Brief Report

Pediatric Perioperative DNR Orders: A Case Series in a Children's Hospital

Sydney E.S. Brown, MD, PhD, Ryan M. Antiel, MD, MSME, Thane A. Blinman, MD, Susanna Shaw, MD, Mark D. Neuman, MD, MSc, and Chris Feudtner, MD, PhD, MPH

Department of Anesthesia and Critical Care (S.E.S.B., S.S., M.D.N.), University of Pennsylvania, Philadelphia, Pennsylvania; Department of Anesthesia and Critical Care (S.E.S.B., T.A.B., S.S.), Children's Hospital of Philadelphia, Philadelphia, Pennsylvania; Leonard Davis Institute of Health Economics (S.E.S.B., M.D.N.), Philadelphia, Pennsylvania; Center for Perioperative Outcomes Research and Transformation (S.E.S.B., M.D.N.), University of Pennsylvania, Philadelphia, Pennsylvania; Department of General Surgery (R.M.A.), Mayo Clinic, Rochester, Minnesota; and ; Pediatric Advanced Care Team (C.F.), Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, USA

Abstract

Context. Do-not-resuscitate (DNR) orders are common among children receiving palliative care, who may nevertheless benefit from surgery and other procedures. Although anesthesia, surgery, and pediatric guidelines recommend systematic reconsideration of DNR orders in the perioperative period, data regarding how clinicians evaluate and manage DNR orders in the perioperative period are limited.

Objectives. To evaluate perioperative management of DNR orders at a tertiary care children's hospital.

Methods. We reviewed electronic medical records for all children with DNR orders in place within 30 days of surgery at a tertiary care pediatric hospital from February 1, 2016, to August 1, 2017. Using standardized case report forms, we abstracted the following from physician notes: 1) patient/family wishes with respect to the DNR, 2) whether preoperative DNR orders were continued, modified, or suspended during the perioperative period, and 3) whether life-threatening events occurred in the perioperative period. Based on data from these reports, we created a process flow diagram regarding DNR order decision-making in the perioperative period.

Results. Twenty-three patients aged six days to 17 years had a DNR order in place within 30 days of 29 procedures. No documented systematic reconsideration took place for 41% of procedures. DNR orders were modified for two (7%) procedures and suspended for 15 (51%). Three children (13%) suffered life-threatening events. We identified four time points in the perioperative period where systematic reconsideration should be documented in the medical record, and identified recommended personnel involved and important discussion points at each time point.

Conclusion. Opportunities exist to improve how DNR orders are managed during the perioperative period. J Pain Symptom Manage 2019;57:971–979.

Key Words

Do-not-resuscitate orders, palliative care, palliative surgery, perioperative guideline adherence, end of Life

Introduction

Some pediatric patients living with serious illness who have do-not-resuscitate (DNR) orders may benefit from surgery or other procedures requiring anesthesia.[1,2] Because anesthesia care entails a risk of adverse events and commonly involves interventions used in resuscitation, such as intubation and mechanical ventilation, or use of vasoactive medications, deciding how DNR orders should be managed during surgery may create challenges for clinicians and patients or families.[3–5] Surgical, anesthesia, and pediatric guidelines recommend against blanket

Address correspondence to: Sydney E. S. Brown, MD, PhD, Department of Anesthesiology and Critical Care, Children's Hospital of Philadelphia 3401 Civic Center Blvd, Philadelphia, PA 19104, USA. E-mail: sydneyesbrown@gmail.com

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suspension of DNR orders before surgery and interventions requiring anesthesia, instead recommending reconsideration of DNR orders including a discussion regarding the likelihood of successful resuscitation in the operating room, documentation of acceptable interventions, and a timeline for reinstatement of DNR orders postoperatively.[1,6–8] Conversations should include a discussion regarding the relative success of resuscitation in the operating room compared with other locations, documentation of acceptable interventions, and a timeline for reinstatement of DNR orders postoperatively.[6–8] These conversations should include the physician who knows the patient/family best (an inpatient physician, primary care doctor, or specialist), the surgeon or proceduralist, and anesthesiologist.[1,2] Despite these recommendations, few data exist about whether, how, when, or by whom perioperative reconsideration of DNR orders actually happens.

