Adrenalectomy Outcomes Are Superior with
the Participation of Residents and Fellows

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BACKGROUND: Adrenalectomy is a complex procedure performed in many settings, with and without residents and fellows. Patients often ask, “Will trainees be participating in my operation?” and seek reassurance that their care will not be adversely affected. The purpose of this study was to determine the association between trainee participation and adrenalectomy perioperative outcomes.

STUDY DESIGN: We performed a cohort study of patients who underwent adrenalectomy from the 2005 to 2011 American College of Surgeons NSQIP database. Trainee participation was classified as none, resident, or fellow, based on postgraduate year of the assisting surgeon. Associations between trainee participation and outcomes were determined via multivariate linear and logistic regression.

RESULTS: Of 3,694 adrenalectomies, 732 (19.8%) were performed by an attending surgeon with no trainee, 2,315 (62.7%) involved a resident, and 647 (17.5%) involved a fellow. The participation of fellows was associated with fewer serious complications (7.9% with no trainee, 6.0% with residents, and 2.8% with fellows; p < 0.001). In a multivariate model, the odds of serious 30-day morbidity were lower when attending surgeons operated with residents (odds ratio = 0.63; 95% CI, 0.45–0.89). Fellow participation was associated with significantly lower odds of overall (odds ratio = 0.51; 95% CI, 0.32–0.82) and serious (odds ratio = 0.31; 95% CI, 0.17–0.57) morbidity. There was no significant association between trainee participation and 30-day mortality.

CONCLUSIONS: In this analysis of multi-institutional data, the participation of residents and fellows was associated with decreased odds of perioperative adrenalectomy complications. Attending surgeons performing adrenalectomies with trainee assistance should reassure patients of the equivalent or superior care they are receiving. (J Am Coll Surg 2014;219:53e61. © 2014 by the American College of Surgeons)
A challenge to this training paradigm is that patients often ask attending surgeons if trainees will be assisting in their operation, and often request that trainees not be allowed to operate. Although many patients might be comfortable with trainees participating in their general hospital care, up to one third of them state on a questionnaire that they do not want trainees performing any part of their operation. Therefore, attending surgeons are often left with the task of reconciling the educational needs of their trainees plus workforce demands with respect for the wishes and autonomy of their patients.

There are a limited number of studies that evaluate how the participation of residents and fellows in adrenalectomy affects patient outcomes, adjusting for patient comorbidities and operative technique. Documentation of equivalent outcomes would provide reassurance to patients undergoing surgery at teaching institutions and peace of mind for attending surgeons responsible for training the next generation of endocrine surgeons. Therefore, the goal of this study was to investigate the association between resident and fellow participation in adrenalectomy and perioperative outcomes using multivariate logistic regression models to analyze data from a contemporary multi-institutional database. Our hypothesis was that patients operated on by attending surgeons with the assistance of residents and fellows do not have inferior 30-day outcomes compared with patients operated on by attending surgeons without a trainee.

**METHODS**

**Database and patient selection**

We used the 2005 to 2011 American College of Surgeons (ACS) NSQIP Participant Use Data File for our analysis. This database contains prospective, multi-institutional information on preoperative risk factors, intraoperative variables, and 30-day morbidity and mortality outcomes for a systematic sample of major inpatient and outpatient surgical procedures at participating institutions. Dedicated and specifically trained Surgical Clinical Reviewers examine medical records and obtain complete 30-day follow-up on all selected patients. The quality of collected data is regularly evaluated with an inter-rater reliability audit of participating institutions, with audits to date demonstrating an overall disagreement of only 1.8% for all variables. Additional information on ACS NSQIP data collection and practices has been described previously and can be accessed on the ACS NSQIP website (http://www.acsnsqip.org/).

