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Original Article

Optimizing Anticonvulsant Administration for Children Before Anesthesia: A Quality Improvement Project



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ABSTRACT

OBJECTIVE: Children with epilepsy are at increased risk of missing scheduled anticonvulsants during the home-to-hospital transition, including when being admitted for procedures requiring anesthesia. This may contribute to breakthrough seizures because of lowered anticonvulsant levels. We conducted an interdisciplinary quality improvement project with a specific aim to increase the percentage of children receiving their anticonvulsants as scheduled before procedures requiring anesthesia. **METHODS:** The Institute for Health Care Improvement methodology was used to develop an interdisciplinary team and improve the process of ensuring administration of maintenance anticonvulsants. Successful components of the improvement project included focusing on the outcome for patients, standardization of medication administration when “nothing per os” before anesthesia and development of a contingency plan when children had not received anticonvulsants at home. **RESULTS:** The percentage of children receiving their anticonvulsants medications at home before procedures requiring anesthesia increased from 58 of 76 (76%) to 334 of 370 (90%) ($P = 0.002$). The number of children receiving maintenance anticonvulsant medications in the hospital before the procedure increased from 8 of 38 (21%) to 15 of 16 (91%) ($P < 0.001$). **CONCLUSION:** The use of established quality improvement methods improved the number of children receiving maintenance anticonvulsants during the home-to-hospital transition. The transition into the hospital for children with chronic illnesses includes a handoff between parents and medical staff. Future efforts to improve care during the home-to-hospital transition will require sustaining these gains and the involvement of parents.

Keywords: neurological disorders, quality improvement, epilepsy, anticonvulsants, pediatric, hospital care, transitions
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Introduction

The transition into the hospital is well established as a time when medication errors occur.^{1,2} Risk factors for medication errors include patient complexity and time-sensitive medicines.³⁻⁵ Children with epilepsy are in these categories. During the transition period, missed doses of anticonvulsants are

common.⁶⁻⁸ Patient reports and pharmacokinetic data suggest that missing even a single dose of anticonvulsants may contribute to seizure occurrence.⁹⁻¹¹ Nonadherence and lower levels of anticonvulsants contribute to seizures, status epilepticus, and mortality.¹²⁻¹⁷ Previous work supports that medication errors with missed administration precede seizure occurrence during the transition into the hospital.⁷

Breakthrough seizures and subsequent unplanned admissions after missed administration of regularly scheduled anticonvulsants during the transition into the hospital occurred at our institution. The consequences included recurrent seizures, a potentially preventable admission to the pediatric intensive care unit, and endotracheal intubation. Nationwide Children's Hospital (NCH) adapted the goal

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of eliminating all preventable harm by 2013.¹⁸ We undertook this project to improve the care of children with epilepsy as they transitioned into the hospital through our main surgical unit (SU). Quality improvement (QI) projects are exempt from Institutional Review Board approval in our institution.

Based on previous work and root cause analyses, we collected medication reconciliation sheets in real time over 5 days in 2011 and analyzed whether children had received anticonvulsant medications before procedures in the SU of the main operating room. Four of 12 children had not received their scheduled morning dose. Our initial findings led to a more comprehensive data collection and a hospital QI commitment including the formation of an interdisciplinary team to address this issue.

A team was established in June of 2012, and an additional baseline data collection began. Our specific aim was to increase the number of children receiving their regularly scheduled anticonvulsant before their outpatient procedure to 100%. Our primary balancing measure, to avoid negative consequences in changing our system, was to ensure that no procedure was canceled because of a nothing *per os* (NPO) violation involving anticonvulsant medications. In September of 2012, implementation of changes to improve the process began. This manuscript was prepared using the Standards for Quality Improvement Reporting Excellence guidelines for reporting of QI research.¹⁹

Methods

Setting

NCH is a 431-bed free-standing children's hospital in Columbus, Ohio. The pediatric neurology division has an active epilepsy program. The anesthesia service provides general anesthesia and sedation services for approximately 30,000 patients a year. Among these, roughly seven to 10 patients a week are receiving routine anticonvulsant medications for epilepsy.