To address this knowledge gap, we reviewed our experience at a large children's hospital among children with an active DNR within 30 days of surgery or procedure requiring anesthesia, from February 2016 to August 2017. Procedures included both open and laparoscopic surgical procedures completed in the operating room and less-invasive procedures requiring anesthesia, such as vascular access, imaging, paracentesis or thoracentesis, and radiation therapy many of which took place in an interventional radiology suite or elsewhere outside of an operating room. Current hospital policy does not require any specific perioperative management of DNR orders, such as mandatory suspension, instead encouraging perioperative decision-making that takes into account clinical and procedural circumstances.

After Children's Hospital of Philadelphia Institutional Review Board approval, systematic review of electronic medical records (EMRs) ascertained patient or family preferences with respect to DNR orders; whether perioperative reconsideration was documented and by whom; whether the DNR was continued, modified, or suspended during the procedure; duration of DNR suspension if applicable; and whether life-threatening events occurred during or after surgery. Data elements were entered into standardized case report forms by the lead author (S. E. S. B.). A second reviewer (S. S.) repeated the analysis independently, notes were compared, and discrepancies discussed until consensus reached. We used this information to inform a process flow diagram outlining important decision time points as well as personnel involved and decisions made at each time point.

Results

During the study period, 23 patients, aged six days to 17 years, had a DNR order in place within 30 days of 11 operating room and 18 nonoperating room procedures (e.g., vascular access, epidural placement for pain management, radiation therapy, imaging) requiring anesthesia. All procedures were nonemergent except one exploratory laparotomy. Six children (26%) had an advanced malignancy; four (17%) had end-stage complications from congenital disease; five (22%) had cerebral palsy with severe global developmental delay or hypoxic ischemic encephalopathy; two (9%) had major complications of prematurity; two (9%) congenital heart disease; and two (9%) were previously healthy children experiencing severe acute illnesses.

Patients presenting for interventional or diagnostic radiology procedures were less likely to have documented preprocedure reconsideration of DNR orders by any provider than those presenting for a surgical procedure or radiation therapy (23% vs. 88%, $P = 0.001$). DNR orders written by inpatient teams often permitted intubation for procedures (58%) or cardiopulmonary resuscitation (CPR) for reversible causes (25%); neither provision was associated with perioperative documentation of DNR reconsideration. Palliative care teams were consulted before 59% of procedures typically for end-of-life planning rather than perioperative decision-making. Consultation with palliative care was not associated perioperative documentation of DNR reconsideration ($P = 0.25$).

DNR Present in the EMRs Absent Documentation of Perioperative Decision-Making

Twelve patients (41%) presented for a procedure or anesthetic with an active DNR order in the EMRs but no documented plan for how resuscitation would be handled in the perioperative period (Table 1). These cases included seven procedures performed by interventional radiology (e.g., vascular access, epidural placement, paracentesis), three MRI studies, one palliative sternal closure, and one ventricular-atrial shunt. No adverse events were reported for these procedures. In nine cases, the presence of a DNR order was noted only in the patient's problem list as part of an Epic smartlink or not mentioned at all, leaving it unclear whether the surgical, interventional radiology, or anesthesia teams were aware that the patient had an active DNR order. In three cases, a DNR was noted to be present, but no plan documented. As DNR orders remained active in the EMRs for these patients during their procedure, the assumption would be that in the absence of written documentation to the contrary, the DNR order was continued through the procedure. Whether this was the intent of the patient/family or the involved providers is unclear.