The ACS NSQIP Participant Use Data File contains 135 variables, including the highest level of supervision provided by the attending surgeon for the case and the highest postgraduate year of any trainee who assisted in the case. These variables were used to differentiate adrenalectomies that were performed by attending surgeons without a trainee vs those in which a resident (PGY 1 through 5) or fellow (PGY > 5) assisted. Patients with no information on trainee participation were excluded from the study. To limit our analysis to adrenalectomies performed at participating institutions from 2005 to 2011, we searched for all principal operative procedures with the CPT codes for adrenalectomy (60540, 60545, 60650) during that time period. The CPT code 60650 was used to differentiate laparoscopic from open adrenalectomies. Sensitivity analyses were performed to rule out bias from grouping CPT codes for open adrenalectomies (60540 and 60545). Data on demographics, preoperative comorbidities, American Society of Anesthesiologists class, and preoperative laboratory values were obtained for all patients.

**Outcomes**

The ACS NSQIP contains data on a large number of 30-day perioperative outcomes. To analyze the association of trainee participation on overall perioperative morbidity, we created a variable for the occurrence of any documented complication within 30 days of operation. This included pulmonary complications (eg, pneumonia, unplanned intubation, or ventilator dependence), cardiac complications (eg, cardiac arrest or myocardial infarction), neurologic complications (eg, stroke or coma >24 hours), renal complications (eg, acute renal failure or progressive renal insufficiency), bleeding complications, sepsis, surgical site infections, wound dehiscence, deep vein thrombosis requiring therapy, pulmonary embolus, urinary tract infections, and peripheral nerve injuries. We also created a variable for the occurrence of any serious complication within 30 days of operation, which included urinary tract infections, superficial surgical site infections, and peripheral nerve injury, the clinical significance of which are not uniform. Additional 30-day outcomes included mortality, mean length of procedure, intraoperative blood transfusion, reoperation, and mean length of stay (LOS).

**Statistical analysis**

Chi-square statistics were used to compare differences in categorical variables related to baseline patient demographic and health characteristics, in addition to perioperative outcomes among the 3 trainee groups. Odds ratios (ORs) were calculated to evaluate the degree of association between trainee group and each preoperative variable with statistically significant results on chi-square test. Analysis of variance was used to compare differences
in the mean values of continuous variables related to patient characteristics and perioperative outcomes among all 3 trainee groups. Bonferroni multiple comparison tests were performed to identify differences between the means of each pair of trainee groups with p value adjustment. Multivariate linear regression models were created to compare mean operative time and LOS in each group, controlling for potential confounding variables.

Univariate and multivariate logistic regression models were developed for 30-day morbidity and mortality. Covariates adjusted for in the multivariate models to control for confounding and heterogeneity of patients within trainee groups included laparoscopic vs open technique, in addition to the calculated probability of morbidity or mortality provided in the ACS NSQIP database. The use of these continuous probability variables was validated by creating multiple models containing different comorbidities identified as confounders; all of these models produced similar adjusted ORs and did not change the conclusions of our analysis. Tests of linear trend in the adjusted log odds of morbidity and mortality were also performed on each multivariate model. The significance level for all comparisons was p < 0.05 and all tests were 2-tailed. Analysis was performed using STATA statistical software (version 12.0, StataCorp LP).

RESULTS

Preoperative characteristics
A total of 4,133 adrenalectomies were identified based on CPT code. After the exclusion of cases with missing data on trainee participation (n = 439), analysis was carried out on the remaining 3,694 cases. Of these 3,694 adrenalectomies, 732 (19.8%) were performed by an attending surgeon alone, 2,315 (62.7%) involved a resident, and 647 (17.5%) involved a fellow. There was no significant difference in patient demographics and most preoperative risk factors for morbidity or mortality based on trainee participation (Table 1). Adrenalectomies involving fellows were more likely to be performed laparoscopically, with an OR of 1.4 compared with cases performed by attending surgeons without a trainee (p = 0.011; 95% CI, 1.08–1.86). In addition, adrenalectomies involving fellows were less likely to be performed on patients with hypoalbuminemia, with an OR of 0.56 compared with cases performed by attending surgeons without a trainee (p = 0.01; 95% CI, 0.35–0.87).

