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Short Commentary

Optimal Complex Patient Transfers: NICU Graduation to PICU-Perspective and Process

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Abstract

Nighttime transfers of patients between different teams in medicine are considered high risk for medical error. Many institutions are implementing process improvement protocols to minimize this error. It is not uncommon for complex pediatric patients to be transferred from the Neonatal Intensive Care Unit (NICU) to the Pediatric Intensive care unit (PICU) during their hospitalization. Patients who transfer, "NICU graduates," have often had prolonged hospitalization. Typically, these patients are chronically critically ill. Despite the "perceived stability" of these "NICU graduates" transfer of patients from the NICU to the PICU can be fraught with problems and result in patient complications, family dissatisfaction and medical personnel frustration if not performed in a multifaceted, coordinated, multidisciplinary manner. Using a case example, we highlight some of the issues that can occur with these transfers and introduce a transfer process that can help to minimize handover related errors.

Keywords: Transfer; Handoffs; Communication; Neonatal intensive care; Pediatric critical care

Introduction

Baby boy B was born at 36 weeks gestation after a pregnancy complicated by anhydramnios and stage III lower urinary tract obstruction for which his mother underwent vesicoamniotic shunt placement at 24 weeks gestation. He was diagnosed with prune belly syndrome with urethral atresia and severe renal cystic dysplasia. His course was notable for severe pulmonary hypoplasia and pulmonary hypertension requiring high frequency mechanical ventilation, inhaled nitric oxide, surfactant, and inotropic support. He began peritoneal dialysis after placement of a dialysis catheter later followed by vesicostomy for urethral atresia. Over the first month of life, he showed significant improvement in his cardiopulmonary status. He was extubated, weaned off all inotropes and maintained on high flow nasal cannula 2 liters per minute with 21-25% FiO_2. At 6 weeks of age (42 weeks corrected gestational age), he was approaching readiness for transfer to the PICU.

There was an unexpected demand for NICU beds and given his relative stability; he was urgently transferred to the PICU on a Friday evening. His initial PICU course was complicated by missed peritoneal dialysis cycles and altered timelines in his medication administration regimen. His family endorsed frustration in the urgency of transfer, loss of known team member relationships and uncertainty of future clinical trajectory. There is a paucity of information in the literature regarding the impact of patient and family transition from the NICU to the PICU especially during urgent need or night-time hours. This case report and review serves to highlight a number of the predictable concerns surrounding such transfers that may be mitigated with stepwise care coordination.

Background

The Neonatal Intensive Care Unit (NICU) and Pediatric Intensive Care Unit (PICU) share similar capabilities to provide care to critically ill infants. Typically, the NICU team cares for premature babies and neonates that have not yet left the hospital. PICU team often directly admit neonates and infants that require intensive care after they have been discharged home and are accustomed to caring for the older "ex-premie" population. There is clearly an overlap in their capacity to care for critically ill infants, and there are often discussions about optimal transition of such patients. There is wide variation from center to center on exact timing and criteria for transfer from NICU to PICU with some starting as early as 48 weeks corrected gestational age and others not until 1 year of age. This remains an area of opportunity for standardization. Discussions typically occur when infants age out of typical NICU criteria and ongoing care needs can be met by a pediatric intensivist and PICU team. Often the patients that are appropriate for transfer have been in the hospital for more than a month and are expected to require at least an additional two weeks of intensive care prior to discharge home. These infants are often technology dependent and have multiple subspecialists guiding their care. Though they remain critically ill, they have transitioned from an acute life-threatening status to a more "chronically critically ill" status. Such patients are viewed as some of the more "stable", though medically complex, infants in the NICU. Due to this perceived "stability," these chronically critically ill NICU patients are often the first patients to be considered for transfer when there is an acute decrease in NICU admission capacity. Often the acute need for NICU bed capacity arises during the middle of the night, with unexpected admissions, or with changes in acuity of other patients with limited bedside staffing. Despite the "perceived stability" of these "NICU graduates" transfer of patients from the NICU to the PICU can be fraught with problems and result in patient complications, family dissatisfaction and medical personnel frustration if not performed in a multifaceted, coordinated, multidisciplinary manner. Baby Boy B's story highlights specific areas of vulnerability in NICU to PICU transfers, provides support for avoiding such nighttime transfers; and if still required, encourages additional vigilance in the transfer process.