DNR Order Modified or Suspended for Procedure Only

In two cases (7%), anesthesiologists modified DNR orders preoperatively based on discussion with the patient and family (Table 2); first, to permit resuscitation for reversible causes during anesthesia; in the second

Table 1
Perioperative DNR Management Not Clearly Documented

Age, Life-Threatening Conditions	Procedures	Reversible Cause Exception	Intubation Permitted	Palliative Care Consult	Preoperative Wishes	DNR Order Documented in Proceduralist/ Anesthesia Note, No Periop Plan	DNR Not Documented in Proceduralist/ Anesthesia Notes
16 yrs, Severe complications of prematurity, chronic respiratory failure[a]	Broviac placement (Interventional Radiology)	x	x	x	Intubation permitted for reversible causes	x	
	PICC (Interventional Radiology)	x	x	x		x	
11 months, CP, HIE	PICC, G-J exchange (Interventional Radiology)		x		Intubation permitted		x
11 months, Terminal malignancy	VA shunt	x	x		Intubation permitted for reversible causes and procedures		x
HIE following cardiac arrest during procedure to correct a congenital heart defect.	Sternal closure		x	x	No ECMO, patient already intubated		x
	PICC (Interventional Radiology)		x	x			x
Seven years, Terminal malignancy[a]	Port placement (Interventional Radiology)			x	DNR/DNI order, patient on hospice		x
	MRI (outpatient)			x			x
11 yrs, Congenital syndrome, multiorgan dysfunction	PICC, paracentesis (Interventional Radiology)		x	x	DNR/DNI, plan for hospital discharge to hospice		x
Six years, Terminal malignancy	MRI & epidural placement			x	DNR/DNI order, initiation of comfort care	x	
14 yrs, Neuroendocrine disorder	MRI				No intubation, mechanical ventilation, CPR		x
Nine years, Congenital syndrome, respiratory insufficiency, severe developmental delay	PICC, Bone marrow biopsy (Interventional Radiology)			x	DNR/DNI if parents present. If not present, want CPR and bag-valve mask until they can be reached to decide		x

PICC = peripherally inserted central catheter; CP = cerebral palsy; HIE = hypoxic ischemic encephalopathy; VA shunt = ventriculoatrial shunt; ECMO = extracorporeal membrane oxygenation; MRI = magnetic resonance imaging; DNI = do not intubate.
[a]Indicates patient appears for more than one procedure.

Table 2
DNR Modified or Suspended for Perioperative Period Only

Age, Life-Threatening Condition	Procedure	Team(s) Documenting Discussion of DNR With Family Before Surgery	Reversible Cause Exception	Intubation Permitted	Palliative Care Consult	Preoperative Wishes, OR Protocol Followed if Applicable
Modified						
[a]10 yrs, septic shock and multisystem organ failure following surgical complications in previously healthy child	Exploratory laparotomy, hemodialysis line placement	Anesthesia (Inpatient team and Surgery were present during discussion)	x	x		Preop: No compressions, defibrillations, or ECMO if patient has cardiac arrest, CPR only for reversible causes, patient already intubated
17 yrs, cerebral palsy, chronic respiratory failure, severe developmental delay	PICC (Interventional Radiology)	Anesthesia	x		x	Preop: Would want bag-valve mask initiated, but stopped if not effective, no intubation or CPR OR: Will correct issues related to anesthesia, DNR for catastrophic events. Patient intubated for procedure.
Suspended						
Six days, congenital syndrome	Myelomeningocele repair	Inpatient team Anesthesia				Preop: DNR/DNI, inpatient team noted that if patient survived surgery planned, no further escalation of care implying DNR would be reinstated after surgery OR: Code status suspended to a "reasonable" degree—Arrested postoperatively, received positive pressure ventilation without improvement, cessation of CPR
Seven weeks, terminal malignancy	VP shunt	Inpatient team Anesthesia			x	Preop: DNR/DNI, anesthesia note suggested DNR would be reinstated once the patient was out of anesthesia care OR: CPR performed briefly in the OR then stopped per parent request
Eight months, cyanotic cardiac disease	Thoracentesis (Interventional Radiology)	Anesthesia		x	x	Preop: No CPR/ECMO, escalating respiratory support permitted (On CPAP preoperatively) OR: DNR suspension documented by anesthesia note, DNR order remained active, implied reactivation once out of anesthesia care
17 yrs, connective tissue disease, chronic respiratory failure	MRI	Anesthesia		x		Preop: DNR for cardiac compressions and defibrillation (has tracheostomy and is ventilator dependent) OR: DNR suspension documented by anesthesia note, DNR order remained active, implied reactivation after out of anesthesia care
[a]11 yrs, terminal malignancy	Port placement (Surgery) Gastric tube	No discussion Anesthesia			x x	Preop: DNR/DNI, no IV lines or blood draws OR: DNR order deactivated in EMR for OR, later reactivated on return to ward for both procedures, no note written