Perioperative outcomes
Overall outcomes for adrenalectomy from the 2005 to 2011 ACS NSQIP are presented in Table 2. Overall mean procedure length was 154 minutes and mean LOS was 4.0 days. Postoperative morbidity was documented in 7.8% of cases, with serious postoperative complications occurring in 5.8%. Overall 30-day mortality was 0.7%.

Mean procedure length was shorter for attending surgeons operating without a trainee than for those assisted by residents and fellows (141, 158, and 154 minutes, respectively; p < 0.001). This difference remained significant on linear regression after adjusting for laparoscopic vs open technique (adjusted increase in operative time of 16 minutes for residents and fellows; p < 0.001). The frequency of intraoperative blood transfusion, reoperation, or death within 30 days did not vary based on trainee participation (Table 2). There was a statistically significant difference in the frequency of postoperative complications and mean LOS based on trainee participation (Table 2). However, multivariate linear regression showed no statistically significant association between LOS and trainee participation after adjusting for laparoscopic vs open technique and the probability of morbidity.

Evaluating perioperative morbidity and mortality with univariate logistic regression, there was no statistically significant association between resident participation in adrenalectomy and postoperative complications when compared with attending surgeons operating without a trainee (Table 3). However, participation of a fellow was associated with decreased odds of overall (OR 0.51; 95% CI, 0.33–0.78) and serious (OR = 0.33; 95% CI, 0.19–0.57) postoperative complications when compared with attending surgeons operating without a trainee. On multivariate logistic regression, after controlling for laparoscopic vs open technique and the probability of postoperative morbidity, resident participation was associated with decreased odds of serious complications only (adjusted OR = 0.63; 95% CI, 0.45–0.89) (Table 4). Interestingly, the participation of fellows continued to be associated with significantly lower odds of overall (adjusted OR = 0.51; 95% CI, 0.32–0.82) and serious (adjusted OR = 0.31; 95% CI, 0.17–0.57) postoperative complications (Table 4). There was a statistically significant inverse linear trend in the log odds of overall and serious morbidity with the participation of a trainee in the operation and increasing postgraduate year of the assisting trainee, both when broken down by resident and fellow as with the rest of the analysis (not shown) and when broken down into junior residents (PGY1–3), senior residents (PGY4–5), and fellows (Table 5). There was no association between 30-day mortality and trainee participation in the univariate or multivariate models after controlling for technique and probability of postoperative mortality (Tables 3 and 4).
This study using a multi-institutional, national database demonstrates that the participation of trainees in adrenalectomy is not associated with adverse perioperative outcomes. In addition, we provide evidence that the participation of residents and fellows in this complex procedure is associated with decreased odds of complications after adjusting for risk of morbidity and laparoscopic vs open operative technique. The finding that surgical residents and fellows do not adversely affect, and might in fact enhance, the quality of surgical care for patients undergoing adrenalectomy is important both for its ability to improve patient confidence in their health care providers and to support advanced training of residents and future endocrine surgeons.
Based on the information captured in the ACS NSQIP database, we are not able to determine why the assistance of fellows in adrenalectomy leads to superior outcomes. Comparison of baseline characteristics did show that fellows were more likely to participate in laparoscopic operations and less likely to operate on patients with hypoalbuminemia, both of which would be expected to improve outcomes. However, the association with superior outcomes persisted after adjustment for laparoscopic technique and the probability of perioperative morbidity. The fact that we see an inverse linear trend in the adjusted odds of morbidity with the addition of a trainee in the operating room and increasing postgraduate year of trainee suggests that those who have the skills to more substantially contribute to the operation or provide experienced postoperative care confer the most benefit to patients. Another possible interpretation of this is that the presence of a fellow in the operating room is a surrogate for an adrenalectomy performed by a high-volume surgeon at a center with an endocrine surgery fellowship. Although the experience of surgeons operating with trainees likely affects our results, it is unlikely to fully explain the association with improved outcomes because the inverse trend in adjusted odds persists if we divide trainees into junior residents, senior residents, and fellows, suggesting that the postgraduate year of the trainee, and their operative skills and perioperative care, is in fact an important contributing factor beyond the distinction between an institution or surgeon who operates with residents and/or fellows. The addition of surgeon- and hospital-volume information would aid additional investigation of the mechanism of this association.

