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Improving compliance with AAP recommendations: Sedation for non-emergent neonatal intubations

***Corresponding Author(s): Bridget K Cunningham,**

Department of Neonatology, Walter Reed National, Military Medical Center, Bethesda, USA,

Email: bridget.k.cunningham.mil@mail.mil

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Abstract

Objective: In 2010, the American Academy of Pediatrics (AAP) published guidance that premedication should be used for all new born intubations except emergent events. We aimed to use a multi disciplinary approach to improve Walter Reed National Military Medical Center Neonatal Intensive Care Unit (WRNMMC NICU) compliance for none-mergent intubations to greater than 80% by May 1, 2014.

Study Design: A quality improvement project was conducted and reviewed retrospectively under IRB approval. Pre-intervention records were reviewed for a 12-month period for all infants admitted to WRNMMC NICU who underwent intubation. Post multi disciplinary intervention, records were reviewed over an 11-month period.

Result: Pre-intervention, 65 non-emergent intubations were performed in the WRNNMC NICU, 55% (36/65) received some form of sedation. Overall compliance with guideline-recommended medications was 58%. Post-intervention, 83% (60/72) of non-emergent intubations were performed with sedation. Medication compliance improved to 88% (53/60).

Conclusion: Our multi disciplinary approach enabled marked improvement in compliance with AAP guidelines

Background

Crucial to decrease the pain and discomfort associated with the procedure, to facilitate intubation, and to decrease adverse reactions. In neonates the adverse physiologic effects of awake laryngoscopy and intubation include airway trauma, laryngospasm, bronchospasm, hypertension, bradycardia, hypoxemia and increased intraocular pressure [1-7]. In the vigorous infant the muscular efforts to resist laryngoscopy, and attempts to cry, are accompanied by an increase in intrathoracic pressure, which may impair venous return from the brain. This alteration in cerebral blood flow can predispose to interventricular hemorrhage [3,4,8-9]. Several studies have shown an attenuated physiologic response when appropriate sedation is used [2,4,8-9].

In children and adults, tracheal intubation is performed under adequate anesthesia even in emergent situations. Common regimens include a combination of a central analgesic, a sedative, and a neuromuscular blocker. Premedication is considered.

Other benefits to premedication include an overall improvement in operator success [10-12]. Many failed attempts can be attributed to suboptimal intubating conditions and lack of provider experience. Given the current practices of noninvasive ventilation, resident duty hour restrictions and management of neonates born through meconium stained fluid, trainees are less experienced and therefore are having more difficulty intubating in both emergent and non-emergent situ-

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ations [10,15]. In 2013 Haubner et al. found that less than 50% of delivery room intubations are successful. The most common overall reasons for failure were patient decompensation.

Intubation (19%) [13]. O'Donnell et al. showed in 2006 that successful intubations frequently require more than one attempt and are rarely accomplished within the currently recommended time frame per the Neonatal Resuscitation Program (NRP) © of less than twenty seconds [14]. Further more, in 2014 Le showed that premedication improves success rates across all training and experience levels [10].

In neonates no consensus exists regarding the optimal drug or drug combination for intubation. In 2010 the American Academy of Pediatrics (AAP) published guidance stating that premedication should be used for all newborns except for emergent intubation during resuscitation either in the delivery room or after acute deterioration at a later age. Use of analgesics or an anesthetic dose of a hypnotic should be given, the use of vagolytics or rapid onset muscle relaxants should be considered, and the use of sedatives alone such as benzodiazepines without analgesia should be avoided [9].

Despite the above evidence and AAP guidance, multiple surveys show that the implementation of these guidelines is highly heterogeneous [17-20]. Observational studies in Neonatal Intensive Care Units (NICUs) around the world have shown varying rates from 38 to 94% [17-20]. During 2012-2013 Walter Reed National Military Medical Center Neonatal Intensive Care Unit (WRNMMC NICU) used sedation in 55% of infants who underwent non-emergent intubation. Of those who did receive some premedication, the drug selection was compliant with AAP guidance only 58% of the time.

We hypothesize that factors associated with avoidance of premedication include unfamiliarity with the AAP statement, an existing culture of sedation avoidance and concern for adverse medication reactions to include respiratory depression, chest wall rigidity and inability to extubate after the INSURE technique [21].

We conducted a quality improvement project at Walter Reed National Military Medical Center (WRNMMC) using a combined approach of a new Electronic Medical Record (EMR) documentation tool with regular classroom based multi-disciplinary educational sessions for physician and nursing staff to improve our NICU compliance with current AAP recommendations to greater than 80% for both overall use of sedation and appropriate medication selection by May 1, 2014. A secondary goal of the project was to improve trainee education about types of and indications for sedation. We hypothesized that appropriate analgesia will improve operator success with fewer attempts required to successfully intubate, thereby impacting the overall learner experience and educational opportunity.