DNI = do not intubate; ECMO = extracorporeal membrane oxygenation; CPR = cardiopulmonary resuscitation; PICC = peripherally inserted central catheter; OR = operating room; CPAP = continuous positive airway pressure; VP shunt = ventriculoperitoneal shunt; HIE = hypoxic ischemic encephalopathy; IV = intravenous; MRI = magnetic resonance imaging; EMR = electronic medical record.
[a]Indicates patient appears for more than one procedure.

Table 3
DNR Revoked Because of Change in Goals

Age, Life-Threatening Condition	Procedure	Team(s) Discussing DNR With Family Before Surgery	Reversible Cause Exception	Intubation Permitted	Palliative Care Consult	Previous DNR Wishes	Why DNR Revoked	Ultimate Disposition of Patient During That Hospitalization
Eight months, congenital cardiac disease, chronic lung disease, pHTN	Cardiac surgery	Inpatient team				DNR, no measures that cause suffering without substantial benefit; bag-valve mask permitted for desaturation, no cardiac compressions	To pursue aggressive care	Comfort care initiated two months after surgery
[a]10 yrs, surgical complications in previously healthy child	Bedside dressing change	Inpatient team	x			No compressions, defibrillation, ECMO, CPR only for reversible causes	Clinical improvement	DNR not reinstated
Three months, complications of prematurity	Ventriculojugular shunt	Inpatient team		x		Intubation permitted if preexisting endotracheal tube comes out, may provide positive pressure ventilation	To pursue aggressive care	Comfort care initiated one month after surgery
[a]11 months, Terminal malignancy	MRI	Inpatient team	x			DNR for irreversible causes only	Team felt it was impossible to distinguish between reversible/ irreversible causes and clinical improvement	Discharged to hospice
Four weeks, complications of prematurity, HIE	Gastric tube and Nissen fundoplication	Inpatient team Surgery	x	x	x	Intubation in OR permitted, no intubation for irreversible causes DNR revoked to pursue aggressive care	Surgery felt to be inconsistent with DNR	DNR not reinstated
10 days, congenital syndrome, brain infarctions, respiratory failure	Suspension laryngoscopy, bronchoscopy	Inpatient team Surgery				DNR. Do not reintubate if endotracheal tube becomes dislodged	Surgery felt to be inconsistent with DNR, family elected to pursue aggressive care	Comfort care initiated 3 months after surgery
Six weeks, congenital syndrome, respiratory failure, cardiac anomalies, pHTN	Gastric tube and tracheostomy	Inpatient team	x		x	DNR for cardiac arrest only, aggressive measures permitted for almost-arrest	To pursue aggressive care	Pneumothorax after surgery, CPR, chest tube placed, ROSC DNR not reinstated
12 yrs, terminal malignancy	Radiation therapy	Inpatient team		x	x	Intubation permitted	Clinical improvement	DNR not reinstated
Seven years, terminal malignancy	Radiation therapy	Inpatient team		x		Intubation permitted (already intubated)	Clinical improvement	DNR not reinstated

pHTN = pulmonary hypertension; CPR = cardiopulmonary resuscitation; MRI = magnetic resonance imaging; OR = operating room; HIE = hypoxic ischemic encephalopathy; ROSC = return of spontaneous circulation.
[a]Indicates patient appears for more than one procedure.

case, to withhold CPR if the patient had a cardiac arrest during the procedure if the anesthesiologist felt the cause was not reversible.