This is the first study evaluating the association of trainee participation and perioperative morbidity and mortality for adrenalectomy using a multi-institutional database and multivariate regression to control for confounding patient characteristics and technique. Previous reports of chi-square analyses of adrenalectomy outcomes from the 2005 to 2008 ACS NSQIP database did not find a significant difference in the rates of perioperative wound infections, medical complications, reoperation, or total morbidity between patients operated on by attending surgeons without a trainee vs with the assistance of any level trainee. One explanation for these differing results is the lack of a distinction between residents and fellows in the previous analysis; if the addition of more senior residents and fellows confers the most benefit in adrenalectomy outcomes, as suggested here, analyses grouping trainees of all postgraduate years together might not detect this association. In addition, the increased sample size of our study, due to 3 additional years of data from 2009 to 2011, increases the power of our study and the ability to detect these associations.

Table 2. Perioperative Outcomes for Patients who Underwent Adrenalectomy in the 2005 to 2011 ACS NSQIP Participant Use Data File

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Overall (n = 3694)</th>
<th>No trainee (n = 732)</th>
<th>Resident (n = 2,315)</th>
<th>Fellow (n = 647)</th>
<th>p Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of procedure, min, mean (SD)</td>
<td>154 (75)</td>
<td>141 (72)</td>
<td>158 (76)</td>
<td>154 (77)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Intraoperative blood transfusion, n (%)</td>
<td>150 (4.1)</td>
<td>28 (3.8)</td>
<td>101 (4.4)</td>
<td>21 (3.3)</td>
<td>0.42</td>
</tr>
<tr>
<td>Postoperative</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underwent reoperation, n (%)</td>
<td>81 (2.2)</td>
<td>19 (2.6)</td>
<td>51 (2.2)</td>
<td>11 (1.7)</td>
<td>0.53</td>
</tr>
<tr>
<td>Length of stay, d, mean (SD)</td>
<td>4.0 (8.6)</td>
<td>4.1 (7.2)</td>
<td>4.2 (9.9)</td>
<td>3.2 (3.9)</td>
<td>0.044</td>
</tr>
<tr>
<td>Any postoperative complication, n (%)</td>
<td>288 (7.8)</td>
<td>68 (9.3)</td>
<td>188 (8.1)</td>
<td>32 (5.0)</td>
<td>0.007</td>
</tr>
<tr>
<td>Serious postoperative complication, n (%)</td>
<td>214 (5.8)</td>
<td>58 (7.9)</td>
<td>138 (6.0)</td>
<td>18 (2.8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>30-day mortality, n (%)</td>
<td>26 (0.7)</td>
<td>7 (1.0)</td>
<td>17 (0.7)</td>
<td>2 (0.3)</td>
<td>0.34</td>
</tr>
</tbody>
</table>

*p Values for the comparison between groups calculated using chi-squared test or ANOVA.
| Denotes statistical significance.

Excludes superficial surgical site infection, urinary tract infection, and peripheral nerve injury.

Table 3. Univariate Odds Ratios for Postoperative Complications and 30-Day Mortality

<table>
<thead>
<tr>
<th>Outcome</th>
<th>No trainee (n = 732)</th>
<th>Resident (n = 2,315)</th>
<th>Fellow (n = 647)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any complication</td>
<td>1 (ref)</td>
<td>0.86</td>
<td>0.65–1.15</td>
<td>0.32</td>
</tr>
<tr>
<td>Serious complication</td>
<td>1 (ref)</td>
<td>0.74</td>
<td>0.54–1.01</td>
<td>0.06</td>
</tr>
<tr>
<td>Death</td>
<td>1 (ref)</td>
<td>0.77</td>
<td>0.32–1.86</td>
<td>0.56</td>
</tr>
</tbody>
</table>

