Surgical Site Infections in Pediatric Spinal Surgery
Patients Drop Following Performance Review

Until recently, children with severe scoliosis caused by neurologic and other, similar disorders have had a roughly 1 in 8 chance of acquiring an infection during the course of surgical treatment. According to published reports, national rates for such surgical site infections (SSIs) have been in the 10% to 15% range, depending on the center and the diagnosis. Now, a multidisciplinary team at NewYork-Presbyterian Morgan Stanley Children’s Hospital has taken a leadership role in a national effort to reduce these troublingly high infection rates in one of medicine’s most vulnerable populations.

“Treating the most complex, involved children with scoliosis, and surrounded by all the world-class staff and resources at this institution, we have an obligation to do better,” said Michael G. Vitale, MD, MPH, Associate Chief, Division of Pediatric Orthopaedics, and Chief, Pediatric Spine and Scoliosis Surgery, Department of Orthopaedic Surgery, Morgan Stanley Children’s Hospital. “These kids may be dealing with neurological problems or heart and lung problems in addition to their deformity. Spinal surgery is a big intervention, and although it promises significant improvement in the lives of these patients, it also carries with it some risk, particularly for surgical site infections. We’re trying to bring that risk down to zero,” said Dr. Vitale, who is also the Ana Lucia Professor of Clinical Orthopaedic Surgery, Columbia University College of Physicians and Surgeons.

Continuous Quality Improvement

Drawing on his experience driving a national quality initiative with the Pediatric Orthopaedic Society of North America, Dr. Vitale formed the Pediatric Orthopaedic Quality Steering Committee at Morgan Stanley Children’s Hospital in 2010 to evaluate all patient care processes employed during the treatment of pediatric patients with severe spine disorders. The stated mission of the Pediatric Orthopaedic Surgery Quality Program is to “improve quality, safety, value, satisfaction and throughput in pediatric orthopaedic patients.”

According to Dr. Vitale, the process begins at admission, continues through surgery, and carries into the discharge process. The Steering Committee’s membership includes orthopaedic surgeons, infectious disease specialists, and nurses as well as hospital administrators with expertise in healthcare quality management. Additionally, the Division of Pediatrics has hired a nurse practitioner—Jennifer Crotty, PNP—to coordinate translational research initiatives designed to assess and improve quality and safety in the treatment of this unique patient population. In this role, Ms. Crotty has facilitated the development of a Pediatric Spine Parent/Patient Satisfaction Survey and helped establish a series of metrics for the division focused on quality performance for pediatric spine patients.

To date, the Steering Committee has devoted a significant amount of attention to the management of SSIs following spinal surgery procedures. At the time the Committee was formed, Dr. Vitale said, the incidence of SSIs in postoperative fusion patients at Morgan Stanley Children’s Hospital was approximately 10% to 15%, on par with the rates at many of the leading surgical centers in the country. In less than 2 years, the Steering Committee’s efforts have reduced the incidence rate to approximately 1%.

“And this is in high-risk patients—patients with multiple comorbid diagnoses, big curves, multiple surgeries,” said Dr. Vitale. “Our team identified risk factors, developed best-practice guidelines, and uses a continuous...
Nanofiber Scaffold Shows Promise for Shoulder Repair

WILLIAM N. LEVINE, MD
HELEN H. LU, PHD

The repair of a torn rotator cuff is one of the most common shoulder surgeries, with some 300,000 rotator cuff tendon repairs performed each year in the United States. Many patients present with massive tears which have a low probability of healing, with one series showing that greater than 90 percent of the repairs fail. When that happens, patients may require revision surgery or a reverse shoulder replacement if arthritis also develops.

The reason for the extraordinarily high failure rate is a highly avascular environment that results in poor healing between the rotator cuff tendons and the bony insertion site on the humerus. “So many of these operations fail not because of the surgeon, the patient, or the physical therapist, but because the healing environment is so poor,” explained William N. Levine, MD, Director, Sports Medicine, and Associate Director of the Center for Shoulder, Elbow and Sports Medicine, at NewYork-Presbyterian/Columbia University Medical Center. In addition, mechanical fixation methods employed during cuff repair do not enable functional integration of the repaired tissue with the body.

Researchers around the world have been searching for the “Holy Grail”—a way of enhancing the healing environment to enable true reattachment of the tendon to the bone, thereby improving the success rate of rotator cuff repairs.

