GENERAL GYNECOLOGY

Impact of robotic operative efficiency on profitability

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OBJECTIVE: We sought to determine the impact of robotic operative efficiency on profitability and assess the impact of secondary variables.

STUDY DESIGN: Financial data were collected for all robotic cases performed for fiscal years 2010 (FY10) and 2011 (FY11) at University of North Carolina at Chapel Hill, and included 9 surgical subspecialties. Profitability was defined as a positive operating income.

RESULTS: From July 2009 through June 2011, 1295 robotic cases were performed. Robotic surgery was profitable in both fiscal years, with an operating income of $386,735 in FY10 and $822,996 in FY11. In FY10, urogynecology and pediatric surgery were the only nonprofitable subspecialties. In FY11, all subspecialties were profitable. Profitability was associated with case time, payor mix, and procedure type (all $P < .05$). Urogynecology case time decreased from 220-179 minutes ($P = .012$) and pediatric surgery from 418-258 minutes ($P = .019$).

CONCLUSION: Robotic operative efficiency has a large impact on overall profitability regardless of surgical specialty.

Key words: cost, efficiency, robotic surgery

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The profit or loss of a procedure is based on total costs and total payments. Robotic surgery has been associated with higher costs than open and standard laparoscopic procedures, largely due to increased operative times and consumable surgical supplies.[1-4] In a retrospective analysis of the 2008 through 2009 Nationwide Inpatient Sample database, 368,239 patients who underwent robotic-assisted surgery were identified and found to have an increased total charge of $1309 per case.[5]

There is the potential for a negative impact on hospital profitability with the introduction of new technology. In addition to the added financial burden that robotics may pose on national health care expenditures, there is the problem of equivalent reimbursements for procedures of similar diagnosis-related groups regardless of surgical approach, ie, laparoscopic vs robotic. For example, several studies have reported a significant financial loss for each robotic-assisted radical prostatectomy compared to the traditional retropubic approach. The greatest effect was noticed with Medicare reimbursements with a reported loss of >$4000 per case.[6] In a contemporary review of comparative hospital costs of open and robotic-assisted radical prostatectomy there was no insurance payor—private or government—that provided sufficient reimbursement to make robotic-assisted radical prostatectomy profitable.[7]

If reimbursement is largely fixed, profitability then relies on a reduction in cost. Cost is principally generated from 2 sources: (1) length of hospital stay; and (2) direct and indirect operative costs. These factors may bidirectionally influence the final outcome. While all minimally invasive procedures are more expensive from a surgical resource perspective, they typically result in shorter inpatient hospitalizations and therefore may present an overall cost savings.[8-10] For example, in a study comparing costs of laparotomy, laparoscopy, and robotic hysterectomy with lymph node staging for a single surgeon, costs of laparoscopic and robotic approaches were equivalent and significantly lower than for open procedures. Operative time for both minimally invasive approaches was the same.[11]

Operative time predicts operative cost more than any other factor. The studies that have shown cost equivalence, or cost savings, of robotic-assisted procedures compared with standard laparoscopy all demonstrate equal or shorter operative times in the robotic group.[12,13] In contrast, those with significantly longer operative times than standard laparoscopy typically show a substantial cost increase.[1,14] While the learning curve for robotic-assisted laparoscopy is potentially shorter than for standard laparoscopy,[15,16] the introduction of new technology dictates that a large number of surgeons are simultaneously in this learning phase and therefore one would expect a higher initial attributable cost.

The primary aim of this study, therefore, was to analyze the effect of operative efficiency on profitability of an established, coordinated, high-volume robotics program at a university teaching

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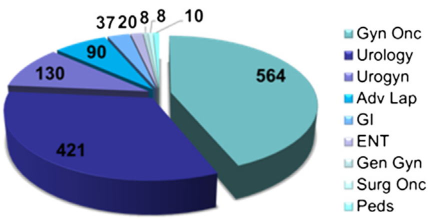
FIGURE 1
Distribution of robotic cases by surgical specialty



Surgical specialties.

Adv Lap, Advanced Laparoscopic Gynecology; *ENT*, Ear Nose Throat; *Gen Gyn*, General Gynecology; *GI*, Colorectal; *Gyn Onc*, Gynecologic Oncology; *Peds*, Pediatric Surgery; *Surg Onc*, Surgical Oncology; *Urogyn*, Urogynecology.

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hospital by reviewing direct and indirect costs and reimbursements over 2 fiscal years. Our secondary aims were to investigate other variables that may influence profitability including type and length of procedure, surgical specialty, insurance status, and individual surgeon. Results of this study may help identify ways to minimize costs of robotic-assisted procedures.