*Denotes statistical significance.
Previous studies investigating the effects of trainee participation on surgical outcomes in other operations have also had mixed results. A single-center series of 2,293 patients operated on by attending surgeons with and without resident assistance found no difference in morbidity, but did find increased mortality, LOS, and hospital cost for patients who underwent 5 common general surgery procedures, although their analyses did not include multivariate models to control for confounding patient characteristics. Analysis of outcomes from 607,683 general and vascular surgery cases in the 2006 to 2009 ACS NSQIP found a marginal increase in the odds of morbidity (OR = 1.07; 95% CI, 1.03–1.10) and a small decrease in the odds of 30-day mortality (OR = 0.91; 95% CI, 0.84–0.99) with the participation of residents, although the latter association was no longer present after adjustment for hospital-level variation. Another analysis of >37,000 patients who underwent common general surgery procedures from the 2005 to 2007 ACS NSQIP also showed a very small increase in morbidity and a decrease in mortality. Given that the latter 2 studies also analyzed ACS NSQIP data and controlled for similar confounders, a likely explanation for differences in our results is their focus on a wider range of general surgery cases, suggesting that the results of our analysis might not be generalizable to other common or complex surgical procedures.

Operative times are consistently longer with the participation of trainees, regardless of operation or specialty. Our results are consistent with previous studies in this regard. This trend has been cited by some as a potential cause of increased morbidity in operations performed with trainee assistance and is a target for quality-improvement efforts. However, adding operative time as a continuous or categorical variable to our regression models did not change our conclusions about the association between trainee participation and perioperative adrenalectomy outcomes. With such small differences in operative time with and without trainees (an additional 16 minutes with both residents and fellows after adjustment for laparoscopic vs open technique), it is unlikely that this factor has a significant clinical impact. The economic cost of these differences, however, might not be so insignificant on a national scale and requires additional investigation using a database with information on total hospital costs for this patient population.

Our study has limitations, many of which are related to the nature of data collection and reporting for the ACS NSQIP database. The hospitals that participate in ACS NSQIP do so on a voluntary basis and, as a result, are not a representative sample of hospitals in the United States. This is a potential source of selection bias because large and academic institutions are over-represented. However, there is evidence that a substantial proportion of complex cases are performed by ACS NSQIP institutions, and that up to two thirds of adrenalectomies are performed at teaching hospitals, which suggests that this database likely captures a large numbers of adrenalectomies performed nationally. An important limitation is the failure of ICD-9 codes to adequately identify the principal diagnosis of patients undergoing adrenalectomy. Due to the frequency of nonspecific coding, including

### Table 4. Multivariate Odds Ratios for Postoperative Complications and 30-Day Mortality Adjusting for Laparoscopic vs Open Technique and Probability of Morbidity or Mortality

<table>
<thead>
<tr>
<th>Outcome</th>
<th>No trainee (n = 732)</th>
<th>Resident (n = 2,315)</th>
<th>Fellow (n = 647)</th>
<th>p Value</th>
<th>95% CI</th>
<th>p Value</th>
<th>95% CI</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any complication</td>
<td>1 (ref)</td>
<td>0.77</td>
<td>0.51</td>
<td>0.32–0.82</td>
<td>0.005*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serious complication</td>
<td>1 (ref)</td>
<td>0.63</td>
<td>0.31</td>
<td>0.17–0.57</td>
<td>&lt;0.001*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>1 (ref)</td>
<td>0.63</td>
<td>0.23</td>
<td>0.032–1.65</td>
<td>0.14</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Denotes statistical significance.