Team membership

After identifying team leaders in anesthesiology and neurology, a process map was developed to identify other team members. The process map identified key steps and personnel involved in successful medical administration. Project team members included perioperative nursing, pharmacy, and QI personnel. This team then developed a key driver document (Fig 1). This was a living document modified over the course of the project. The method and results below correspond to our key drivers which are included as follows:

- (1) Parent execution of on-time anticonvulsant administration;
- (2) System awareness of consequences of missed doses of anticonvulsants; and
- (3) Contingency measures for anticonvulsant administration in the hospital.

QI methodology

QI projects at NCH are undertaken using the rapid cycle improvement methodology as described in the Improvement Guide by Langley and Provost and based on the Plan-Do-Study-Act (PDSA) cycles from the Institute for Health Care Improvement.²⁰

Parent execution of on-time anticonvulsant administration

Preanesthesia or SU nurses to educate parents on anticonvulsant administration before the day of surgery. This intervention was designed to improve the parents' awareness of the importance of, and assistance in

how to give, medications on the morning before procedure. In our hospital, preanesthesia nurses commonly perform parent teaching 3–7 days before a procedure. SU nurses make a reminder call the night before procedure. The initial test of this intervention was used with a single parent of a child with epilepsy scheduled to undergo magnetic resonance imaging (MRI) under anesthesia. The parent was given standard NPO instructions and medication administration goals. The parent was asked how she would attain these goals. The parent verbalized understanding but was unsure of what fluids constituted a clear liquid to give with medication. The parent then stated she would completely withhold medication fearing cancellation of the procedure. The parent was able to identify an appropriate plan for an anticonvulsant administration when given options for clear liquids, including a slurry of frozen apple juice. Nursing team leaders, based on this success, suggested that the preanesthesia nurses take responsibility for emphasizing medication administration at the same time as the NPO rules. Eventually, this responsibility was transitioned to SU nurses.

Simplification of medication restrictions before procedures. During the collection of baseline data, we simplified the approach for parents and nursing. We identified and focused on medications that should not be given before procedures under anesthesia. This list was short including Angiotensin Converting Enzymes inhibitors, angiotensin-II receptor blockers, diuretics, anticoagulants, and metformin. Anticonvulsant medications were not on this list.

Standardization of NPO procedures related to anticonvulsant administration for providers and parents

Standardization is a well-accepted method to improve quality.²⁰ Our process map identified that these families received information from three different groups including cardiology, MRI, and the preanesthesia unit. Our baseline data indicate missed anticonvulsant doses before procedures in all three groups. We discovered a lack of standardization in NPO and medication recommendations that were distributed to parents. In addition, both physician and nursing staff outside anesthesiology often misunderstood the need for anticonvulsant administration when NPO. Our goal was to develop a standardized approach to NPO instructions. All providers would give the same NPO instructions to all families before procedures with anesthesia.

System awareness of error and consequence

The following interventions, focusing on medical staff, were designed to improve awareness and consequences of failure to give anticonvulsant medications. During the period from June 2012 to March 2013, all cases of children who had not received anticonvulsant medication before arrival and were admitted to the hospital were reviewed by both of the project neurologists (C.J. and S.D.) to determine if a seizure was documented. If a seizure was present, a report was made using the voluntary electronic adverse event reporting system. Depending on the seriousness of the event, the safety team could escalate the response. The next step would be a "huddle," where the events would be reviewed with the individuals involved in the patient care, the error's consequences, and identify future prevention strategies. Team members were provided with a weekly stacked bar chart that identified the percentage of children receiving anticonvulsants appropriately (Fig 2). The team could see when the parents or hospital gave anticonvulsants before procedures. The reports were provided to all team leaders.

Multiple other approaches were used as well. Presentations in QI workshops and faculty meetings along with group e-mails to neurology, anesthesiology, and nursing staff focusing on both the existence of the problem and its consequences took place. When discussing consequences, the importance of modeling compliance to anticonvulsant administration to parents by medical personnel was stressed along with the potential for seizures and unplanned hospitalization.

Contingency measure—anticonvulsant administration in the hospital

The primary interventions were designed to improve anticonvulsant administration before arrival to the hospital. However, we decided to add to our primary outcome the contingency measure of giving medication in the hospital when not given by caregivers at home. This intervention

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