DNR orders were suspended immediately before anesthesia in six cases (21%) (Table 2), more commonly by the anesthesiologist (88%) than the inpatient team (25%). Duration of projected DNR suspension was never documented specifically; however, duration was suggested by 1) anesthesia or inpatient notes indicating that care would not be escalated further after surgery (specifics regarding what constituted "escalation" were not described) (2 cases); 2) anesthesia notes indicating DNR suspension for the procedure while an active DNR order remained in the EMRs, suggesting continuation of the order once the patient left anesthesia care (2 cases); and 3) the inpatient team canceled the DNR order before surgery in the EMRs and reinstated the order postoperatively, without written documenting regarding this decision (2 cases).

Two patients undergoing palliative procedures with suspended DNR orders died in the perioperative period. In both cases, preoperative documentation revealed extensive discussion involving anesthesia and the inpatient team regarding planned intraoperative resuscitative efforts. One patient suffered a cardiac arrest the morning after surgery. Positive pressure ventilation was initiated despite plans to avoid postoperative care escalation because providers noted that the DNR had been suspended because of surgery, and duration of DNR suspension had not been formally documented. Positive pressure ventilation was stopped without escalating CPR after unsuccessful attempts to contact the parents. In the second case, providers agreed preoperatively that should a catastrophic event take place intraoperatively, CPR would be initiated and the parents brought to the operating room to be with their child, at which point CPR would be stopped. When the patient arrested, this plan was carried out.

DNR Order Modified or Suspended Beyond the Perioperative Period

In nine cases (31%) (Table 3), the DNR was suspended several days before surgery. Reasons included 1) clinical improvement (five cases); 2) desire to pursue aggressive care (five cases); 3) procedures felt by the surgical team to be incompatible with a DNR order (three cases); 4) to pursue palliative radiation therapy (two cases); and 5) disagreement about the appropriateness of a DNR order (one case). In most cases, decision to rescind the DNR was made between the patient/family and the inpatient team. Surgical teams wrote notes describing their decision-making for two patients in whom they felt surgery was incompatible with having a DNR order.

Five of these patients survived to hospital discharge without having their DNR order reinstated, one of whom required CPR for a pneumothorax the night after surgery. The four remaining patients had their DNR orders reinstated weeks to months later with cessation of life-sustaining interventions.

DNR Order Perioperative Management Process Diagram

This analysis, combined with published statements regarding clinical practice recommendations, enabled us to create a process flow diagram outlining times in the perioperative period at which a discussion about goals of care and resuscitation may be appropriate and the personnel who should be involved in each discussion (Fig. 1). Four time points were identified:

A. When the DNR order is placed, the primary medical team should document the rationale behind clinical decision-making, patient/family goals, and specific interventions or interventions to be permitted or avoided. If the patient/family desires DNR suspension for all procedures requiring anesthesia, that can be documented, but does not replace the need to revisit the DNR if a specific procedure is desired because DNR orders are often placed weeks to months before a procedure, clinical considerations often change, and procedures vary in risk and clinical context.

B. When a surgery or procedure requiring anesthesia is being considered, the primary medical team, surgeon, and/or proceduralist should document whether the DNR remains appropriate given the clinical situation, whether modifications to the DNR should be made, and the duration of perioperative DNR suspension, if applicable. Anesthesia consultation should be sought to address concerns related to anesthetic technique or perioperative DNR continuation/suspension. Reconsideration of DNR orders at this time is necessary because patients may prefer to suspend elements of a DNR order temporarily (e.g., intubation) to have a procedure done safely that will enable them to accomplish longer-term goals (e.g., dying at home, relief of breathlessness caused by a pleural effusion). These decisions must be made on a case-by-case basis.

