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EDITORIAL – GYNECOLOGIC ONCOLOGY

Improving Surgical Site Infection Rates Through Continuous Quality Improvement

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Over the past decade surgical site infections (SSIs) have been recognized as a preventable and costly complication—costly not only in a monetary sense, but also in regard to both morbidity and mortality. Estimates for annual expenditures to manage SSIs in the US range from $3.5 to $10 billion, not surprising when the average 30-day cost of a single organ/space SSI after hysterectomy approaches $20,000.[1–3] Notably, these figures do not account for lost wages and long-term disability. Additionally, deaths among patients who develop a SSI are directly attributable to the infection in 77 % of cases, and for patients with ovarian cancer, diagnosis of a SSI increases the risk of death by 50 %.[1,4]

National registries have been used to identify risk factors for SSI. Causes are multifactorial and may be broadly categorized as patient, procedural, and care process-related. Every effort should be made to address modifiable risk factors before surgery; however, patient risk factors such as body mass index and nicotine use may be nonmodifiable when a surgical intervention is required without delay. Procedural factors may or may not be modifiable. For example, minimally invasive approaches are the standard of care for patients with endometrial cancer and are associated with a 16-fold reduction in SSI compared with laparotomy.[2] Despite the fact that minimally invasive surgery has been identified as a quality measure by the Commission on Cancer, only 50 % of endometrial cancer surgeries in the US are performed using this approach.[5] Lastly, care process and institutional factors are critically important because they are under the control of health care providers and potentially have an important impact on patient outcomes. It is estimated that nearly 60 % of SSIs are preventable by following evidence-based guidelines.[1] These guidelines have led to the development of quality measures from the Centers for Medicare and Medicaid Services (CMS) and the Centers for Disease Control and Prevention (CDC).

In this issue, Taylor et al. use a bundle of six interventions to modify their perioperative care processes and successfully reduce their SSI rate by 40 %.[6] The Institute for Healthcare Improvement defines a bundle as "a small, straightforward set of evidence-based practices that, when performed collectively and reliably, have been proven to improve patient outcomes".[7] Critics have pointed out that implementation of a bundle introduces multiple interventions simultaneously, such that the most impactful changes cannot be individually identified. This is a valid concern from a scientific perspective, but from a clinical perspective, the goal of surgeons and patients is to eliminate infections, and implementation of bundles of interventions has been shown to be extraordinarily effective. Bundles reduced overall SSI rates from 9.8 to 4.4 % in colorectal surgery and from 6.0 to 1.1 % in patients undergoing laparotomy for advanced ovarian or uterine cancer.[8,9] One investigation of more than 3000 patients demonstrated an inverse correlation between the number of bundled elements utilized and the rate of SSI, suggesting that each element has an additive impact on risk reduction.[10]

The bundle implemented by Taylor et al. was thorough and included important elements such as patient education, follow-up phone calls, and evidence-based perioperative interventions. Additional interventions with a high level of scientific evidence supporting their use that are endorsed as core SSI prevention strategies by the CDC include: treating remote infections if possible before surgery, surgical site

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hair removal only when necessary without the use of razors, appropriate antiseptic skin preparation, normothermia, limiting operating room traffic, and postoperative control of blood glucose to <200 mg/dL.[11] It is possible that some or all of these interventions are part of the standard perioperative practice at MD Anderson Cancer Center and were simply not commented on in this current study. Other strategies with some scientific evidence to support implementation include testing and decolonization of MRSA, adjusting antibiotic dosing in obese patients, maintaining inspired oxygen levels to at least 50 % FiO_2 perioperatively, and providing surgeons feedback on their specific SSI rates.[11] Irrigation with povidone-iodine solution, prophylactic negative pressure wound therapy, and preoperative oral antibiotics may be advantageous in specific patients or specialties.[12–14] However, some of these interventions are more complex and/or costly to implement and may warrant a standalone intervention to implement.

A major strength of the current investigation is the cost analysis, clearly showing a favorable result for both the patient and institution. The increased personnel costs associated with prolonged operating time from glove, gown, and surgical pan exchange and patient phone calls were not considered (i.e., a time-derived activity-based costing analysis). However, the magnitude of the savings, together with the sensitivity analyses provides a convincing and robust result that should reassure skeptics who resist adopting this bundle. Additionally, interventions such as enhanced patient education and follow-up nursing calls may favorably impact patient satisfaction.

Much like weight loss, obtaining initial quality improvement is far easier than achieving sustainable improvement. Provider engagement and enthusiasm may support the initial implementation, but long-term maintenance of an intervention requires a culture change and can be enhanced by utilizing process improvement tools that incorporate a control phase. It is critically important in the months and years ahead to monitor compliance with bundle elements, follow future infection rates, communicate results to the surgical teams, and perform root-cause analyses to identify additional opportunities for improvement. For example, one surgical quality metric goal suggested by CMS is >95 % compliance with surgical care improvement process (SCIP) measures. As administration of appropriate preoperative antibiotics is a key SCIP measure, process modifications such as the use of standardized electronic order sets should improve the reported 74 % compliance with preoperative antibiotics reported in the present investigation compared with national norms.[15,16] Importantly, this work and those of others should be used to educate other surgical specialties in our own institutions and across the nation to address alarming variations in SSI. Our most difficult challenge is not to discover new knowledge, but rather to integrate existing knowledge into our practice, sustain improvements, and successfully diffuse these best practices elsewhere.

National benchmarking of SSI rates is available from a number of registries, but outcomes may vary greatly depending on the data source (billing data vs. abstracted data such as NSQIP), and risk adjustment in some registries has lagged far behind our current knowledge. For example, in Minnesota, SSI rates are adjusted by age and incision type only. Not including surgical approach may be logical to encourage the use of minimally invasive surgery. However, other factors that impact SSI such as disseminated cancer, medical comorbidities, and case mix are not under the control of the surgeon. Our own institution's standardized infection rate reported to the state in colorectal surgery nearly doubled overnight when the reporting inclusion CPT codes were changed to include rectal anastomoses. While this change may have had a small impact on some practices, groups such as our own which are a regional and national referral center for patients with rectal cancer and inflammatory bowel disease were disproportionally affected by having a large population of high risk patients undergoing high risk procedures. In the current study approximately 25 % of patients underwent enteric resections, and it is difficult to compare the infection rate in this practice to one in which 40 % of patients undergo enteric resection, or another practice in which 0 % require enteric resection. These are just a few examples of the modifications required to identify and reward practices that deliver high value care.

While purists may critique the fact that the intervention in this project was not randomized, the most important consideration is that SSI rates are currently 40 % lower at MD Anderson Cancer Center compared with 2014, and this result was achieved at a very low cost using evidence-based practices. Taylor and colleagues have made a difference in the value and outcomes of their practice. We should all challenge ourselves to join the cycle of continuous improvement for the benefit of our patients. While our goal on the horizon should always be perfection, our goal for tomorrow should be simply to do better than yesterday.

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