Cost Analysis of Prophylactic Intraoperative Cystoscopic Ureteral Stents in Gynecologic Surgery

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Context: Prophylactic intraoperative ureteral stent placement is performed to decrease operative ureteric injury, though few data are available on the effectiveness of this procedure, and no data are available on its cost.

Objective: To analyze the cost of prophylactic intraoperative cystoscopic ureteral stents in gynecologic surgery.

Methods: All cases of prophylactic ureteral stent placement performed in gynecologic surgery during a 1-year period were identified and retrospectively reviewed through the electronic medical records database of Summa Health System. Costs were obtained through the Healthcare Cost Accounting System. The principles of cost-effective analysis were used (ie, explicit and detailed descriptions of costs and cost-effectiveness statistics). Importantly, we evaluated cost and not charges or financial model estimates. In addition, we obtained the contribution margins (ie, the hospital’s net profit or loss) for prophylactic ureteral stent placement. Other gynecologic procedures were also analyzed.

Results: Among 792 major inpatient gynecologic procedures, 18 cases of prophylactic intraoperative ureteral stents were identified. Median costs were as follows: additional cost of prophylactic intraoperative ureteral stenting, $1580; additional cost of surgical resources, $770; cost of ureteral catheters, $427; cost of surgeons, $383. The contribution margins per case for various gynecologic surgical procedures were as follows: oophorectomy, $2804 profit; abdominal hysterectomy, $2649 profit; laparoscopically assisted vaginal hysterectomy (LAVH), $1760 profit. When intraoperative ureteral stenting was added, the contribution margins changed to the following: oophorectomy, $782 profit; abdominal hysterectomy, $627 profit; LAVH, $262 loss. Overall, the contribution margin profit was decreased by about 85%, from $2400 to $380.

Conclusion: Prophylactic intraoperative ureteral stenting in gynecologic surgery decreases a hospital’s contribution margin. Because of the expense of this procedure, as well as scientific data suggesting a lack of effectiveness, the authors argue that prophylactic intraoperative ureteral stenting should not be used in gynecologic surgery to decrease operative ureteric injury.

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The purpose of prophylactic intraoperative ureteral stent placement is to decrease operative ureteric injury. Prophylactic intraoperative ureteral stents have been used during conduit surgery, renal transplant, ureteroscopy, colorectal surgery, and gynecologic surgery, including laparoscopically assisted vaginal hysterectomy (LAVH) and radical hysterectomy. The theoretical advantage of prophylactic intraoperative ureteral stent placement in gynecologic surgery is for ease of ureteral identification and, thus, to avoid operative ureteric injury. The theoretical disadvantages of this procedure are urothelial trauma during placement and manipulation, reduced ureteral mobility (adding to the risk of ureteric injury), and increased cost.

The approximate rate of ureteral injury during major gynecologic surgery is 1%. A prospective randomized trial to evaluate the ability of intraoperative ureteral stent placement to decrease operative ureteric injury by 50% (ie, to a rate of 0.5%) would be a rather arduous study requiring approximately 3000 patients. Therefore, there has been scarce scientific evaluation of the effectiveness of prophylactic stents. Furthermore, there has been no previous evaluation of the cost-effectiveness of prophylactic intraoperative ureteral stenting in gynecologic surgery.

The purpose of the present study is to analyze the cost of prophylactic intraoperative ureteral stent placement in gynecologic surgery. We hypothesized that the cost would negatively affect a hospital’s contribution margin. Contribution margin—a hospital’s net profit or loss for a procedure—is the...
“gold standard” used by financial officers for evaluating financial performance.7

Methods
All cases of prophylactic cystoscopic intraoperative ureteral stent placement performed in gynecologic surgery during a 1-year period, from January 1, 2008, to December 31, 2008, were identified using the electronic medical records database of Summa Health System, which is headquartered in Akron, Ohio. These cases were retrospectively reviewed. Approval of Summa Health System’s Institutional Review Board was obtained for the present study.

Importantly, we evaluated costs—not charges or financial model estimates. Although more difficult to obtain, costs (ie, actual hospital costs for wages, supplies, equipment, and other needs) were used rather than charges (ie, hospital bills to patients) because of striking differences in reimbursement. Financial model estimates were not used because such estimates are based on multiple assumptions (eg, various clinical algorithms of possible therapeutic strategies and results) and, thus, they are fraught with potential bias.

Besides evaluating costs, we also obtained and evaluated the contribution margins for prophylactic ureteral stent placement and other gynecologic procedures used with the included patients.

Principles of Cost-Effectiveness Analysis
Three of the 6 principles of cost-effectiveness analysis8-11 were used in the retrospective review of costs. We used principles 1 (explicit description of cost), 3 (detailed description of cost), and 6 (cost-effectiveness statistics), because they apply to the type of cost analysis that we performed. Principles 2 (explicit description of benefits), 4 (adjustment for different time periods), and 5 (sensitivity analysis of assumptions) were not used, because they apply strictly to cost-effectiveness analyses. The following text describes the 3 principles that we applied to the cost analysis of prophylactic intraoperative cystoscopic ureteral stents in gynecologic surgery8-11:

- **Principle 1: Explicit Description of Cost**—The costs evaluated in the present study were the hospital’s costs. Besides prophylactic ureteral stent placement, the gynecologic surgical procedures evaluated in our study were oophorectomy, abdominal hysterectomy, and LAVH. We obtained the contribution margins of each of these procedures over the same 1-year period. Because gynecologic surgical procedures are reimbursed on a Diagnosis-Related Group basis, adding the cost of prophylactic intraoperative ureteral stenting would negatively affect contribution margins.

- **Principle 3: Detailed Description of Cost**—The cost of prophylactic intraoperative ureteral stenting included the additional cost of surgical resources (ie, wages of anesthesiologists, nurses, and other personnel; supplies; equipment; utilities; support services), the cost of ureteral catheters, and the cost of surgeons.

Costs were obtained through the hospital’s finance department using the Healthcare Cost Accounting System (CostFlex Systems Inc, Mobile, Alabama).

- **Principle 6: Cost-Effectiveness Statistics**—Because we did not compare the benefits of prophylactic intraoperative ureteral stenting vs no stenting, a cost-effect ratio calculation was not performed. Instead, the actual additional cost was calculated.

Results
Among 792 major inpatient gynecologic procedures found in our review of the Summa Health System database, we identified 18 cases of prophylactic intraoperative ureteral stent placement. Of these 18 eligible cases, the median age of patients was 42 years (range, 30-77 y), and the median weight of patients was 165 pounds [75 kg] (range, 115-262 lb [52-119 kg]). See the Table for the main recorded characteristics of the patients.

Five patients were diagnosed preoperatively as having pelvic pain, 5 as having an ovarian mass, 4 as having leiomyomas (ie, fibroids), and 4 as having endometriosis. Twelve patients had previous pelvic surgery. The patients’ current surgical procedures were oophorectomy (8 patients), abdominal hysterectomy (7 patients), and LAVH (3 patients).

The median additional cost of prophylactic intraoperative ureteral stenting was $1580; median additional cost of surgical resources was $770, the median cost of ureteral catheters was $427, and the median surgeon cost was $383. The contribution margins per case for the gynecologic surgical procedures were as follows: oophorectomy, $2804 profit; abdominal hysterectomy, $2649 profit; LAVH, $1760 profit. When intraoperative ureteral stenting was added to patients’ care, the con-
tribution margins changed to the following: oophorectomy, $782 profit; abdominal hysterectomy, $627 profit; LAVH, $262 loss. Overall, the contribution margin profit of gynecologic surgical procedures with the use of prophylactic intraoperative ureteral stenting was reduced by about 85%—from approximately $2400 to $380.

Comment

Although prophylactic intraoperative ureteral stenting is used in multiple types of surgery,1-5 including conduits,1 renal transplant,1 ureteroscopy,2 colorectal surgery,3 and gynecologic surgery (including LAVH and radical hysterectomy5), there exists few scientific data on the effectiveness of this procedure. The only prospective randomized trial to show a benefit of intraoperative ureteral stenting in decreasing operative ureteral injury was with use of the procedure during renal transplantation.1 In a recent prospective randomized trial of prophylactic intraoperative ureteral stenting in colorectal surgery, the procedure did not decrease ureteral injury.3

In a literature search of the National Library of Medicine’s PubMed database, we found 1 prospective randomized trial evaluating the effectiveness of prophylactic intraoperative ureteral stenting during gynecologic surgery. Of 3141 patients who underwent gynecologic surgery in that trial, ureteral injury occurred in 1% of the patients receiving stents and in 1% of the patients not receiving stents (P=.77).12 In a retrospective review of 3071 patients undergoing gynecologic surgery, ureteral injury occurred in 0.6% of the stented group and 0.1% of the nonstented group (P=.10).13 In a retrospective review of LAVH, no advantage to ureteral stenting was found.4 Therefore, our PubMed search revealed no scientific data to support the use of intraoperative ureteral stenting during gynecologic surgery to prevent operative ureteral injury.

In a PubMed literature search we were unable to find any studies evaluating the cost-effectiveness of intraoperative ureteral stenting during gynecologic surgery. In a decision analysis on the cost-effectiveness of intraoperative ureteral stenting during gynecologic surgery,14 stenting was not cost-effective. However, that decision analysis14 was problematic because it had 16 scenarios, it made more than 13 assumptions, and it analyzed reimbursement rather than cost.

Systems-based practice is one of the core competencies in osteopathic medical education.15 A major component of systems-based practice is cost analysis. Thus, it is important that osteopathic physicians be aware of cost analysis and of the use and relevance of cost analysis in their clinical practices.

The main strength of the present study is that it evaluates costs—data that are more difficult to obtain than data on charges or financial model estimates. Furthermore, we obtained data on contribution margins, which are also difficult to obtain.

We believe that further cost analyses of prophylactic intraoperative ureteral stent placement and other surgical procedures are needed, particularly to better evaluate patterns of care that are currently not based on strong medical studies.

Conclusion

Our cost analysis of prophylactic intraoperative ureteral stenting in gynecologic surgery confirmed our hypothesis that this procedure decreases a hospital’s contribution margin. We found that adding the cost of prophylactic intraoperative ureteral stenting to that of other gynecologic surgical procedures reduced a hospital’s overall contribution margin by about 85%, and when used with LAVH, stenting resulted in a net loss. Because of the expense and the lack of scientific data demonstrating effectiveness, it is our opinion that prophylactic intraoperative ureteral stenting should not be used in gynecologic surgery to decrease operative ureteric injury.

References