Senior Residents as Teaching Assistants During Laparoscopic Cholecystectomy in the 80-Hour Workweek Era: Effect on Biliary Injury and Overall Complication Rates

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PURPOSE: The resident as teaching assistant (TA) in the operating room is an important role in the maturation of surgical trainees. One concern in the current 80-hour workweek era is that current senior residents (SRs) are unprepared to serve as TAs, potentially leading to higher complication rates and a significant increase in the length of operations. The aim of this study was to analyze whether SRs serving as TAs during laparoscopic cholecystectomy (LC) resulted in an adverse effect on complication rates in the 80-hour workweek era.

METHODS: A retrospective review was conducted of 1668 LC performed at 2 affiliated general surgery teaching hospitals from 2003 through 2007. Teaching hospital A was a public teaching hospital where junior residents (JR) performed the LC with a scrubbed SR as TA under faculty supervision. Teaching hospital B was a community-based affiliate hospital where the JR performed LC with only scrubbed faculty supervision. Operative case duration, JR level, patient gender/age, operative indication, final pathology, and complication data were gathered and univariate and multivariate analyses were performed.

RESULTS: Despite a higher rate of acute cholecystitis in the TA hospital, LC-associated complications occurred at similar rates with and without SR as TA. The rate of biliary injury was also the same in both hospitals. On multivariable analysis, only male gender was associated with complications (odds ratio = 1.7; p = 0.004).

CONCLUSIONS: In the 80-hour resident workweek era, SRs acting as TAs during LC is not associated with increased total complications or an increased rate of biliary injury.

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INTRODUCTION

General surgery residency is a prototypical experiential education model. Although the "see one, do one, teach one" approach is a now a rarity, the role of the resident as a teacher continues to be a critical component of a general surgery residents' education. The duty to teach the more junior housestaff escalates in frequency as residents matriculate through their years in a formal 5-year residency training program.[1] Postgraduate year (PGY-4) and PGY-5 level residents spend considerable time teaching lower-level residents basic operative techniques. Teaching assistant (TA)–level cases must be recorded on the Accreditation Council for Graduate Medical Education (ACGME) operative log website, which further emphasizes their importance in a general surgery curriculum.

As duty-hour restrictions have increased over the last decade, one major concern across all general surgery residencies is the level of preparedness of residents as TAs. Junior residents (JR) who operate less because of these new duty-hour mandates (e.g., 80-hour week and 16-hour intern shift) may have more difficulty teaching in their senior resident (SR) years.[2] Patients may endure longer operative times and may have higher complication rates at the hands of less prepared teaching SRs. The aim of this study was to analyze whether SRs serving as TAs during laparoscopic cholecystectomy (LC) resulted in an adverse effect on complication rates in the 80-hour workweek era.

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METHODS

A retrospective review was condcucted of 1668 LC performed at 2 affiliated teaching hospitals from 2003 through 2007. Teaching hospital A is a public hospital where JR performed the LC with a scrubbed SR as TA under faculty supervision. Faculty were always present to confirm the critical view before clipping the cystic duct and cystic artery. Faculty at teaching hospital A were routinely not scrubbed in the case. Faculty would only scrub at teaching hospital A if the patient required conversion to an open cholecystectomy. Teaching hospital B is a community-based affiliate hospital where the JR performed LC only with scrubbed faculty supervision.

Operative case duration, JR level, patient gender and age, operative indication, final pathology, and complication data were gathered for each case. Cholecystectomy-associated complications included biliary injury, bowel injury, wound infection, wound dehiscence, hernia, *Clostridium difficile* infection, postoperative respiratory compromise (hypoxemia, pneumonia, and severe atelectasis), and retained biliary stones. Biliary complications were categorized into 2 types: common bile duct (or hepatic duct) transection/injury requiring operative repair (e.g., hepaticojejunostomy or T-tube placement) and cystic duct leak requiring biliary stent placement.

The patient and resident data were collected in an Excel database (Microsoft Excel, Microsoft Corporation, Redmond, WA) for each year and translated into native SAS format using DBMS/Copy® (Dataflux Corporation, Cary, NC). Statistical analyses were performed using SAS 9.3 (SAS institute Inc, Cary, NC).

Descriptive statistics were evaluated for all variables. As the main outcome measures were not normally distributed, they were reported as medians with interquartile ranges and were compared using the nonparametric Wilcoxon rank sum test; $p < 0.05$ was considered statistically significant.

RESULTS

Overall, 1070 LCs were performed at teaching hospital A and 601 LCs were performed at teaching hospital B. During the study time period, residents performed an average of 136.3 LCs during their junior years and an average of 95.4 LCs in their senior years.

The JRs performing the LCs at teaching hospital A were primarily at the PGY 2 level of training (mean PGY level = 2.1). Teaching hospital B residents were on average about 1.5 years further advanced in their training (mean PGY level = 3.7, $p < 0.0001$). Public teaching hospital A cared for patients who were younger and had more acute cholecystitis (Table 1). Both hospitals had an equivalent percentage of male LC patients.

Despite teaching hospital A having a higher rate of acute cholecystitis and conversion to open cholecystectomy, cholecystectomy-associated complications occurred at similar rates in both hospitals (Table 2). A similar rate of common bile/hepatic duct injury and cystic duct stump leak was also seen at both hospitals. The duration of surgery was longer in teaching hospital A. More intraoperative cholangiograms were performed at teaching hospital A. Multivariate analysis demonstrated that only male gender was associated with complications (odds ratio = 1.7; $p = 0.004$).

DISCUSSION

Senior surgical residents teaching JR surgical techniques is a nationwide educational principle in general surgery residency. With the ACGME-mandated duty-hour reductions, there is considerable concern that SRs would be less experienced and thus less well prepared to take on teaching roles in the operating room. The main finding of the present study was that common bile/hepatic duct injury rates (0.19% vs. 0.17%) were similar for LCs performed by JR with SRs serving as TAs as compared with LCs performed by JR with an attending assisting. Power analysis revealed that 1800 patients were needed to show 0.2% difference in biliary injury rate with a statistically significant p value of 0.05. Although our study only included 1671 patients, the common bile duct injury rates were so similar across both institutions that we would have needed 18,000 patients to show a statistically significant difference. The common bile/hepatic duct injury and cystic duct stump leak rates reported herein are in line with the current literature rates of 0.1 to 0.4% and 1.0 to 1.5%, respectively.[3,4] The overall complication rates in our large sample size were identical (8.5%). These similar complication rates were observed in spite of the fact that patients in teaching hospital A (with TA) had more advanced biliary disease (57.4% with acute cholecystitis vs. 22% at teaching

TABLE 1. Patient Demographics

	Hospital A (Senior Resident as Teaching Assistant) ($N = 1070$)	Hospital B (No Senior Resident as Teaching Assistant) ($N = 601$)	p Value
Mean age (y)	38.7	45.4	$p < 0.0001$
Male gender	20.5%	23.7%	$p = 0.1$
Acute cholecystitis	57.4%	22.0%	$p < 0.0001$
Mean junior resident level	3.7 (95% CI 3.6-3.7)	2.1 (95% CI 2.1-2.2)	$p < 0.0001$