



Sustained improvement in intraoperative efficiency following implementation of a dedicated surgical team for pediatric spine fusion surgery



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ABSTRACT

Objective: Determine if dedicated surgical teams can improve and sustain intraoperative efficiency for pediatric posterior spine fusion (PSF)

Design: Comparison of OR efficiency data from sequential summer improvement projects and outcome data following adoption of a dedicated surgical team model for PSF cases.

Setting: Academic tertiary pediatric hospital

Participants: Patients undergoing PSF for adolescent idiopathic scoliosis, anesthesiology team, orthopedic surgeons, operating room nurses, neurophysiologists, radiology technicians, preoperative nurses, improvement advisors.

Intervention(s): Dedicated surgical team care model for PSF developed using formal quality improvement methodology.

Main outcome measure(s): Total operating room time for PSF surgery.

Results: A multidisciplinary quality improvement team developed and implemented a dedicated team model leading to a 29% reduction in total operating room time in summer 2015 pilot data compared to data collected during a less structured improvement effort in summer 2014. This dedicated team model was expanded to more complicated patients and another high-volume surgeon in January 2016 with consistent improvement in operative efficiency from a historical average of 395 min to 317 min following implementation of the dedicated team model.

Conclusions: Multidisciplinary efforts are useful for creating dedicated teams and sustainable reductions in total OR time for pediatric PSF.

1. Introduction

Surgical management of adolescent idiopathic scoliosis (AIS) with multilevel posterior spinal fusion (PSF) is one of the most costly surgical procedures performed in pediatric medicine.¹ Increasingly, institutions are charged with developing value based care models for surgical populations in which the efficiency and efficacy of health care management is critically evaluated to optimize patient outcomes while redu-

cing system cost.² We have previously published on the implementation of a recovery pathway for AIS patients undergoing PSF which reduced LOS while maintaining effective pain control.³ Given the success of a multidisciplinary quality improvement team focused on post-operative care, we decided to apply a similar approach to improve the intraoperative management of this surgical population.

Optimizing operating room efficiency is important for a variety of reasons including reducing anesthesia and operative time which can

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potentially impact patient outcomes,⁴ increase operating room capacity,^{5,6} and reduce institutional costs.⁶ Much of the work examining operative efficiency has been conducted in adult surgical populations and the scope of this work has been broad. Areas of focus have included analysis of overall patient flow from surgical booking to recovery using Lean methodology,⁷ incorporation of dedicated block rooms to control anesthesia time,^{6,8} focus on reduction of operating room turnover time,⁵ and the institution of dedicated team models for care of specific surgical populations.⁹ Establishing a culture of engagement, cooperation, and shared mission is key to a successful dedicated team model. The concept of parallel processing¹⁰ is also vital for this type of work as it allows for multiple patient specific tasks to be completed in parallel rather than in series. This type of coordinated work was not standard in our operating rooms and we believed that implementation of this management strategy could help us streamline the care of patients undergoing posterior spine fusion.

In the summer of 2014, a small group of anesthesiologists and two orthopedic surgeons began an effort to reliably complete two or more cases in a day by starting spine cases one half hour earlier either in the operating room or a dedicated induction room in the preoperative area. The goal was to complete two cases, either two spine fusions or one spine fusion and a non-fusion case, in one room in one day. Little was known about historical operating room times and no metrics were set to allow for tracking outcomes. Anesthesiologists were charged with starting the case early and quickly so that the room did not start off the day “behind.” Consistent strategies or protocols for patient preparation were not defined and the preoperative nursing, anesthesiology, surgery, and operating room (OR) nursing teams did not have an opportunity to develop a unified approach to patient preparation. Because communication was not optimized ahead of time, this pilot effort put stress on the organizing team members.

In planning for the summer of 2015, we assembled a multidisciplinary team and, using formal quality improvement methodology, developed a dedicated surgical team model that would enable completion of two posterior spinal fusion cases per day in one room on 5 specific days. Subsequently, we expanded this dedicated surgical team model in the January 2016. We present a description of the process we undertook to improve OR efficiency and track metrics in this surgical population. Additionally we present a comparison of our 2 summer pilots with “lessons learned” and data suggesting sustained intraoperative efficiency improvement using a dedicated surgical team model.