Materials and Methods

To better understand the impact of our quality improvement project we conducted an IRB approved retrospective chart review. The pre-intervention time period was defined as Jan 1, 2012 through Jan 1, 2013. Medical records from this time period were reviewed to determine existing compliance rates and find possible barriers to improvement. Our root cause analysis revealed several areas that were likely contributing to the under use of premedication. Specifically there was a lack of knowledge regarding the AAP guidance and recommendations published in 2010. Further more there was controversy regarding what constitutes a non-emergent intubation verse an emergent procedure. Additionally we found that several providers were avoiding premedication due to potential adverse effects such as respiratory depression, chest wall rigidity and inability to rapidly extubate after surfactant administration.

Our combined interventional approach was implemented in November 2013. The educational sessions were classroom based and given to both physician and nursing staff. We defined emergent intubations as those occurring in the delivery room or during an acute decompensation categorized by significant bradycardia and inability to stabilize with Bag Mask Ventilation (BMV). We reviewed AAP guidance and recent literature advocating for the use of sedation and its impact on operator success. We used the Cormack-Lehane airway scale [22] to educate trainees on proper procedural technique and methods to improve their view of the vocal cords during direct laryngoscopy. The educational sessions were held every 3 to 4 months during the post-invention period defined as November 2013 through October 2014. During each session we presented our current compliance with AAP guidelines in the WRNMMC NICU, comparing both pre and post-intervention data.

The new Electronic Medical Record (EMR) tool included a section for anesthesia provided and procedural details (Supplementary Figure. 1). The drop down medication menu includes analgesia, sedative, hypnotic/dissociative, vagolytic, and muscle relaxant medications. The EMR requires the provider to enter the drug dose in addition to the indication, or purpose of use, thereby reinforcing to trainees the mechanism of action for each drug. Also included are procedural specifics such as number of intubation attempts, method in which placement was confirmed, and associated complications (bleeding, bradycardia, hypoxemia, etc).

Medication compliance was defined per AAP guidance as the use of a rapid onset opiate, rapid onset opiate plus a benzodiazepine; rapid onset opioid (i.e. fentanyl), benzodiazepine(i.e. versed) and a vagolytic (i.e. atropine); or any of the above medications plus the addition of a muscle relaxant. Our unit regularly uses fentanyl and versed for invasive procedures such as central line placement, therefore there was an existing comfort level with dosing and administration for these two medications.

Intubations were reviewed monthly to track compliance and improvement. Infants were included in data analysis if they underwent endotracheal intubation during their admission. Emergent intubations occurring in the delivery room or during an acute decompensation (significant bradycardia unresponsive to Bag Valve Mask ventilation (BVM)) at a later age were excluded. Detailed data was collected with respect to infant demographics (gestational age at birth, sex, birth weight, and age at time of procedure), indication for intubation (Respiratory Distress Syndrome (RDS), respiratory distress, respiratory failure, surfactant administration, surgery, reintubation, sepsis, apnea bradycardia episodes, or other), pre-procedural sedation (class of medication and specific drug chosen), number of attempts required prior to successful intubation, level of provider training performing the procedure (intern, resident, fellow, attending), documentation compliance with new EMR tool, and any associated complications. Infant demographics were compared using standard descriptive statistics. Continuous data were analyzed and compared with the Mann-Whitney U test with an α level of 0.05 accepted as significant. (Graph Pad Prism 6, Graph Pad Software, La Jolla CA).

Methods

During the pre-intervention time period of 2012 to 2013, 65 non-emergent intubations were performed in the WRNNMC NICU. Only 55% of infants (36/65) received some form of sedation. Sedated infants were born at an older gestational age and weighed more at birth than non-sedated infants, however there was no difference in age at the time of intubation (day of life (DOL)) (**Table 1**). Overall compliance rate with AAP recommended medications was 58% with midazolam as the most frequently used medication (Figure 1). Indications for intubation were reviewed; the most common indications documented included respiratory distress, surfactant administration, a combination of RDS and surfactant administration, and respiratory failure (Supplementary **Figure 2**)

Post intervention data was collected from Nov 1, 2013 through Oct 1, 2014. During this 11-month period, 72 nonemergent intubations were performed, 83% (60/72) used premedication. In this epoch, sedated infants weighed more at birth, but there were no detectable differences in gestational age at birth or the age at time of intubation (**Table 1**). Similar indications for intubation were found during the post intervention time period (Supplementary **Figure 2**). Medication selection compliance improved to 88% during the post intervention period (53/60). The most common regimen used was a combination of fentanyl and midazolam (52%) (**Figure 1**).