Materials and Methods

After institutional review board exemption was obtained, a deidentified financial database was used to collect data for fiscal years 2010 (FY10) and 2011 (FY11) at 1 academic medical center: the University of North Carolina at Chapel Hill (UNC). Robotic-assisted surgery was first introduced at UNC in 2005 and an organized robotics program, the Computer and Robotic Enhanced Surgery (CARES) Center, was launched in 2008. A dedicated robotics nursing team and coordinator were also established. The coordinator maintains the database for all robotic procedures and assists with scheduling and data capture.

A retrospective analysis was performed for all robotic surgical cases performed during this time period. All surgical subspecialties performing robotic surgery at UNC were included: gynecologic oncology, urogynecology, advanced laparoscopy, general gynecology, urology, gastrointestinal surgery, otolaryngology, surgical oncology, and pediatric surgery. Two da Vinci Si surgical systems (Intuitive Surgical, Inc, Sunnyvale, CA) housed in the UNC operating rooms were used to perform all procedures. All associated costs, charges, assigned overhead, and total reimbursements were collected. Evaluation included total number of surgical cases (case volume), types of procedures performed, surgeon specialty, surgeon name, mean room time, mean case time, insurance carrier, total cost, charges, payments, direct variable contribution margin, and operating income. Profitability was defined as a positive operating income. Operating income was defined as total revenue minus total operating costs (fixed and variable). Direct variable contribution margin was defined as payments minus direct variable costs (eg, instrumentation, operating room supplies, and labor).

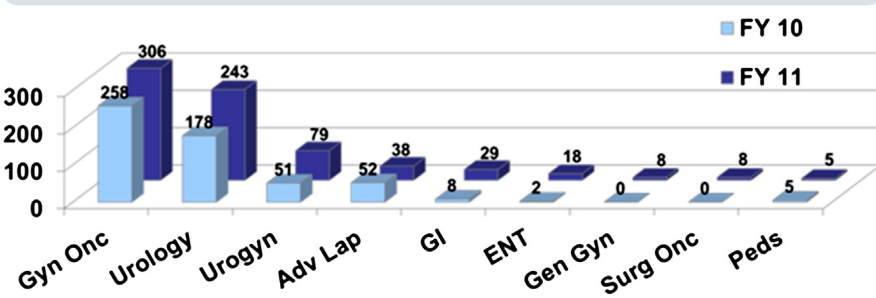
Statistical analysis was performed with both SPSS (IBM Corp, Armonk, NY) and SAS (SAS Institute, Cary, NC) software, using χ^2, *t* test, analysis of variance with Tukey post hoc analyses, and Pearson correlation where appropriate.

Results

From July 2009 through June 2011 there were 1295 robotic surgical cases performed at UNC among 9 surgical specialties and 29 surgeons. Each case was defined as a single patient encounter, even if >1 procedure was performed. In both years, gynecologic oncology had the largest proportion of cases (43.6%), followed by urology (32.5%), urogynecology (10.0%), advanced laparoscopy (6.9%), gastrointestinal surgery (2.9%), otolaryngology (1.5%), pediatric surgery (0.8%), general gynecology (0.6%), and surgical oncology (0.6%) (Figure 1). Surgical volume increased from FY10 to FY11 for all surgical subspecialties (Figure 2). In FY10 there were 556 total cases and in FY11 there were 739 total cases. There was a significant increase in average cost, charges, payments, and direct variable contribution margin from FY10 to FY11. Operating income also increased from FY10 to FY11, but the association was not significant (Table 1).

In both fiscal years, robotic surgery was profitable, based on a positive operating income. In FY10, total operating income was $386,736; and in FY11 total operating income was $822,996. In FY10, all surgical specialties were profitable except urogynecology and pediatric surgery, while in FY11 all surgical specialties were profitable. The transition to profitability for these 2 specialties was associated with a significant improvement in mean case performance time. Urogynecology mean case time improved from 220-179 minutes (P = .012) and pediatric surgery mean case time improved from 418-258 minutes (P = .019). In turn, mean operating income per case for urogynecology improved from −$186 to $450 and for pediatric surgery from −$4434 to $1492. Operating income was positive in both years for all other specialties. We then

FIGURE 2
Increase in surgical volume from FY 2010 to 2011



Surgical volume.

Adv Lap, Advanced Laparoscopic Gynecology; *ENT*, Ear Nose Throat; *FY*, fiscal year; *Gen Gyn*, General Gynecology; *GI*, Colorectal; *Gyn Onc*, Gynecologic Oncology; *Peds*, Pediatric Surgery; *Surg Onc*, Surgical Oncology; *Urogyn*, Urogynecology.

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