TITLE: An observational study using video recordings to explore the first hour after admission to a Neonatal Intensive Care Unit (NICU)

Running title: Admission to the NICU

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An observational study using video recordings to explore the first hour after admission to a Neonatal Intensive Care Unit (NICU)

ABSTRACT

AIM To explore the admission process to our Neonatal Intensive Care Unit.

METHODS A first phase quality improvement initiative was conducted. We utilised observational video recording of a convenience sample of inborn admissions. Two remote GoPro cameras were placed, one giving an overview of activity and the other focussed on the infant. Recordings captured the first hour after admission including transfer to the NICU by the birthing team. The video footage of each case study was reviewed by a multidisciplinary panel using an agreed semi quantitative analysis of events.

RESULTS Ten admissions to the NICU were video recorded between June and October 2018. Gestational age 28[2]- 40[1]. A focus on maintaining airway support was inconsistent as was the ability to provide continuous monitoring of vital signs. Overall leadership of the process was lacking, and handover often appeared fragmented. Median temperature on admission was 36[2] (35[4]-37[3]) °C. Vascular access and fluid management occurred at a median of 36 (13 – 67) minutes.

CONCLUSIONS Planning and approval for this study was protracted, particularly negotiating the use of video recording. Anecdotally, this delay is thought to have contributed to an improvement in managing admissions, particularly when maintaining airway support and monitoring. However, our baseline data has highlighted a lack of leadership, fragmented handover, low admission temperatures and broad time frames to achieve vascular access. A guideline to streamline handover and nursery transition is currently being implemented, a subsequent evaluation cycle is planned.

KEY WORDS: Neonatal Intensive Care, Quality Improvement, Video Recording, Admission Process

98 **INTRODUCTION**

The term “Golden Hour” has been coined to reflect the initial resuscitation and admission to the neonatal intensive care nursery. [1] Several studies demonstrate that respiratory support, thermoregulation, and vascular access are important factors associated with stabilizing a neonate during *the golden hour*. [2] The quality of care during the golden hour has been shown to have significant impact on the neonates’ immediate wellbeing and long-term outcomes .[3] Golden Hour checklists or bundles emphasising a smooth transition from birthing suite or theatre and admission to the NICU have been developed both internationally and within Australia.[4,5 ,6,7]

Immediate resuscitation is regularly reviewed by the International Liaison Committee on Resuscitation (ILCOR)[8] and the American Academy of Pediatrics and the American Heart Foundation have developed a formal training program (NRP®) to disseminate guidelines. [9] Similarly, the Australian Resuscitation Council represents professional groups and devises guidelines for teaching and practice of resuscitation[10]. Guidelines governing neonatal resuscitation require teams at high-risk birth to be proficient in leadership, communication, problem solving and procedural competence in order to achieve optimal outcomes for high-risk neonates .[1] It is essential that this process continues during transfer and admission to the NICU . A logical approach is to continue the principles of resuscitation management during the admission process by adopting a team approach to prioritise treatment and stabilise the neonate’s condition. Health professionals have discrete roles during the admission of a neonate to the NICU. Levels of experience differs between staff therefore leadership and effective communication aligned with resuscitation guidelines will facilitate optimal outcomes. Previous studies report inconsistent poorly prioritised processes contribute to hypothermia, hypoglycemia, and stress to the neonate. [5]

We perceived we had a problem with admission processes in our unit, incidental tasks such as weight and blood pressure appeared to be taking precedence over security of airway and effective monitoring. There was no clear guideline and a perceived lack of leadership. We convened a team

to investigate the process as a quality improvement (QI) initiative as a similar approach has proven effective in other centers .[2,5,6] We chose to obtain baseline data by video recording a series of admissions to the NICU. The following specific objectives were developed.

1. Document the current admission process for the first hour post admission to establish how nursing and medical staff prioritise interventions when stabilising the neonate.

2. Provide an insight into role behavior / teamwork during the admission process

3. Document the approach to handover from the birthing suite/operating room team to the NICU admission team.

4. Ascertain the timing of variables associated with care, during the admission process. (Monitoring of vital signs, admission wrapping, attention to thermoregulation, respiratory support (endotracheal tube / nasal prong site position and security), blood analysis and vascular access, timing of fluid administration, medications administered, X-ray as ordered)

This report details the process of data collection and an initial analysis of the data. We are in the process of closing the QI loop.

METHODS

Research Design, Setting, Participants, Data Collection & analysis

This prospective observational study utilised observational video recordings of a convenience sample of inborn admissions in a 92-bed (30 NICU) tertiary referral setting. A random and convenient selection process of neonates admitted to the NICU was undertaken. Inclusion and exclusion criteria were applied to this process with only routine, uncomplicated and planned admissions chosen to be recorded. A sample of 10 admissions provided a snapshot of baseline data surrounding the admission process during the first hour in the NICU.