2. Methods

The formal improvement process was started on April 1, 2015 and the stated goal was to improve the efficiency of care for patients undergoing PSF for AIS through standardization of OR workflows. The outcome goal was to complete 2 spine fusions in one room on 5 separate pilot days during the summer of 2015. Following completion of the pilot, the team would use the lessons learned to expand a dedicated surgical team model with a clearly defined scope to other appropriate surgeries. Concurrently, we developed a data visualization tracking tool to monitor the effectiveness of our interventions.

2.1. Definitions of times and time intervals

For the purposes of this improvement project, we focused our attention on the total operative time from the patient's entrance to exit from the operating room. Times used for this project are summarized in [Table 1](#). We chose to deemphasize specific time points (anesthesia ready, surgical preparation, emergence) as preparation was being completed in parallel not in series so these intervals were difficult to define in traditional terms. Total OR time was measured and also broken down into non-operative time and operative time, and we evaluated all three to identify potential areas for improvement.

Table 1
Summary of intraoperative time points and intervals used in the report.

Name	Definition
Milestones	
Anesthesia Start	Patient identified and anesthetic care started
Anesthesia Ready	Anesthesia induced, airway secured, and vascular access obtained
Surgery Prep	Patient positioned and surgical site prepared for incision
Surgery Start	Surgical incision
Surgery Finish	Dressing applied and final x-rays completed
Patient Out of Room	Patient exits the operating room
Intervals	
Non-operative time	Time before Surgery Start and after Surgery Finish until Out of Room
Operative Time	Time from Surgery Start to Surgery Finish
Total Case Time	Anesthesia Start to Patient Out of Room

2.2. Patient demographics and surgical procedures

We focused on a surgical population of otherwise healthy adolescents undergoing PSF for AIS. The surgical population for the 2015 pilot included patients with a BMI less than 30 kg/m² and a mild curvature that was likely to be correctable without multiple osteotomies. Upon expansion of the dedicated team model, we included patients with more severe curves that would require osteotomies for correction as well as patients with a BMI greater than 30 kg/m². We excluded all patients with neuromuscular scoliosis as their care is more variable and beyond the scope of this improvement project.

2.3. Institutional characteristics

The Children's Hospital Of Philadelphia is a tertiary-care free standing children's hospital with 535 beds and 6 surgeons who treat pediatric spine disorders. The group performs between 110 and 130 spine fusions for AIS annually with 2 surgeons accounting for approximately 70% of the surgical volume in this population. The 2015 summer pilot was conducted with our highest volume surgeon to develop the improvement framework needed to establish a dedicated surgical team model within our institution. This model was ultimately expanded to a second high volume surgeon, and thus the improvement project reflects the care of approximately 70% of our patients undergoing posterior spinal fusion for AIS.

2.4. Development of an improvement strategy

A formal multidisciplinary team was assembled in the spring of 2015 with the organizational guidance of a quality improvement advisor and data analyst. The team included representatives from all care providers involved in spine fusion operations: the orthopedic surgeon, anesthesiologists, nurse anesthetists, postoperative recovery nurses, operating room nurses, radiology technicians, spine equipment representatives, and an electro-physiologist.

The improvement process included structured weekly multidisciplinary team meetings to understand and map the OR process and identify areas where team coordination could be improved. The team generated a swim lane diagram to outline all roles and steps involved in spine fusion surgery ([Appendix A](#)). Within our institution, the OR nursing staff is responsible for transporting patients from the preoperative area to the OR. This was recognized as a challenge for the OR nurses who are responsible for completing a complicated instrumentation setup. To give the OR nurses more time to complete this process, the anesthesiology team assumed responsibility for patient transport to the OR. After group analysis of the operative process, a surgical checklist was created to clearly define team member roles and responsibilities ([Fig. 1](#)).

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