### Table 5. Tests for Linear Trend in the Log Odds of Morbidity and Mortality with the Participation of a Trainee in the Adrenalectomy and Increasing Postgraduate Year of Assisting Trainee

<table>
<thead>
<tr>
<th>Variable</th>
<th>Any complication, odds ratio (95% CI)</th>
<th>Serious complication, odds ratio (95% CI)</th>
<th>Death, odds ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No trainee</td>
<td>1 (ref)</td>
<td>1 (ref)</td>
<td>1 (ref)</td>
</tr>
<tr>
<td>PGY 1−3</td>
<td>1.1 (0.7−1.64)</td>
<td>0.81 (0.5−1.32)</td>
<td>0.5 (0.11−2.34)</td>
</tr>
<tr>
<td>PGY 4−5</td>
<td>0.7 (0.51−0.97)</td>
<td>0.59 (0.41−0.85)</td>
<td>0.66 (0.25−1.74)</td>
</tr>
<tr>
<td>PGY &gt; 5</td>
<td>0.51 (0.32−0.82)</td>
<td>0.31 (0.17−0.57)</td>
<td>0.23 (0.03−1.65)</td>
</tr>
</tbody>
</table>

*Denotes statistical significance.

PGY, postgraduate year.
among many 255.8 (ie, other specified disorders of adrenal glands) and 255.9 (ie, unspecified disorder of adrenal glands), which accounted for 5.6% and 7.9% of patients, respectively, we were unable to definitively determine the indication for a large proportion of the adrenalectomies we analyzed. This forced us to exclude a diagnosis variable from our models, leaving our conclusions potentially biased due to confounding by indication (because the diagnosis of a patient that puts them at risk of worse outcomes can influence whether a trainee participates in their operation). Although controlling for other associated comorbidities can reduce the impact of this bias, the inability to adjust for diagnosis in our model must be acknowledged. In addition, ACS NSQIP does not provide tumor-specific information, such as tumor size, which affects the complexity of an adrenalectomy and would be related to both the participation of a trainee and outcomes.

Another limitation is that we are unable to control for surgeon or hospital adrenalectomy volume or for teaching status of the institutions, because hospital- and surgeon-level data are not available in the ACS NSQIP Participant Use Data File. Given evidence that surgeon volume inversely correlates with complication rates, hospital cost and LOS, and hospital-volume or teaching status affects postoperative management, these factors should be included in our models and their absence might affect our estimate of the association between trainee participation and perioperative outcomes. As has been mentioned in previous publications, we cannot determine the degree of trainee participation in each case from the data provided, which limits our ability to attribute any difference in outcomes to intraoperative trainee factors, or who is assisting in operations performed without a trainee. However, as discussed here, the presence of an inverse linear trend in the adjusted odds of morbidity with increasing postgraduate year of the trainee suggests that the surgical skills of the trainee and their postoperative care plays a role in this association and, therefore, that resident or fellow presence in the operating room is unlikely to be a surrogate for other factors. With limited surgeon- and hospital-level data, it is difficult for us to determine how the presence of fellows leads to superior outcomes.

CONCLUSIONS
The participation of residents and fellows in adrenalectomy does not adversely affect and appears to improve perioperative outcomes. The participation of fellows specifically reduces the odds of overall and serious 30-day adrenalectomy complications. Given that increased exposure of trainees to this operative technique is critical to adequately train future endocrine surgeons, attending surgeons should be comfortable reassuring patients that their care will be equivalent or superior with the addition of a resident or fellow to their operative team.

Author Contributions
Study conception and design: Seib, Greenblatt, Duh
Acquisition of data: Seib, Greenblatt
Analysis and interpretation of data: Seib, Greenblatt, Campbell, Shen, Gosnell, Clark, Duh
Drafting of manuscript: Seib, Greenblatt, Campbell, Shen, Duh
Critical revision: Seib, Greenblatt, Campbell, Shen, Gosnell, Clark, Duh

REFERENCES

Discussion

INVITED DISCUSSANT: SAMUEL K SNYDER (Temple, TX): As a program director for an endocrine surgery fellowship, I must admit that I do like the title of this paper. It fits my bias for promoting endocrine surgery fellowship training. However, it is important to keep the proper perspective and realize that this is not a cause and effect relationship, but perhaps just an association. It seems intuitive, doesn’t it, to anticipate superior results for an adrenalectomy under the direction of a staff endocrine surgeon of the caliber of Drs Clark, Duh, or Shen, assisted by a PGY 6 fellow who is sincerely interested in mastering the adrenalectomy procedure. The authors have done extensive statistical analysis of 7 years of ACS-NSQIP data to support this conclusion. I have three questions for the authors:

1. Is a PGY 6 trainee really a fellow interested in endocrine surgery or minimally invasive surgery? The resident could still be in general surgery or urologic surgery training after experiencing an additional year or two of preliminary training before attaining a categorical training spot, or after coming out of a year or two in research, or after having to repeat a year of residency training, etc. Does the NSQIP data reliably sort this out?
2. Fellows desiring involvement in adrenalectomy procedures should reasonably gravitate to the most experienced specialists or subspecialists for training in adrenal surgery. They should equally reasonably gravitate to the larger and higher-volume medical centers for training because adrenalectomy is generally not a common operative procedure. One could argue that your data are really just measuring this fact and not strictly the participation of fellows. How does your analysis of NSQIP data resolve this dilemma?
3. Outcomes research is becoming increasingly important in the evolving surgical era of “pay for performance.” Your study carries implications for disclosure to patients of relative outcomes by different surgical teams to obtain adequate informed consent for adrenalectomy. In light of your results, how do you recommend that the private practice endocrine surgeon now counsel his or her patient preoperatively?

DR QUAN-YANG DUYH: The first question is whether NSQIP actually distinguished fellow vs just a slower resident who may have taken an extra year or two. Actually, you’re right, it doesn’t. But according to our study, a slower resident may actually be very good. In fact, if you look at the title, we actually cheated between the initial abstract and the paper. We added resident and fellow to the title. In fact, in the analysis, both the assistant, or the resident, and the fellow helped the surgeon and helped the patient. You see the linear trend at the higher level help improve the complication rates. So you are right. We can’t tell specifically the difference between a fellow and a resident, but it’s probably, in general, going to be correct, the PGY 6 or more.

The second question related to whether or not the PGY year, or the assistance by a trainee, is just a surrogate for a high-volume surgeon, for centers of excellence. And you are absolutely right. There is really no way that we could clearly separate those out, and I’m sure a lot of that is related to the fact that the fellows go to higher-volume centers. But that also would not explain the linear trend that you see of junior resident, senior resident, and higher level fellow or resident help, the linear trend of improvement with that. In fact, the question I ask myself is if that is the case, then should we have always 2 surgeons operating on the patient at the same time? Forget about the junior resident and the senior resident and the fellows.

To answer your third question, if I were a patient, I should probably ask for 2 or 3 competent endocrine surgeons in the operating room at the same time. I don’t really have a good answer for you in terms of the third question: how you deal with informed consent with the patients. It’s way more complicated than I can get into, but you are absolutely right. You want to have good surgeons, and I think what we are showing is that you want to have a good level of help. When the patients come to you and say, “I want you to do the operation, I don’t want anybody else in the room helping you doing this,” I can tell them that they actually do want my trainees to be there with me.

DR KAREN R BORMAN (Washington, DC): This is a really nice paper. I would submit a couple of observations and ask you a question. For the cases that are categorized as having no trainee, are there truly no trainees in any aspect of the care? Because one could envision the circumstance in which, for coverage reasons or whatever, an attending was doing an adrenalectomy. It seems unlikely, because they’re great cases and one would think that people gravitate to them, but that shows my bias. But at any rate, there may, in fact, be trainees, whether they’re fellows or residents, involved in the perioperative care. And I think one of the messages here that I personally would take away is that there is an advantage to trainees in perioperative care in terms of detection and management of complications potentially earlier that will lead to better overall outcomes. So I wonder that 20% of cases had no trainee. The NSQIP may not give you a way to sort that out, whether or not there were trainees in the postoperative care of those patients.

I think you’ve attributed your linear trend to the better operative skills or presumably more experienced or advanced trainees.