Two run charts were created to better display our results over time. Figure 2 displays our chosen process measures, overall premedication use and documentation using the new EMR tool. Documentation compliance was rapidly achieved and maintained throughout the study time period (**Figure 2**). The use of premedication varied over time. After each educational session we found an overall increase in the use of sedation. As time elapsed we found that premedication use waned, however after May 2014 the goal of 80% was achieved consistently. The second run (**Figure 3**) chart depicts the overall use of premedication and the compliance with AAP recommendations (medication selection). Again after May 2014 premedication was provided consistently 80% of the time with appropriate medication selections.

Discussion

Our combined approach of multidisciplinary educational sessions, a new EMR tool, and nursing advocacy led to marked improvement in compliance with AAP guidelines regarding sedation for non-emergent neonatal intubations. The educational sessions informed both trainees and staff providers, of not only the evidence behind the AAP guidance but also the overall impact on operator success when premedication is used. Additionally during each session we reviewed our current progress towards our goal of 80% compliance, further highlighting the need for improvement.

We found a positive response to the live classroom based sessions with both physician and nursing staff. The nursing staff felt better empowered to advocate for their patient's comfort and safety, further increasing the chances of premedication being given. Pre-existing nursing comfort with medication administration, dosing and easy access within unit, prevented delays in care and reassured physicians that the sedation would be rapid and well tolerated.

As time elapsed the demonstrated improvement waned, necessitating regular interval updates regarding overall progress and a review of the educational material. We consistently achieved our goal of 80% premedication use and medication selection compliance by May 2014. The new EMR documentation tool reinforced the importance of sedation use and appropriate medication selection. It also allowed us to better track trainee success and procedural complications. Unfortunately data are not available on the number of attempts required to successfully intubate prior to this study. Of note, we did not experience any adverse side effects (respiratory depression, chest wall rigidity, or inability to extubate after surfactant administration) during the post-intervention time frame. Moving forward we will increase our goal to 100% compliance.

Our design has several limitations. First is the relatively short post-intervention period of only 11 months. A common problem with quality improvement design is sustainability and it is unknown if these interventions will be successful long-term or if further adjustments will be required to maintain our current compliance levels. Second we analyzed a relatively small number of intubations, these methods have been proven successful in a single small academic center and their generalizability is limited to larger, higher volume NICUs.

Since May of 2014 sedation has been consistently provided prior to non-emergent intubations in the WRNMMC NICU. We believe that the familiarity with the new EMR tool and nursing advocacy will contribute to the long-term success of these interventions. Further more we hypothesize that the physician practice culture has been modified away from an avoidance of sedation.

Conclusion

Utilizing a combined method to facilitate quality improvement is a successful approach when new practice guidelines are published. Expansion to other larger, higher volume centers to evaluate the success or usefulness of these interventions is warranted. Further study regarding the impact these methods have on trainee success at intubation is indicated.

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Figures

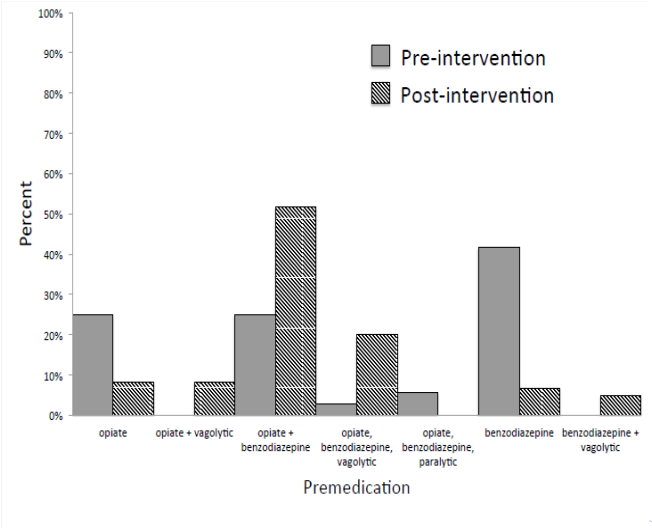
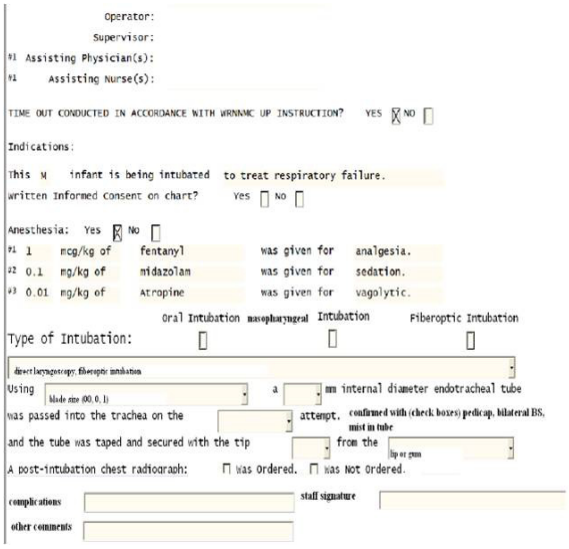


