarding the patient outcomes associated with the teaching assist role have been polarizing. Multiple studies have demonstrated that the impact may be beneficial, deleterious or neutral. Seib et al.³ analyzed the impact of both resident and fellow participation within adrenalectomy, a complex procedure to evaluate. Utilizing the NSQIP database, 4133 adrenalectomies were identified for their analysis. These cases were able to be identified by attending surgeon involvement alone, fellow and senior resident. After multivariate logistically regression, they were unable to find a statistically significant correlation between trainee involvement and patient length of stay, and after further analysis there was no statistical significance in overall morbidity of cases with attending surgeon only compared to those with trainee involvement. Additionally, there was a statistically significant finding of decreased odds of complications for cases which involved trainees. These findings in a complex case of adrenalectomy speak to the validity of trainee involvement in patient care does not adversely affect patient outcomes and may even be advantageous to patient safety.

Krell et al.⁴ demonstrated an increased risk of wound infection and venous thromboembolism in 17,057 patients undergoing laparoscopic gastric bypass within their hospital system from 2006 to 2012. This finding stands in contrast to our findings that resident involvement does not increase postoperative complication rates, and may be more a factor of the TA case selection rather than a direct effect of resident involvement within the case itself.

High volume cases with resident involvement have also been studied in regard to outcomes with resident involvement. Hernandez-Irizarry et al.¹¹ evaluated laparoscopic hernia repairs and demonstrated that although cases took longer to complete, there was no increase in complications to patients. This further stands to show that while training residents, cases may be expected to take longer there is documented evidence that this does not necessarily increase the risk profile of surgical cases to patients.

As our data demonstrates, chief resident autonomy in the operating room is safe. Admittedly, the retrospective design of our study is a limitation, however the validity remains. Resident autonomy can be safely facilitated by using an acute care surgical model, as our institution demonstrates. Our model, placing a chief resident and junior resident together on a team which sees all acute

surgical consults places them in a position to perform TA cases at a higher rate than if left to serendipity. Placing residents in a position where the TA role is not only accepted, but encouraged for acute, basic general surgery cases with appendectomy being the leading case performed at our institution. Approximately 320,00 of these are performed within the United States annually.¹² With this large volume of basic general surgery cases to be performed, utilizing an acute care surgery model promotes surgical independence, furthering resident education without sacrificing surgical safety.¹³

Further work needs to be centered regarding the safety and efficacy of resident autonomy within the operating room. Increased operative time is known to be a risk factor for surgical morbidity, and resident involvement typically results in longer operative time, with this decreasing as the level of trainee increases.¹⁴ Our results demonstrate the safety of the TA role, however our data may be limited as it does not have detailed preoperative comorbidity or risk stratification data for each patient and procedure, or the ability to exactly match cases performed as SS/SP to those assigned as NP for case complexity. Prospective data is currently being collected to evaluate further the factors that allow this approach to be safe for patients, all while furthering the educational duty that surgical residencies have for their trainees.

Conclusions

The data we have gathered demonstrates no significant difference in overall patient morbidity utilizing a selective NP approach. Our institution has fostered a climate where relative senior resident autonomy in the operating room is not only allowed, but encouraged. This environment is fostered by an open collaborative amongst chief residents and attending surgeons, and is also tailored to the particular skills and assessment of competency of each resident by the responsible attending surgeons. Both parties must be in agreement with the expectations and challenges, and the indications to escalate the level of direct staff involvement for this approach to be safe for patients. If during an NP case a resident reaches a point of uncertainty or an unexpected operative finding or difficulty, then the attending surgeon is immediately notified and presents to the operating room to offer guidance or to scrub in and assume direct control. We also emphasize to residents at all levels that the act of calling for help and knowing one's limits is a critical sign of surgical maturity and sound intraoperative decision making, and in fact that not calling for help is the only "unforgivable sin" when some intraoperative problem arises. The ability to recognize scenarios in which further consultation with a subspecialist, or even just a trusted colleague fosters an environment of collaboration, all working towards the common goal of furthering

patient care in a safe manner and preparing residents for independent practice.

Conflicts of interest

The authors have no conflicts of interest to declare and have received no financial or material support related to this manuscript.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amjsurg.2019.01.012>.

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