Handovers

In general, handovers and transitions in care are times of increased risk for patients. Changes in staffing models and work hour restrictions for house staff have required more care team transitions and patient care handoffs [1]. There is expanding research demonstrating that handovers increase vulnerability for error. A 23,000 patient retrospective cohort study published in 2015 showed increased mortality rate (2.68% vs 2.08%, P=0.007) in adult patients with transitions in care team (end of rotation transition) compared to those in a control group that did not have a care team transition [2]. Care team transitions have been cited as leading contributing factors in sentinel events by the Joint Commission [3]. With increasing attention on the role miscommunication plays in these transitions in care, a great deal of effort has gone into trying to make the handoff process less error prone. An area of active quality improvement and research is in the arena of standardized handoffs. There is data supporting the premise that standardization of handoffs significantly reduces error and preventable adverse events [4]. While not completely obliviating associated risk, standardization has attenuated such risk to ensure safer transfer.

Nighttime Transfers

When a patient meets criteria for transfer, during the daytime hours, the transfer process is initiated. In contrast, nocturnal ICU transfers are often based on the intensive care units needs rather than the needs of the patient. This is true of adult, pediatric and neonatal night-time ICU to ICU transfers. ICU beds are limited. Whether due to staffing shortages or new admissions, ICU bed utilization favors moving a less critically ill patient in order to care for a more acutely ill patient. Transfer from an adult ICU at night has been shown to be associated with increased mortality compared with those transferred during the day. A large multiple-center, retrospective observational cohort study demonstrated that even after adjustment for illness severity, source, case-mix, gender, and hospital size, mortality was increased 1.22 fold when transfer occurred at night [5].

Patient Complexity

Children with medical complexity are a rapidly growing population [6]. The majority of NICU patients would be considered medically complex when they are transitioned out of the NICU to the PICU. It has been shown that medically complex patients have increased vulnerability to medical error. A study published in Pediatrics showed that children with defined "special medical needs or who were technology dependent" had significantly higher rates of hospital-reported medical errors [7]. Additionally, these patients have been shown to be at higher risk of medication errors [8]. Finally, medically complex patients benefit from a multifaceted coordinated team to provide care without gaps. This has led some hospitals to designate a separate multidisciplinary chronic care team, to ensure family-centered, coordinated, efficient care [9]. Often in addition to being medically complex, NICU patients are also medically fragile. There are no standard protocols to follow that delineate their disease process, but rather their care plan has been forged over days of tiny titrations of feeds and ventilator settings. Many medically complex patients require medications at unusual doses or for "off label" reasons and therefore assumptions about dosing or indications can lead to mismanagement without

specific attention to these details [10]. Small deviations from the way care was delivered in the NICU can be more impactful due to this fragility.

Family experience

Having a critically ill child is undoubtedly a stressful experience. A significant aspect of the care of the patient revolves around caring for the family and optimizing the family centered approach. Admission to the NICU or PICU is generally due to a sudden, unexpected, life-threatening event and may be surrounded by uncertain prognosis. The care team present during the acute traumas that occur with critical illness are intrinsic to the family's experience. Over the course of a prolonged NICU admission, families become familiar with NICU routines and develop relationships with the care teams, enabling an understanding of specific areas of concern and effective methods of communication. Poor preparation for transfer of care or NICU graduation are a clear source of parental stress. The loss of the familiar provoked apprehension in terms of the future clinical course of their child, eroded therapeutic trust, and escalated concern with regards to the competency of the new care team that was accentuated with even minor changes in changes in medical regimen [11]. While NICUs and PICUs care scope overlaps, the routines of these units are distinct, and the "survivors' bond" cannot be established quickly with a new team.