C. Immediately before the procedure, the anesthesiologist should document whether the DNR will be continued, modified, or suspended for the procedure itself. Anesthesiologist involvement

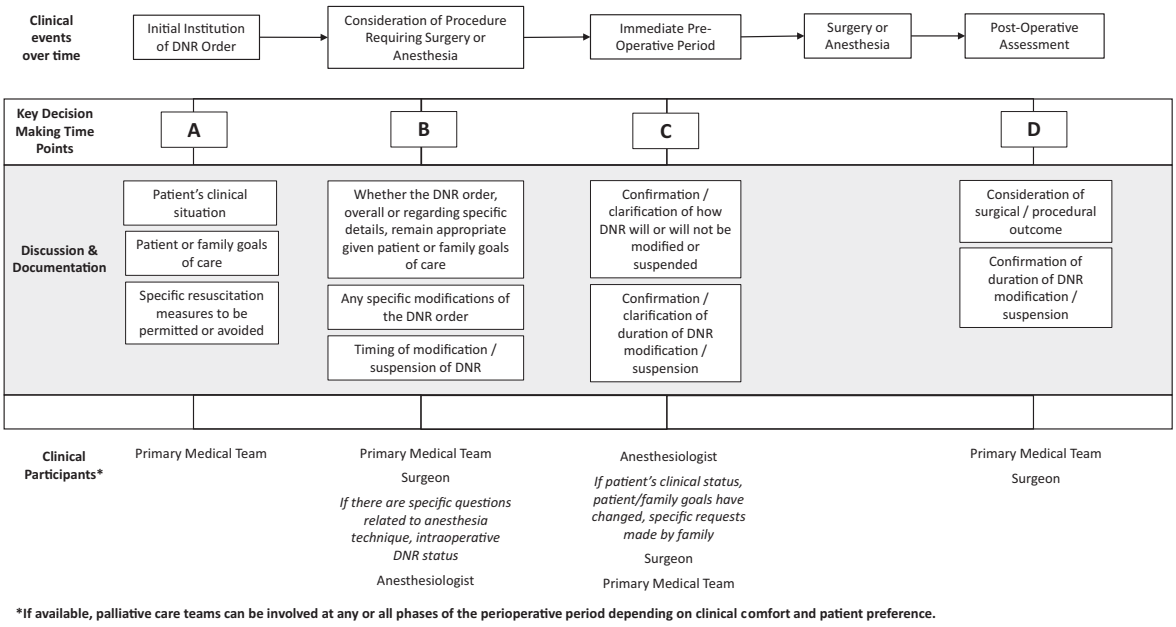

Fig. 1. Process flow diagram outlining key decision points and critical personnel for decision-making regarding DNR orders in the perioperative period. DNR = do not resuscitate.

in perioperative DNR decision-making is critical because emergency procedural resuscitation is managed by anesthesiologists, because anesthesia itself poses a risk to patients, and because many commonly used anesthesia interventions constitute "resuscitation." If concerns arise during the anesthesiologist's preoperative evaluation regarding the DNR order or particular patient/family requests, additional consultation with the primary medical team or surgeon could be warranted as well. Projected duration of DNR suspension or modification should be documented.

D. Finally, at the postoperative assessment, the surgeon or proceduralist and primary medical team should document whether DNR suspension or modification (if applicable) remains appropriate given surgical outcome and/or changes in goals of care. Time D can be revisited until the patient is no longer determined to be in the perioperative period.

Palliative care teams can provide decision support during each phase depending on clinical expertise and patient and family preference.