Participants included the preterm neonate, their parents, nursing, and medical staff present during the first hour of admission. In addition, allied health care professionals such as radiographers

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were included. Routine care was given to all neonates participating and approach to treatment was not altered.

Two remote GoPro cameras were placed, one giving an overview of activity and the other focussed on the infant. The cameras were placed in advance of an expected admission and were controlled remotely. Although staff were aware that recordings would be made during the period of study, they were not aware of which cases would be recorded. Recordings captured the first hour of life and were archived under a study number. The captured footage was independently reviewed by 2-3 members of the multidisciplinary research team conducting the study. A previously agreed semi quantitative analysis of events was used to document each individual admission. The specific audit tool captured information about the timing and type of each intervention. Timings for previously determined interventions were entered into excel spread sheets for further analysis. The collated information from video recordings informed a discursive approach to derive recommendations for improving the admission process.

Ethics

This study was approved by the Human Research Ethics Committee and Research Governance Systems Western Australia (RGS0000000765). Consent from staff was obtained prospectively and parents retrospectively. Signed hard copy consent forms have been archived in locked cabinets. Video footage is considered a research record and has been electronically archived on a password protected hospital server. These methods of storage comply with the Australian Government National Health and Medical Research Council guidelines (NHMRC).[12]

RESULTS

Ten admissions to the NICU were video recorded between June and October 2018. Gestational age range 28[2]-40[1], birthweight 1140 -3350 gms. One infant was intubated receiving intermittent positive pressure support (IPPV), and 9 continuous positive airway pressure (CPAP) support by mask,

one of these subsequently required endotracheal intubation and administration of surfactant soon after admission. Interventions occurring during the admission process are listed in table 1.

In general, the case studies demonstrated an admission process that was effective in concentrating on airway support and monitoring. However, in three cases a significant delay in providing optimal respiratory support was noted. One due to monitoring equipment failure. A second study revealed a delay of 2.5 mins with application of CPAP support due to a process of weighing, initial observations and photographs being obtained. There was no apparent leadership in this case study. The vision captured marked signs of respiratory distress with recession and audible grunting. Another case study required an escalation in respiratory support to intubation and ventilation. Leadership was evident and preparation of equipment occurred quickly at 3:37 minutes the airway was supported with mask IPPV and the procedure occurred at 10:42 minutes after arrival. Surfactant was administered 14:50 minutes after admission. Whilst timings maybe considered protracted in this instance the neonate was stable and a decision was made to collect the intubation camera for teaching purposes.

A major deficit was noted in handover. The approach was poorly focussed and fragmented with snippets of information shared between several team members. However, a single focused handover occurred on two occasions (20%). Cross checking neonatal and maternal unique identifier numbers occurred in 4 admissions (40%). In general, leadership and identification of priorities for each case study was lacking. There was fragmentation into medical and nursing teams who communicated well within team but failed to communicate as a whole group. Priorities differed with medical staff focussed on setting up for venous access whereas nursing staff completed weight and observations. Where seen a physical assessment occurred between 1:20 – 45 minutes.

Venous access appeared prioritised in all cases, allowing early point of care blood gas analysis and plasma glucose (PGL) readings. However, some delays occurred due to technical problems or the inability to place a peripheral intravenous cannula (PIVC). Umbilical catheterization occurred in 2

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cases. In one case secondary to failed PIVC attempts. The administration of intravenous fluids was achieved at a median of 36 (13 – 67) minutes.

Regarding thermal care, all neonates were transferred from the birthing area to the NICU on a pre-warmed resuscitaire with provision for overhead radiant heat, however the delivery of heat was interrupted whilst disconnected from a power source. It has not been routine practice to re-connect to an external power source on arrival in the NICU. Our current practice of wrapping neonates less than 32 weeks gestation in plastic sheeting (Neowrap™) prior to transfer to the NICU was observed in all admissions less than 33 weeks. In addition, seven infants had placement of overlying prewarmed blankets and application of knitted bonnets. Admission temperature, recorded at a median time of 4.57 minutes with the median temperature 36[2] (35[4]-37[3]) ^{o}C which may be reflective of a combination of factors including ambient temperature of delivery suites and theatre, provision of non-humidified/heated inspired gases and time taken for admission in relation to distance from delivery areas to NICU.

Measures of infection prevention were observed in all admissions, with the majority, but not all staff members donning gloves prior to patient handling. Vascular access occurred for all admissions and all adhered to guidelines with the use of dedicated procedure trolley, sterile pack, and gloves. Accurate assessment of adherence to an Aseptic No Touch Technique in establishing vascular access and connection of IV fluids was observed as challenging with the video material captured. However, the procedures appeared to be less compliant as the number of attempts to gain vascular access increased. On the one occasion when the insertion of the central catheter was viewed, the sterile filed was maintained and fluid administration was deemed appropriate. All appropriate infection prevention measures were noted during the single intubation occasion.

Parents were well received and acknowledged in all cases. They were congratulated and staff explained the processes that were occurring and what would take place.