Applying the evidence

We have cited an association of increased adult mortality with night-time transfers and with transition in care, associated communication and medical errors especially in the medically complex patient and increased parental anxiety with unplanned patient transfers. While these studies and reviews are not performed in our specific NICU to PICU transfer population, we believe that the concerns are universally applicable. Based on these concerns our institution has instituted a staged, coordinated, multidisciplinary family centered transfer protocol to mitigate these risks (Figure 1 and Table 1). This protocol was developed in a response to the issues that surrounded the transfer of Baby boy B.

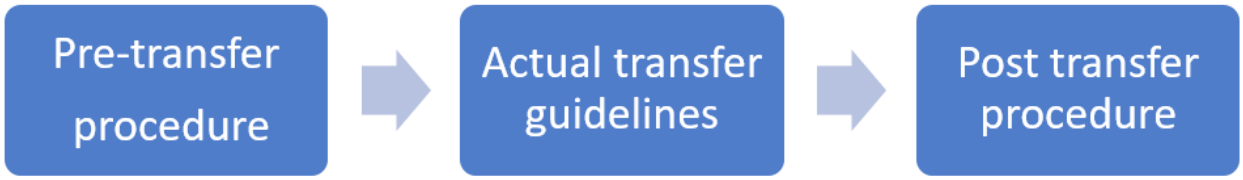

Figure 1: Schematic of NICU to PICU transfer process.

Stage	Timeframe	Steps and guidelines	Participants
Pre-transfer	Day prior to transfer	Parental tour of the unit	Parents/charge RNs
		Handovers at all levels to ensure transitions without gaps	Resident to resident Attending/fellow to attending/fellow RN to RN RT to RT SW to SW Dietician to Dietician Pharmacist to Pharmacist
		Joint rounds in the NICU with the PICU team attending (phone or in person)	NICU team PICU attending, fellow (resident optional)
		Staffing commitment for nurses on the day of transfer and onward to avoid bounce backs	Nurse managers

Transfer	Transfer day	Planned transfer during midweek, day time hours	
		Formal bedside handover	Parents NICU (resident/attending) PICU (resident/attending)
		Order review and sign off	NICU resident PICU resident
Post-transfer	Day after transfer	Joint rounds in the PICU with the NICU team attending (phone or in-person)	NICU attending PICU team

Table 1: NICU to PICU transfer process.

Moreover, this was presented to PICU and NICU team members and hospital leadership to ensure buy-in and compliance and is now part of our standard transfer procedure. While urgent transfers may still be required, engaging in elements outlined and implementing shared follow up rounding has helped to mitigate risks in this transfer process and has improved verbalized family satisfaction. We understand that at times it will not be possible to have this degree of coordination, but every effort will be made to avoid nighttime transfers and if they occur than due diligence to ensure that the steps that were skipped in the process are addressed by the team the next day is essential.

Conclusion

Transfers of patients between units and teams in the hospital is a time of increased risk for medical error. The complexity of NICU patients (long stay, medically fragile, technology dependent) adds to the risk of error. We advocate for avoiding night transfers and implementing a staged, standardized process when transferring "NICU graduates" to the PICU. Timing of transfer (age, medical stability) and best practice methods for handovers are still areas in need of further study.

Conflict of Interest: The authors declare no competing financial interests related to the work described.

Consent for Publication: Parental consent was obtained for the case presentation.

Author Contributions

AB conceptualized the paper, performed literature search, drafted the manuscript and approved the final version. EO performed literature search, helped to write the manuscript and approved the final version. AS led the construction and implementation the transfer framework at our institution. AS also conceptualized the paper, performed literature search, helped to write the manuscript, and approved the final version.

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