Figure 1: Change in medication selection between the pre-intervention and post-intervention epochs



Supplamentary Figure 1: Change in medication selection between the pre-intervention and post-intervention epochs

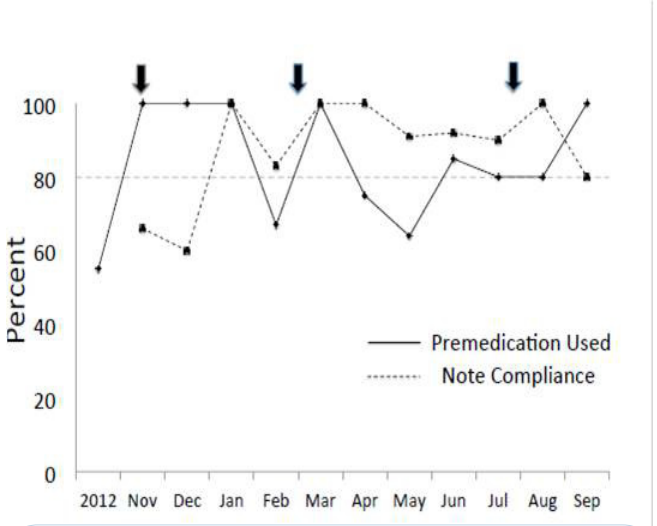
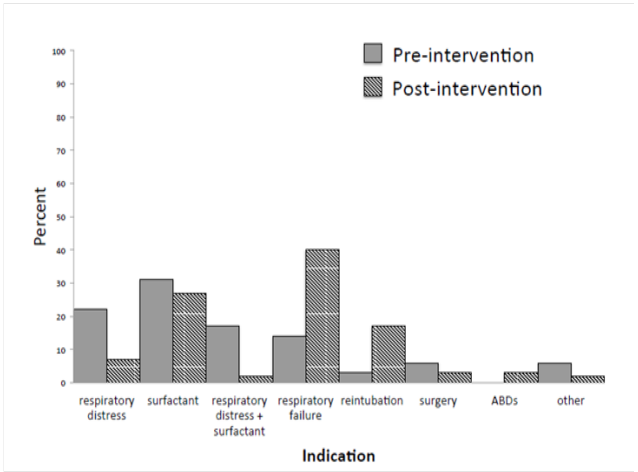


Figure 2: Process measures. Percentage use of premedication and compliance with new EMR tool over time (months)



Supplamentary Figure 2: Indications for Intubation.

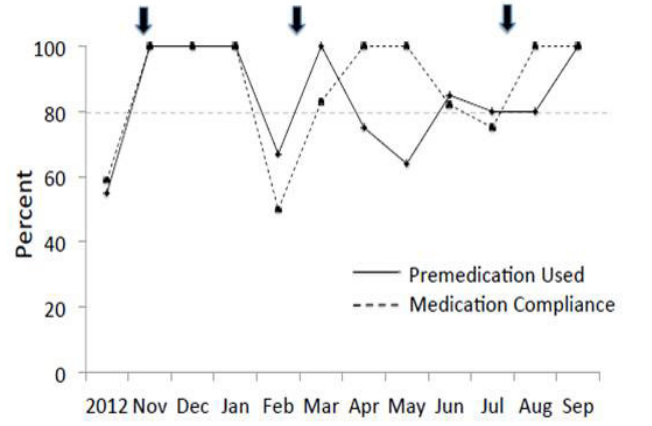


Figure 3: Outcome measures. Percentage of premedication use and medication compliance over time (months).

Table

Table 1: Infant demographics. Continuous data analyzed and compared using Mann-Whitney U test with an α level of 0.05 accepted as significant.

	Pre-Intervention				
	Pre-medication		No Pre-medication		P-Value
	Median	IQR	Median	IQR	
Gastational Age	34.7	29.1-3704	30	26.7-33.9	0.002
Birth Weeight (g)	2450	1498-2900	1280	730-1950	0.0005
Day of Life	1	1-2	1	1-1	.43
	Post Intervention				
	Pre-medication		No Pre-medication		P-Value
	Median	IQR	Median	IQR	
Gastational Age	29.5	23.9-36.8	25.5	23.5-28.8	.1555
Birth Weeight (g)	1440	615-2843	615	610-1201	.0468
Day of Life	3	1-23	15.5	4-24	.217

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