1. Briefly describe the relevance of the current study with respect to evaluating surgeon performance and the provision of quality care. What other measures exist? What are the strengths and weaknesses of the other measures? How does this study fit in with current trends in US healthcare?

Establishing surgical competence and monitoring surgeon performance are essential to patient safety. Surrogate markers of competence have included setting a predetermined number of cases, time taken for task completion, and subjective assessment by a mentor. However, all surgeons may not achieve adequate performance with a fixed sample size; operative time can vary depending on the anatomic and procedural complexity; and mentor assessment may be subject to bias and may not be consistently reproducible.

Cumulative Summation (CUSUM) is a mathematical model that can provide surgeons with a real-time, unbiased, self-assessment tool to examine individual outcomes after each procedure. When CUSUM analysis is applied to surgical outcomes, desired performance goals are defined and then observed performance is measured and compared to the desired performance goal using the CUSUM equation. The equation can be recalculated after each procedure for real-time performance monitoring for individual surgeons.

CUSUM analysis has previously been reported in the literature to describe the learning curve for procedural skills such as endotracheal intubation, fetoscopic laser ablation, robotic hysterectomy, and laparoscopic sacrocolpopexy. The objective of this study was to apply CUSUM analysis to a
single procedure, robotic sacrocolpopexy (RSCP), to monitor maintenance of surgical skill proficiency.

2. During what time frame was the study conducted? During how many months total was data collected?

We examined performance from September, 2008 through December, 2011, a 39 month time frame.

3. Given surgeon 1 and 2 performed RSCPs for 7 and 5 years, respectively, provide a rough estimate of the total number of cases each surgeon completed prior to the study? How do these estimates compare to the proficiency numbers for similar surgeries mentioned in the discussion section?

a. Prior to September 2008, surgeon 1 and 2 completed approximately 28 and 125 RSCPs cases respectively.

b. The absolute number of cases performed is not typically useful in defining surgical proficiency, however the surgeons in this study completed well over 10 cases each prior to the study. As such, this study was designed to evaluate RSCP performance over time rather than proficiency.

4. Are trocar injuries during midurethral sling placement part of the CUSUM analysis? If not, why not?

a. The CUSUM equation is versatile and as such any variable can be included as long as the overall outcome can be defined as a “success” or a “failure”. As the primary outcome of our study was application of the CUSUM analysis to robotic sacrocolpopexy, we chose to exclude trocar injuries during midurethral sling placement from the analysis. Including complications from concomitant procedures could potentially bias the results if one of the surgeons had few complications from RSCP but had several trocar injuries at the time of sling placement.

5. Please provide the correct equation based on the example given at the end of the methods section, page 84. What is the correct answer to the equation? Based on the target value selected by the authors, write the equation for the surgeon who never has a complication in n cases.

a. \[ S_n = (0.9 - 0) + 2(0.9 - 1) + (0.9 - 0) = 1.6 \]
The correct answer is provided in the text and is 1.6. Ultimately, the graph is more valuable than the numerical answer of the sum of the equation.

b. \[ S_n = (0.9 - 1)n = (-0.1)n \]

6. Compare and contrast each surgeon with respect to concomitant procedures performed (Table 1). In what key ways do the surgeons differ? How might these differences affect the CUSUM graph of each surgeon?
a. There was a statistically significant difference regarding the type of hysterectomy performed with surgeon 1 performing no supracervical hysterectomies (SCH) and surgeon 2 performing a SCH more often than a total hysterectomy (TLH) (0 SCH vs 89.3% SCH for surgeon 1 and 2 respectively, p<.001).
b. Surgeon 2 performed a perineoplasty more often than surgeon 1 (31 (50) vs 4 (3.7), p=< 0.001).
c. Surgeon 1 performed bilateral salpingoophorectomy at the time of colpopexy more often than surgeon 2 (33 (30.8) vs 7 (11.3), p<.004).
d. As TLH is theoretically more surgically challenging than SCH, this could have influenced the CUSUM graphs. However, as the extent of bladder dissection was the same in both groups, and as we didn’t include mesh exposure as an indicator of surgical failure, the differences in surgical procedures likely would only have a small impact.

7. Were any sacrohysteropexies performed during the study time frame? If not, how many RSCPs did each surgeon perform for posthysterectomy pelvic organ prolapse?

a. No sacrohysteropexies were performed during this study period.
b. There was no difference in the rate of robotic sacrocolpopexy for vaginal vault prolapse after hysterectomy between surgeons (surgeon 1, 49/107 (45.8%) vs. surgeon 2, 34/62 (54.8%), p= 0.26).

8. Describe other complications unique to RSCPs. When do these complications occur? How might these complications be identified and how might these complications affect a CUSUM graph?

a. The only specific complications associated with a robotic sacrocolpopexy compared to either a laparoscopic or open sacrocolpopexy are complications of prolonged, steep trendelenburg position such as facial and corneal edema. In this study cohort, we did not experience either of these complications, but these outcomes certainly could be included in a CUSUM analysis.
   i. When compared with an open colpopexy, the robotic approach was initially found to be associated with a longer operative time. Over the study period, surgical efficiency improved. However the advantage with this minimally invasive approach was a shorter hospital stay and less blood loss.5
   ii. Minimally-invasive colpopexy may also be associated with trocar-related complications such as vascular injury to the abdominal wall and port-site herniation.
b. The complications that we assessed for this analysis were all identified intra-operatively. One could certainly expand the CUSUM data entry time frame to include any complications that occurred postoperatively. In this
study, we reviewed all the operative notes, discharge summaries and the Medical Information Management Database, Transfusion Database, and Operative room robotics database for each case to ensure accuracy of reporting. Any complication can be added to the CUSUM equation. The outcome is then dichotomized such that any complication equals a failure and any case that has no complications is considered a success. An outcome that occurs later such as prolapse recurrence or mesh exposure would take more time to observe. As such, it would take several months-years to be able to categorize an event a success or failure.

References:


