

Experience with Combining Pediatric Procedures into a Single Anesthetic

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Abstract

Introduction: The combination of multiple procedures within a single anesthetic may provide many challenges for the perioperative team. Coordination of specialties, consideration for parental time burdens, and travel expenses as well as limiting multiple anesthetic exposures to the children are pertinent factors to consider when advocating the combination of surgical procedures. **Methods:** The electronic medical record at Nationwide Children's Hospital was retrospectively queried to obtain information on patients having a single anesthetic encounter for 2 or more procedures involving 2 or more services over 1 year (July 2015–June 2016). **Results:** One thousand one hundred twenty patients had 2 procedures during a single anesthetic encounter. The average anesthesia time was 127 ± 102 minutes, and average PACU time was 64 ± 37 minutes. The unanticipated admission rate was 85 of 1,120 cases (7.6%). Five (6%) of the unanticipated admission cases were ASA status 1, 33 (39%) were ASA status 2, and 47 (55%) were ASA status ≥ 3 ; compared with 87 (9%), 481 (50%), and 391 (41%) in the group not requiring unanticipated admission ($P = 0.032$) (see Fig. 1). **Conclusions:** These data demonstrate the feasibility of combining several procedures during a single anesthetic encounter and may result in decreased healthcare costs as well as limitation of parental cost and time obligations. (*Pediatr Qual Saf* 2019;4:e207; doi: 10.1097/pq9.000000000000207; Published online 30 August, 2019.)

INTRODUCTION

Combining multiple procedures under 1 anesthetic in children may present specific challenges for the perioperative team. Coordination of services and various specialties often proves challenging and time-consuming. However, several factors encourage such care. Recently, concerns have been raised regarding the exposure of children to multiple anesthetics. The Food and Drug Administration announced a new warning in November 2016 concerning the potential detrimental effects on the developing brain of prolonged or repeated exposure to commonly used anesthetic agents. Although there is no definitive clinical research to prove a direct correlation between general



anesthesia and adverse neurocognitive outcomes in children, most pediatric anesthesiologists consider it prudent to limit multiple anesthetic exposures, whether due to simple safety concerns, potential neurocognitive effects, or cost containment.

Care coordination and health-care financing strategies for children and youth with special health care needs (CYSHCN) is gaining importance.¹ However, the focus of care coordination efforts has been on medical homes coordinating outpatient care.¹ CYSHCN also require an increased outlay of resources when undergoing a procedure requiring sedation and anesthesia, but relatively little work has addressed care coordination in the perioperative environment. This coordination starts when arriving at the hospital (ie, specialized medical transport), and additional support before, during, and after procedures (ie, ventilation, suctioning, and oxygen delivery). Although CYSHCN account for a disproportionate share of the cost of pediatric healthcare, strategies of perioperative care coordination need not be limited to these children. Healthy children presenting for elective surgery would also benefit from similar care coordination. Such coordination could reduce the family's total burden from time away from work, travel expenses, and potentially offer a safety benefit. Additionally, there would only be 1 fee for preoperative and postoperative care.

There remains a dearth of information involving care coordination by combining multiple procedures under a single anesthetic encounter. Whereas prior research has emphasized

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ASA Status	Total # Patients	Expected Discharge Status	Unanticipated Admission
1	92	87	5
2	514	481	33
> 3	438	391	87

Fig. 1. The number of patients who met their expected discharge status vs those who had unanticipated admissions based on the American Society of Anesthesiologists classification.

combining dental procedures with other elective surgical care, this represents only a limited share of procedures that we combine in our practice.²⁻⁵ We report the characteristics and outcomes of cases at our institution to better characterize children who successfully undergo combined procedures and to highlight common combinations of procedures.

METHODS

For this study, we obtained Institutional Review Board approval with a waiver of individual consent. The electronic medical record (EMR) at Nationwide Children's Hospital was retrospectively queried to obtain information on patients having a single anesthetic encounter for 2 or more procedures involving 2 or more services over 1 year (July 2015 to June 2016). Cases included any procedure performed in the main operating room, the radiology department, off-site areas, or any combination of these. Surgical subspecialties involved included otolaryngology, general surgery, orthopedic surgery, neurosurgery, plastic surgery, colorectal surgery, cardiothoracic surgery, gynecology, urology, ophthalmology, and oral and maxillofacial surgery. Nonsurgical services included hematology/oncology, radiology, interventional radiology, pulmonology, gastroenterology, wound care services, and audiology. We included patients with the following preprocedure admission statuses: ambulatory, outpatient in a bed, or AM admission. The surgeon or proceduralist initially assign these preprocedure admission statuses. Ambulatory cases were expected to be discharged after their procedure and recovery. Outpatients in a bed were cases with a planned admission to the inpatient ward with <24 hours of observation. AM admission indicated that the patient was admitted to the inpatient ward on the morning before their procedure and was scheduled to remain in the hospital after completion of the procedure and recovery. We excluded any patient who had been in the hospital before the procedure (current inpatient) from our search. We defined an unanticipated admission as any patient that had an upgrade from their scheduled admission status (eg, ambulatory to floor or ICU admission).

RESULTS

One thousand one hundred twenty patients had 2 procedures during a single anesthetic encounter, and were scheduled for either ambulatory, outpatient in a bed or AM admission status. The average age of the patient was 5.5 ± 6 years. ASA physical status was 92 ASA 1; 514

ASA 2; 438 ASA ≥ 3 ; and 76 missing data (Fig. 1). The number of services involved included the following: 2 services—922 cases (82%); 3 services—185 cases (17%); and 4 services—13 cases (1%). Location was divided as follows: 1 location—909 cases (81%); 2 locations—210 cases (19%); 3 locations—1 case (0.1%). Determining whether a patient can remain in the same location or needs to change anesthetizing locations depends on a multitude of factors. For example, if the procedure is surgical, surgeons can work in sequence to perform their respective parts of the case. Occasionally, nonsurgical procedures can follow surgical ones as in the case of auditory brainstem testing following bilateral myringotomy tubes. Then there are other cases, in which the procedure itself is dependent on the equipment need, such as imaging studies like MRI, CT, or PET scan. The average anesthesia time was 127 ± 102 minutes, and average PACU time was 64 ± 37 minutes. The unanticipated admission rate was 85 of 1,120 cases (7.6%). Five (6%) of the unanticipated admission cases were ASA status 1, 33 (39%) were ASA status 2, and 47 (55%) were ASA status ≥ 3 ; compared with 87 (9%), 481 (50%), and 391 (41%) in the group not requiring unanticipated admission ($P = 0.032$ by Chi-square test). Aside from the higher than anticipated unanticipated admission rate, we noted no other increased morbidity.

DISCUSSION

With the growing implementation of EMR systems in our hospital, along with a general demand to combine cases requiring general anesthesia by healthcare professionals and families, we completed 1,120 combined procedures over 1 year in a hospital that provides ~37,000 anesthetics a year. Our approach in selecting patients for combination cases continues to evolve but relies heavily on the EMR to identify patients who have multiple procedures scheduled within a 2-week window. After we identify these patients, we work with the associated surgeons, radiologists, dentists, and proceduralists to coordinate care. In some cases, the process is facilitated as multiple specialties already work together in multidisciplinary conferences and clinics to provide coordinated care for specific patient populations. For example, the colorectal surgery, urology, and gynecology services will discuss specific patients with anorectal and urogenital malformations in case conferences to formulate the surgical plan. The hematologists are involved in coordinating the care of their patients requiring lumbar puncture, bone marrow biopsies, surveillance MRI, or nuclear medicine scans. Our complex care team identifies patients from their service who may benefit from combining their anesthetic care. On occasion, parental requests will dictate the combining of procedures under a single anesthetic encounter.

With the movement toward bundled care payments by the Centers for Medicare and Medicaid Services and other insurance providers, cost reduction for both the

hospital and families has prompted the combining of procedures under a single anesthetic encounter. Based on a previous study at our institution, Raman, et al⁶ achieved a 30% reduction in cost by combining anesthetic care. This reduction was the result of having a single preoperative and postoperative encounter as well as minimizing single-use equipment-related charges as well. In addition to cost savings for the institution, combined procedures may reduce the time that parents have to take off from work and reduce school absences for patients. For families that live a significant distance from the hospital, a single combined anesthetic may also decrease travel and temporary housing-related costs.

The recent drug safety communication issued by the Food and Drug Administration regarding general anesthesia affecting the neurocognitive development of young children has increased awareness and concern among parents.^{7,8} Although no definitive data support this claim, it is still prudent to examine the safety of our current practices. While combining anesthetics may not necessarily limit the length of exposure for the child, it does limit the number of exposures, including the number of vascular access attempts and airway manipulations. Safety may also be improved as anesthetic induction and emergence are the 2 most challenging and risk-associated times of anesthetic care.

Our unanticipated admission rate was higher (7.6%) in this study versus our general population (0.1% from previous work).⁹ While 85%–90% of our patients go through the pre-admission screening process, we may miss scheduled status changes so that patients are not scheduled for postoperative admission. The unanticipated admission rate may also be due to the initial incorrect booking of ambulatory cases or outpatient in a bed of medically fragile children or younger children. These patients were *either* originally scheduled as ambulatory patients who were upgraded to outpatient in a bed or inpatient status *or* originally outpatient in a bed status and then upgraded to inpatient status after their procedure. However, we attribute the majority of the upgrade in admissions to either an extended operative/procedure time (>3 hours) or an extended PACU stay (>1 hour). The extended operative/procedure time suggests that perhaps the complexity of the surgical procedure, thus necessitating a longer anesthetic, may have warranted an upgrade in admission status. An extended PACU stay may be the result of longer recovery time due to longer anesthetic exposure. Longer procedure times or anesthetic care may result in the need for additional interventions in the PACU, such as racemic epinephrine, nebulized albuterol, additional opioids for pain, or antiemetics for postoperative nausea and vomiting. We must balance the potential need to escalate care following a long duration of general anesthesia with safety first and then cost. One must then determine if the additional anesthetic or surgical time incurred by combining procedures is worth the potential for a change in the admission. This concern may be

particularly relevant when comparing 2 outpatient procedures to 1 longer inpatient procedure.

At our institution, we utilize a pre-admission testing system, where patients of higher acuity or complexity, are reviewed days to weeks before their scheduled procedure to determine whether additional testing is warranted; consultations with other specialties are required for medical optimization, or an upgrade in scheduled admission status is needed. While this system captures some combined procedures, most are identified by a surgeon or proceduralist requesting the evaluation of a medically challenging child. Thus, there are opportunities for improvement. One possibility would be to create a system to automatically capture combination cases and schedule admission status based on the length of scheduled procedure time and ASA status to decrease our unanticipated admissions.

CONCLUSIONS

These preliminary data demonstrate the feasibility of combining several procedures during a single anesthetic encounter even in patients with a higher ASA physical status. Although we achieved this outcome with no significant morbidity, it did increase the incidence of unplanned admissions. The success of this practice has been increased by the EMR, which identifies patients scheduled for another procedure when a new procedure is scheduled. The combining of procedures may not only decrease the cost related to hospital care but also costs due to parental time away from work or extended travel time to the hospital. While it is unclear if hospital outcomes are directly impacted, we feel the benefits mentioned above of a single anesthetic encounter make further investigation warranted.

DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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