Online First

Analysis of Pediatric Direct Laryngoscopy and Bronchoscopy Operative Flow

Opportunities for Improved Safety Outcomes

Rahul K. Shah, MD; Justin Cohen, MD; Anju Patel, MD; Craig Derkay, MD

Objective: To study pediatric direct laryngoscopy and bronchoscopy operative flow.

Design: Observational quality improvement initiative.

Setting: Two freestanding tertiary care children's hospitals.

Patients: Pediatric patients undergoing direct laryngoscopy and bronchoscopy.

Main Outcome Measures: Trained medical students observed direct laryngoscopy and bronchoscopy operative flow. An audit tool containing 144 fields was completed during each encounter for the following domains: timing of the case, preoperative preparation, operative flow, and operating room personnel assessment.

Results: Forty-one cases were observed. The mean time between the patient entering the operating room and the beginning of the case was 12 minutes. In all the patients, a complete history was obtained, and a physical examination was performed. The equipment was ready for 31 cases (76%) and was checked before 32 cases (78%). Anesthesia equipment was checked before 36 cases (88%). Issues with intravenous access were recorded for 19 cases (46%). The operating room orientation needed to be changed to accommodate the procedure in 11 cases (27%). Preoperative preparation of the patient proceeded smoothly in 16 cases (39%), and the operative flow proceeded without disruption in 19 cases (46%). The scrub nurse left the operating room in 2 cases (5%), the circulating nurse left in 15 cases (37%), and the anesthesiologist left in 9 cases (22%).

Conclusions: Although a common pediatric otolaryngology procedure, direct laryngoscopy and bronchoscopy operative flow is ideal in less than half the cases. Areas for improvement include obtaining intravenous access, reducing operating room personnel turnover, verifying equipment, and educating staff on operating room setup. To our knowledge, this is the first observational quality improvement initiative in otolaryngology to study the operative flow of a specific procedure and provide insight into areas of patient risk and opportunities for improvement in efficiency.


Quality Improvement initiatives have increased in the last decade, with national grassroots mobilization following the landmark report by the Institute of Medicine To Err Is Human.1 Efforts recently have been aimed at identifying areas of patient risk in the field of otolaryngology.2 Chalian et al3 investigated the use of intraoperative pathways for head and neck patients undergoing radial forearm free flap reconstruction, noting improved operative efficiency after implementing the pathways into the provision of care. It is believed that attention to the flow of care in the operating room should result in similar gains in safety and efficiency.4 A surgical procedure that is amenable to the study of operative flow would be one that is frequently performed and carries potentially high stakes if disruption occurs during the preoperative preparation or case flow. In such procedures, the need for efficient operative flow is critical. Based on these considerations, we chose pediatric direct laryngoscopy and bronchoscopy (DL/B) to investigate opportunities for improved safety outcomes. Anecdotally, it is thought that the operative flow of laryngoscopy and bronchoscopy cases is often suboptimal for various reasons, including complexity of instrumentation, deficient staff education, and personnel issues.

Without objective data demonstrating areas of deficiency, it is difficult to vali-
date such beliefs. Such data must be acquired before any targeted quality improvement interventions can be performed. In the initiative described herein, impartial observers watched the operative flow of DL/B cases and recorded various steps of the process, with the aim of identifying areas in which quality improvement efforts could be focused.

### METHODS

Institutional review board approval was obtained from 2 free-standing tertiary care sites of data collection, Children’s National Medical Center, Washington, DC, and King’s Daughters Children’s Hospital, Norfolk, Virginia. An audit tool was developed that contained 144 fields to be completed during each DL/B case (Figure). The domains for which the impartial observer collected data were timing of the case, preoperative preparation, operative flow, and operating room personnel assessment. Free-text space at the end of the audit tool was included for comments about communication issues and general observations.

We attempted to control for as many variables as possible during the observation of consecutive regularly scheduled pediatric patients at 2 institutions undergoing DL/B. The impartial observers watched at least 10 DL/B procedures before completing their first audit tool. To maintain objectivity and focus on the operative flow, the impartial observers were not allowed to participate in the surgery or become involved in any aspect of the case. They were instructed to stand in a corner of the operating room and, regardless of what transpired, to remain impartial. In an effort to reduce bias, the impartial observers were nonphysician members of the health care team. At both institutions, the impartial observer was a medical student.

Forty-one patients were included in the study. The mean time between the patient entering the operating room and the beginning of the case was 12 minutes (range, 5-27 minutes). Although the audit tool included space for information about the total prior case turnover time, insufficient data were collected to comment on the results for this variable. The mean (SD) total procedure time was 22 (21) minutes (range, 4-108 minutes). This represented a mean (SD) of 47% (18%) of the total time the patient was in the operating room.

In all patients, a complete history was obtained, a physical examination was performed, and a working preoperative diagnosis was established. The equipment was ready for 31 cases (76%) and was checked before 32 cases (78%). Anesthesia equipment was checked before 36 cases (88%). A laser was used in 3 cases (7%), which was not ready in 1 of the cases. Issues with intravenous access were recorded for 19 cases (46%). The operating room orientation needed to be changed to accommodate the procedure in 11 cases (27%). Preoperative preparation of the patient proceeded...
smoothly in 16 cases (39%), and the operative flow proceeded without disruption in 19 cases (46%).

