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Original Article

The Accuracy of Surgeons' Provided Estimates for the Duration of Hysterectomies: A Pilot Study

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ABSTRACT **Study Objective:** To determine the accuracy of gynecologic surgeons' estimate of operative times for hysterectomies and to compare these with the existing computer-generated estimate at our institution.

Design: Pilot prospective cohort study (Canadian Task Force classification II-2).

Setting: Academic tertiary women's hospital in the Northeast United States.

Participants: Thirty gynecologic surgeons including 23 general gynecologists, 4 gynecologic oncologists, and 3 urogynecologists.

Intervention: Via a 6-question survey, surgeons were asked to predict the operative time for a hysterectomy they were about to perform. The surgeons' predictions were then compared with the time predicted by the scheduling system at our institution and with the actual operative time, to determine accuracy and differences between actual and predicted times. Patient and surgery data were collected to perform a secondary analysis to determine factors that may have significantly affected the prediction.

Measurements and Main Results: Of 75 hysterectomies analyzed, 36 were performed abdominally, 18 vaginally, and 21 laparoscopically. Accuracy was established if the actual procedure time was within the 15-minute increment predicted by either the surgeons or the scheduling system. The surgeons accurately predicted the duration of 20 hysterectomies (26.7%), whereas the accuracy of the scheduling system was only 9.3%. The scheduling system accuracy was significantly less precise than the surgeons, primarily due to overestimation ($p = .01$); operative time was overestimated on average 34 minutes. The scheduling system overestimated the time required to a greater extent than the surgeons for nearly all data examined, including patient body mass index, surgical approach, indication for surgery, surgeon experience, uterine size, and previous abdominal surgery.

Conclusion: Although surgeons' accuracy in predicting operative time was poor, it was significantly better than that of the computerized scheduling system, which was more likely to overestimate operative time. Journal of Minimally Invasive Gynecology (2015) 22, 57–65 © 2015 AAGL. All rights reserved.

Keywords: Hysterectomy; Operating room utilization; Operative time

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Accurate estimation of operative time is integral to efficient scheduling of the operating room (OR). Overestimation of surgical time leads to underutilization of operating rooms, resulting in fewer scheduled procedures on any given day. Alternatively, underestimation of surgical time may lead to unplanned overtime and potential cancellation or delay of procedures. Therefore, inaccurate scheduling of elective operations can lead to both increased costs and suboptimal use of the operating room and to patient and surgeon/staff dissatisfaction.

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Hysterectomy is the most frequently performed major gynecologic procedure in the United States [1]. The surgical approach (laparotomy, vaginal, or laparoscopic) is influenced according to patient characteristics, surgical history, and surgeon preference. Factors that may influence the level of difficulty of hysterectomy include uterine dimensions, patient body mass index, previous abdominal surgery, and surgeon experience with the planned approach. Gynecologic surgeons seem to be able to estimate the level of difficulty of a hysterectomy in a large percentage of cases [2]. Currently, little is known about gynecologists' ability to accurately predict operative time.

When constructing the operating room schedule, many institutions use a variant of block scheduling in which blocks of time are reserved for individual surgeons or groups until a deadline is reached, at which time the remaining time becomes available to other surgeons. However, there does not seem to be a preferred method to accurately use the available block time, and some institutions use commercial scheduling software whereas others use only historical data to generate time estimates [3]. At our institution, which is a tertiary care hospital for women only, the operative time assigned for hysterectomy is based on a computer model that examines the last 10 similar procedures performed by the individual surgeon. After excluding the longest and shortest procedures, the average operating room time of the remaining 8 procedures is used to predict the anticipated duration of the surgery being scheduled, and operating room time is allocated accordingly. However, this model does not take into consideration the various factors that may make the procedure more or less difficult and thus affect the duration. Furthermore, reports in the literature have suggested that relying solely on historical times is likely an ineffective strategy to predict the duration of future procedures [4]. A simple prediction model that combines historical times with surgeons' mean estimates seems to yield a good measure of future operative times [5].

Surgeons' predictions have been taken into consideration in developing prediction models for operating room times [3,6,7]. However, none of the currently available data specifically describe the accuracy of gynecologic surgeons when predicting operative time for hysterectomies. The primary objective of the present study was to determine the accuracy of surgeons' predictions when estimating operative times for hysterectomies compared with the current scheduling algorithm at our institution. The secondary objective was to determine patient and surgery characteristics that may contribute to the accuracy, or lack thereof, of predictions by the surgeons and the scheduling system.

Material and Methods

We conducted a pilot cohort study at a tertiary care hospital for women only in the Northeast United States. Within the hospital, 8 operating rooms are dedicated to gynecologic procedures and breast surgery performed by both gynecologic generalists and subspecialists. After obtaining approval from the institutional review board at Women and Infants Hospital, a 6-question survey was provided daily to all gynecologic surgeons performing a non-emergent hysterectomy that day. Robotic-assisted hysterectomies were excluded from the analysis primarily because this technology was new to our institution at the time. Consequently, the surgeons were still in the steep portion of the learning curve, which would likely render their predictions less accurate, along with potential greater variability in actual procedure duration. In addition, the scheduling software did not include enough cases to make a prediction for robotic operative time in the usual manner.

The survey assessed the surgical approach, indication for the procedure, any additional procedures that would be performed concomitantly, the number of years the provider had been practicing, and the prediction of the duration of the procedure (Fig. 1). The surgeons were asked to estimate operative times in a range of <1 hour to >3 hours, in 15-minute intervals. The time frame specified was skin incision to wound closure because this is the time used in the scheduling system. The number of surveys per surgeon was limited to 4 to prevent any individual surgeon from skewing the results.

After each survey was collected, the patient's medical record was reviewed to obtain demographic data, medical and surgical history, body mass index, and uterine size (estimated and actual weight from the pathology report). The operative report and intraoperative nursing record were also reviewed to determine the actual operative time, preoperative and postoperative diagnosis, procedure actually performed, and complications.

For comparison between the surgeons' and the scheduling system prediction we used actual surgery duration in minutes as the gold standard. Minutes were imputed from the surgeons' categorical estimates by taking the upper boundary of the corresponding 15-minute interval. The absolute values of the differences were compared, and for comparability the scheduling system estimate and the actual operative time were rounded to the closest 15-minute interval (<8 minutes difference rounded down, ≥ 8 minutes difference rounded up). To assess factors that could potentially cause the estimates to be inaccurate, a secondary analysis was performed of each procedure and surgeon characteristics and calculated whether and by how much each factor had affected the surgeons' and the scheduling system predictions. Factors evaluated included patient body mass index, previous abdominal surgery, indication for hysterectomy, procedure performed, surgeon experience, and uterine size.

Our hypothesis was that the surgeons' prediction of operative time would be more accurate than the scheduling system estimate. Accuracy was established if the actual procedure time was within the 15-minute increment predicted by either the surgeon or the scheduling system. On the basis of our hypothesis, we designed the study as a superiority trial.