Using state-of-the-art nanofabrication methods, Dr. Lu and her team first formed nanofibers of polylactide-co-glycolide acid (PLGA), a polymer commonly found in degradable sutures, as well as fibers composed of PLGA and hydroxyapatite nanoparticles.

Fig. 1 Diagram on left shows rotator cuff tear while middle one shows where the bi-phasic nanofiber scaffold will be inlaid at the injury site. Diagram on right shows completed cuff repair with scaffold between the tendon and bony insertion.
Researchers around the world have been searching for the “Holy Grail”—a way of enhancing the healing environment to enable true reattachment of the tendon to the bone, thereby improving the success rate of rotator cuff repairs.
quality improvement loop to affect change. It’s working.”

Like organizations in other industries—including manufacturing and aviation—that have focused efforts on quality improvement over the past 25 years or so, the Pediatric Steering Committee has embraced some of the concepts of Six Sigma, a process improvement approach crafted by Motorola in the 1980s. Six Sigma is designed to improve the quality of process output by identifying and removing the causes of defects or errors and minimizing variability in the processes used to create them.

To reduce SSIs, for example, the Steering Committee has evaluated several of the processes involved in fusion surgery to identify possible risk factors and potential measures to address them. They have developed multiple metrics and checklists—Dr. Vitale refers to them collectively as a Pediatric Orthopaedic Surgery “dashboard”—to measure performance and guide clinicians through every stage of patient care, from the surgery itself to patient education (“Did we formally engage the patient and family in the process? Did the patient have a nutritional consult prior to surgery? Did we address any skin problems prior to surgery?”). The group has developed a perioperative checklist for both the operating room (OR) staff and the orthopaedic physicians, as well as postoperative checklists for patients, parents, and inpatient nurse practitioners.

“Ultimately, optimizing quality is a shared responsibility, demanding transparency and commitment to change,” Dr. Vitale said.

The dashboard also includes guidelines on issues such as when to initiate antibiotic therapy and which antibiotic to use, as well as other prophylactic approaches. Several members of the Steering Committee were among the authors of a paper titled “Building Consensus: Development of a Best Practice Guideline for Surgical Site Infection Prevention in High Risk Pediatric Spine Surgery,” which has been accepted for publication in the Journal of Pediatric Orthopaedics and proposes 14 approaches for reducing SSIs in spinal fusion surgery.

As part of another, related initiative, entry into the OR is sporadically monitored during spine procedures, in an effort to decrease OR traffic, thought to correlate with risk for infection. Dr. Vitale’s team categorizes OR traffic as “essential, equivocal, or nonessential,” and then uses this data as part of the continuous quality improvement feedback chain, with the ultimate goal of limiting “all nonessential access to the OR during each case,” he said.

“We see this initiative as part of a growing recognition that clinicians need to be doing more to both measure and improve quality, safety, satisfaction, and value,” Dr. Vitale continued. “As a specialty, we now recognize that we have too many medical errors and that we have been too slow to develop an infrastructure to support quality. And what we have seen through our efforts here is an example of the so-called Hawthorne Effect—that simply by observing behaviors we have been able to change them. The Hospital and its patients have benefited as a result.”

Michael G. Vitale, MD, MPH

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**TABLE. A SAMPLING OF THE CONSENSUS GUIDELINES FOR SURGICAL SITE INFECTION PROPHYLAXIS FOLLOWING SPINAL FUSION SURGERY**

<table>
<thead>
<tr>
<th>Patients should receive a preoperative Patient Education Sheet*</th>
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<tbody>
<tr>
<td>Patients should have a preoperative nutritional assessment*</td>
</tr>
<tr>
<td>Patients should receive perioperative IV prophylaxis for gram-negative bacilli*</td>
</tr>
<tr>
<td>Adherence to perioperative antimicrobial regimens should be monitored (ie, agent, timing, dosing, redosing, cessation)*</td>
</tr>
<tr>
<td>OR access should be limited during scoliosis surgery whenever practical*</td>
</tr>
<tr>
<td>Postoperative dressing changes should be minimized prior to discharge to the extent possibleb</td>
</tr>
</tbody>
</table>

*aInterventions reached consensus after the first round of voting.

*bIntervention reached consensus after the second round of voting.