DISCUSSION

Despite a small sample of admissions to the NICU we have been able to identify areas for improvement in our admission process. This video analysis was used for routine admissions and complex cases were excluded however the baseline knowledge will aid in a focus of leadership, guideline development and education to enhance all admission processes in our NICU.

To our knowledge there have been no previous reports of video recordings used to assess the admission processes in the NICU however previous recordings of neonatal resuscitation have been used for developing teamwork and improving clinical practice through feedback evaluation and informing education. [14,15] Our experience with using the video footage of these admissions to recommend changes and inform practice improvement aligns with those using recordings to improve neonatal resuscitation. [12,13,14,15] Gaining ethical approval to conduct this study was a first for this tertiary unit. We hope this provides a benchmark to use video recordings in the future for cycles of quality improvement or management within the NICU.

The ethics approval process for video recording was protracted taking 9 months before final approval was granted. During this time, the concerns about our admission process were freely discussed within the unit and we suspect that a change in attitudes to admissions were already occurring by the time the study commenced. Despite this the use of video footage to capture these case studies identified several areas where the admission process could be improved. Deidentified clips from the studies also provided a rich source of teaching material to illustrate the necessary improvements.

The need for team leadership surrounding our admission procedures was perceived as vital to prioritise care and achieve timely outcomes. This mimics the work that has been

done around neonatal resuscitation. [12,13,14,15] Previous studies have discussed the necessity for the leader to bring together the team, have 'situational awareness' and provide guidance for the team. [14] Team members need to know their specific role in order to enhance the process. [16]

Incentives to provide direction and maintain focus for all staff involved is an important factor. Similar studies have shown adopting checklists and targeting improvement for the first 60 minutes of life from birth to admission to the NICU has been successful in preventing any cascades of events that lead to increased morbidity and mortality. [4, 17] Whilst we have not adopted a checklist approach, we have developed a targeted new guideline with specific interventions to assist the team leader and staff to prioritise safe optimal care using communication and teamwork. As an adjunct to the written guideline a 'Take 5' presentation has been developed and posted to provide quick and focussed education for all staff. 'Take 5' presentations are able to engage staff by providing educational material that is easily accessible. [18] Similarly, situational point of care education is being implemented to support staff during the change of practice surrounding admissions.

Handover in our setting follows the ISOBAR format. [19] Adopting the stop look and listen approach will require a change in culture. Transfer of information that is relevant (antenatal / prenatal history) and current situation (resuscitation) is essential to determine and prioritise care. Similarly, within our setting identification of the neonate cross checked with maternal unique identifiers is necessary. Handover needs to occur once, with all relevant staff paying attention adopting a *stop,look and listen* approach . The team leader should determine the timeliness of the handover according to the condition of the neonate being admitted and other competing priorities.

It is essential to prioritise care with any newborn. Our neonates are transferred from the birthing suite resuscitaire to the admission bed, they are usually stable and appropriately monitored on the transfer cot and moving to a definitive cot is not usually a priority Maintaining an airway is essential and requires a hands-on approach along with continuous monitoring of saturation levels and heart rate. However, in our study we noted that some staff delay essential tasks such as intubation or applying necessary respiratory support to perform less essential tasks. Our multidisciplinary review team attempted to identify and prioritise these less-essential tasks. We finally agreed that the process of events such as performing a weight or non-invasive blood pressure should be deemed timely by the designated leader depending on the situation at hand. Therefore, when developing the guideline these tasks were not forgotten but considered additional steps.

The importance of thermal care during the stages of resuscitation transfer and admission to the NICU are not be underestimated. All admissions were transferred on preheated resuscitaires without battery packs, warmth was maintained with prewarmed blankets, hats and plastic wraps. The range of admission temperatures varied with some less than optimal. The multidisciplinary review team highlighted that it was not common practice to attach the transport resuscitaire to a power source on arrival in the NICU. The lack of an overhead heater may have contributed to the low admission temperatures. Our new guidelines now include providing power to the resuscitaire, particularly where transfer to the admission bed is likely to be delayed.

Parents are invited to accompany their newborn to the NICU to avoid parental separation which is known to have negative effects on the physical and emotional wellbeing of both parent and baby. [20] Being able to accompany their neonate to the NICU could help

reduce stress levels. In our video footage all parents were welcomed and congratulated. In addition, the condition of the neonate was discussed as was a plan for further management during their stay in the NICU. Photos were taken for the mother to view especially if she was unable to visit in the immediate future.

CONCLUSION

Our baseline data highlighted the need to improve leadership of the admission process and to streamline the handover. Similarly, leadership is required to prioritise the needs of each induvial infant during admission. Our observational study also highlighted deficiencies around the verbal handover of care from the resuscitation tem to the admission team. This data has been used to develop a targeted guideline for handover and transition to the neonatal nursery, this is currently being implemented. To complete this QI cycle, we intend to measure the effectiveness of implementing the new guideline by repeating an observational video study to complete the quality cycle.

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