Consistent with recent recommendations, the model provides opportunity for shared decision-making that accommodates patient/family wishes about duration and timing of DNR suspension (if applicable) and acceptable interventions[1,6–8] in combination with the clinical judgment of care team members (primary medical team, palliative care, surgeon/proceduralist, and anesthesiologist) directly involved in the perioperative care of the patient. Important specific parameters, including the time points in the perioperative period when DNR orders should be reconsidered and decisions documented, and the personnel involved at each time point, were added to complement previous work, which has focused primarily on the content of perioperative decision making surrounding DNR orders. Although developed based on the experiences at one institution, these processes may be common to other children's hospitals, allowing this model to be used elsewhere, likely with some adaptation.

Discussion

Before discussing several implications of this study's findings, we should consider five principal limitations. First, as this review was conducted in a single institution, patient mix, processes of care, and clinical policies may differ elsewhere, prompting potentially different patterns of decision-making regarding perioperative management of DNR orders. Second, as data were obtained from the EMRs, we were only able to measure what clinicians documented, not the content of actual conversations or whether families were satisfied with their informed consent. Third, we were not able to thoroughly assess the many possible specific reasons why families, patients, and clinicians chose to revoke DNR orders in the perioperative period, although rationales were often present in clinicians' notes. Fourth, this analysis only included patients for whom a DNR order was documented in

the EMRs preoperatively. Some patients may present from home or a facility for a procedure with a DNR order in place that is not communicated to the care teams; such patients were not included in this analysis. Finally, patients who received procedural sedation without involvement of anesthesia services were not included in this analysis. Even with these limitations, though, several findings warrant discussion.

Absent Documentation Regarding Perioperative Decision-Making Surrounding DNR Orders

In this case series study from a single children's hospital, we found that notes documenting perioperative decision-making about resuscitation plans were absent for 41% of procedures, most commonly for procedures conducted in interventional or diagnostic radiology. Anesthesiologists and inpatient teams most commonly were responsible for suspending or modifying DNR orders. Documentation by surgeons and interventional radiologists was rare, consistent with other studies finding inconsistent documentation of goals of care by surgeons preoperatively.[9–12] Lack of documentation may be problematic because "low-risk" procedures still incur risk of adverse events, which increases with patient complexity,[13–15] and because undesired resuscitation is likely to be upsetting and confusing to families and patients.[5,16–20] In this case series, significant adverse events requiring CPR occurred in 10% of cases.

Duration of DNR Suspension or Modification

Although projected duration of DNR suspension was often implied by anesthesiology notes, it was often unclear whether resumption of the DNR immediately after surgery was something that either the inpatient or surgery teams agreed with. Failing to clarify when the DNR order will be reinstituted among all teams can result in misunderstanding among providers, frustration among parents, and have clinical consequences,[21,22] illustrated by one case we reviewed in which an infant whose DNR order been suspended for surgery received CPR postoperatively, and providers were uncertain how to proceed because it was unclear whether DNR suspension still applied.

Obligatory Suspension

In a few cases, a DNR order was suspended for an extended duration so that patients with end-stage illness could receive palliative cancer care (requiring repeated anesthetics) or surgery. Patients with life expectancies of weeks to months might still benefit from placement of central venous catheters, surgical management of pleural effusions, resection or debulking of tumor causing pain or other symptoms, receipt of palliative radiation, placement or revision of ventriculoperitoneal shunts, or operative orthopedic procedures for fractures.[7,23–27] Future investigations should examine whether DNR suspension is necessary or appropriate for all these patients or desired by families and whether more flexible policies can improve patient and family quality of life.

Conclusion

Examination of the perioperative management of DNR orders among children presenting for surgery and anesthesia highlights a consistent failure to document resuscitation plans preoperatively. Future quality improvement efforts may focus on the four identified decision points outlined in our process model and should explore institutional adherence to perioperative required reconsideration of DNR orders and whether institutional policies regarding perioperative DNR orders affect palliative surgical care offered to children living at the end stages of serious illness.

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