The scrub nurse left the operating room in 2 cases (5%), the circulating nurse left in 15 cases (37%), and the anesthesiologist left in 9 cases (22%). Throughout the study, no sentinel events or serious adverse events, including untoward outcomes, were observed.

Qualitatively, the free-text comments about communication issues were varied. In 7 cases (17%), the impartial observer specifically noted good communication.

**COMMENT**

Despite that it is one of the most common pediatric otolaryngology procedures performed, DL/B operative flow is ideal less than half of the time. Specific areas were identified as opportunities for improved safety outcomes. These include obtaining intravenous access, reducing operating room personnel turnover, verifying equipment, and educating staff on operating room setup. Recently highlighted by the Joint Commission Center for Transforming Healthcare as important in preventing wrong-site surgery, the “continuum of care” is underscored in our initiative. Proper booking of a case (including the need for specialized equipment, laser, and others) and communication between the anesthesiologist and surgeon before the case are crucial to achieve safe and efficient operative flow.

The delivery of care in the operating room depends on effective communication, and issues in this regard are not unique to otolaryngology. A large study of Harvard University (Boston, Massachusetts) teaching hospitals found that communication breakdowns were common between residents and attending surgeons of many specialties, frequently resulting when residents failed to seek out attendings for assistance in decision making. Results of studies exploring the most frequent causes of avoidable surgical errors demonstrated that communication faults are second only to technical errors.

Acknowledging the importance of communication, other investigators have researched the usefulness of focused interventions. The use of policy-based interventions has shown particular benefit in reducing communication breakdowns. Arriaga et al. found that patient management was modified in one-third of surgical cases as a direct result of a communication intervention.

Although our quality improvement initiative was not designed to measure communication efficacy per se, our results mirror those of other studies. Of all the communication errors observed, Halverson et al. found that those relating to equipment and to team dynamics represented 36% and 24%, respectively. In their study, the implementation of a team training exercise resulted in enhanced communication in these domains. Knowing which aspects of communication are breaking down enables the application of appropriately directed interventions. Our analysis of DL/B operative flow provides such information.

In addition to team training and strategies to increase interpersonal skills, the use of intraoperative pathways has been shown to enhance nonverbal communication and improve the operative flow. In a study of intraoperative pathways in head and neck cases, the planned case progression from various perspectives was measured by timed actions. The use of intraoperative pathways led to enhanced efficiency and streamlined care, with potential improvement in resource use and surgical performance. Based on our study findings, the need for intraoperative pathways in DL/B cannot be overstated and will help the surgical technician, nurse, anesthesiologist, and surgical team be aware of progressive steps and anticipate requirements.

In our study, the mean total procedure time represented on average 47% of the total time the patient was in the operating room, indicating the need for improvements in operating room efficiency. No normative data exist on how much operating room time should be spent on the DL/B procedure itself, but only through investigations such as the present study can normative and improvement data be obtained.

From a quality improvement standpoint, the results herein identify several requirements that can be readily modified at institutional levels and should not require significant effort. These include the following: (1) the need for the team (anesthesiologist, nurse, and scrub nurse) to remain in the operating room for the duration of the case (because these are short cases), (2) the need for anesthesiologists and the operating room team to check their equipment before the case, and (3) the need to ensure that operating room setup preferences of the surgeon are followed (because of nuances in these cases).

In addition to the basic needs aforesaid, other quality improvement efforts will likely require more significant effort but will markedly improve the operative flow of these cases. These include (1) the potential identification of patients with poor intravenous access ahead of time and establishment of a plan accordingly (recruiting an extra anesthesiologist to help, assembling an intravenous access team, using a vein finder, etc) and (2) the formation and use of dedicated teams for airway endoscopy cases (demonstrated to be efficacious for other surgical procedures).

In conclusion, although a common pediatric otolaryngology procedure, direct laryngoscopy and bronchoscopy operative flow is ideal in less than half of cases. Areas for improvement include obtaining intravenous access, reducing operating room personnel turnover, verifying equipment, and educating staff on operating room setup. To our knowledge, this is the first observational quality improvement initiative in otolaryngology to study the operative flow of a specific procedure and provides insight into areas of patient risk and opportunities for improvement in efficiency.

Submitted for Publication: March 21, 2012; accepted April 8, 2012.

**Published Online:** June 18, 2012. doi:10.1001/archoto.2012.883

**Correspondence:** Rahul K. Shah, MD, Division of Otolaryngology, Children’s National Medical Center, 111 Michigan Ave NW, Washington, DC 20010 (rshah@cnmc.org).

**Author Contributions:** All authors had full access to all the data in the study and take responsibility for the in-
tegrity of the data and the accuracy of the data analysis. Study concept and design: Shah, Cohen, Patel, and Derkay. Acquisition of data: Cohen, Patel, and Derkay. Analysis and interpretation of data: Shah and Derkay. Drafting of the manuscript: Shah, Cohen, and Derkay. Critical revision of the manuscript for important intellectual content: Shah, Cohen, Patel, and Derkay. Statistical analysis: Shah, Cohen, and Derkay. Administrative, technical, and material support: Shah, Cohen, Patel, and Derkay. Study supervision: Shah and Derkay. Financial Disclosure: None reported. Previous Presentation: This study was presented in part at the Annual Meeting of the American Society of Pediatric Otolaryngology; April 29, 2011; Chicago, Illinois.

REFERENCES


