Efficacy of a Premedication Algorithm for Nonemergent Intubation in a Neonatal Intensive Care Unit

JW VanLooy, Robert E Schumacher, and Varsha Bhatt-Mehta

BACKGROUND: Preventing significant oxygen desaturation and hypotension through adequate analgesia and sedation during nonemergent intubation in neonates is desirable. However, in many neonatal intensive care units, elective intubations occur without adequate premedication. There is significant variation in the choice of premedication agent(s) and doses, and an ideal regimen for use during nonemergent intubation has not been developed.

OBJECTIVE: To evaluate the efficacy of an algorithm developed for analgesia and sedation during nonemergent intubation in neonates.

METHODS: Prospectively collected continuous quality improvement data on a premedication algorithm for nonemergent intubation were analyzed following institutional review board approval. Midazolam 0.1 mg/kg and fentanyl 2 µg/kg (if the patient was not already receiving morphine for sedation) were administered prior to nonemergent intubation. Heart rate, oxygen saturation, respiration rate, mean arterial pressure, and pain scores were recorded at baseline prior to medication administration, during the procedure, and for 2 hours after the procedure. Data during laryngoscopy and until the time of tube taping were obtained from the bedside cardiorespiratory monitor. Additional fentanyl was allowed for more than 3 intubation attempts and rocuronium 0.6 mg/kg was allowed for more than 5 attempts. The physiological changes that occurred over time were compared with baseline. The number of attempts made, time to intubation, and medications used are presented.

RESULTS: Ninety evaluable patients were included. Mean ± SD birth weight and postnatal age at treatment were 2040 ± 961 g and 14 ± 17 days, respectively. Heart rate decreased and oxygen saturation increased significantly (160 vs 154 beats/min, p = 0.01; 96.4% vs 93.8%, p = 0.002, respectively) from baseline to completion of the procedure; however, mean arterial pressure showed no significant difference (44.9 vs 44.7 mm Hg; p = 0.85; n = 68). The number of attempts at intubation were recorded for 66 patients; of those, 52 required 3 or fewer attempts for successful intubation (median, 2).The time to successful intubation was 7.2 ± 5.6 minutes (recorded in 45 pts.). Average fentanyl and midazolam doses were 1.92 ± 0.53 µg/kg and 0.096 ± 0.026 mg/kg, respectively. No patient received rocuronium.

CONCLUSIONS: A systematic approach to premedication during nonemergent intubation successfully prevented acute physiological changes.

KEY WORDS: algorithm, neonatal intensive care, nonemergent intubation, premedication.

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Premature infants have the underlying neurologic capacity to experience pain.[1,2] Several studies have shown potential increases in nociceptive responses among infants who undergo frequent invasive procedures; in these infants, poorly controlled pain during early life has been shown to predispose them to increased pain responses in future experiences.[3-6] Additionally, prior studies have shown increases in both blood and intracranial pressure with the manipulation of the airway in premature neonates, putting them at increased risk for intracranial hemorrhage due to altered cerebral blood flow.[7-10] Premedication during intubation can potentially stabilize such physiologic responses while reducing the number of attempts needed for successful intubation.[11,12]

Many institutions have implemented standardized protocols for providing analgesia and sedation prior to elective and semielective procedures in an attempt to improve consistency for medication use and reduce adverse events.[13] A standardized protocol using midazolam and fentanyl as the sedative and analgesic agents of choice during nonemergent or elective intubation was developed in our neonatal intensive care unit (NICU). Recognizing the adverse effects of fentanyl, such as chest wall rigidity and possible hypoten-

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sion, when used in conjunction with midazolam, a continuous quality improvement (CQI) initiative to monitor the effects of the proposed changes in practice was developed. The protocol was developed as a progressive algorithm and provided an option to use a nondepolarizing neuromuscular blocking agent when necessary (Figure 1).

The purpose of this study was to evaluate the efficacy and safety of the standardized, stepwise escalation of sedation and analgesia (henceforth referred to as premedication) protocol for nonemergent intubation in our NICU, using a plan for systematic evaluation of the success of this CQI initiative developed prior to introduction of the protocol in the NICU.

Methods

DESIGN

Safety and efficacy data were prospectively collected during the CQI initiative. Following institutional review board approval, retrospective analysis of the CQI data and chart review to collect any missing demographic or other necessary information was performed. Although morphine and lorazepam are routinely used for analgesia and sedation in our unit, we chose fentanyl for this procedure due to its shorter half-life and increased cardiovascular stability[14] and midazolam for its perceived shorter duration of effect compared with lorazepam (although a wide variation in duration of effect has been observed in neonates[15]). Once intubation was successfully achieved, morphine and lorazepam could be used for continued analgesia and sedation. Procedures for data collection to evaluate the success of this CQI initiative were put in place prior to the start of the protocol, because monitoring the safety and efficacy of the potent protocol medications was of primary importance.

PATIENT SELECTION

Infants requiring elective (nonemergent) intubation were entered into the protocol if they were considered by the caregiver to be relatively clinically stable, with vital signs and oxygen saturation values within normal ranges. These infants required reintubation for accidental extubation, intubation for increasing respiratory depression, failed planned extubation, or elective intubation prior to a surgical procedure. Established intravenous access to receive premedication according to protocol was required. Eligible patients were prepared for intubation with preoxygenation and airway suctioning as necessary. All house staff involved in intubation procedures were Neonatal Resuscitation Program credentialed and had demonstrated the necessary knowledge and skills required for intubation, although they had limited experience. If an infant became unstable during the procedure, a preexisting emergent airway/intubation protocol was activated.

PREMEDICATION PROTOCOL

The premedication protocol consisted of 3 components: medications, monitoring of physiologic parameters, and staff education.

Drug Therapy

Eligible infants received midazolam 0.1 mg/kg as a slow intravenous bolus, followed by intravenous fentanyl 2 µg/kg administered over 5 minutes using a syringe pump. There was then a 1- to 2-minute waiting period to allow for drug effect. During that time, oxygen administration and bag mask ventilation was provided as necessary. Intubation was then attempted for up to 3 times by an intern and/or resident. If intubation was unsuccessful following those 3 attempts, an additional dose of fentanyl 2 µg/kg could be given and 3 additional intubation attempts were made by either the neonatal nurse practitioner or a neonatology fellow. Each intubation attempt was limited to less than 30 seconds and all intubation attempts were made within 5–10 minutes of administration of the medication.

If, following the second 3 attempts, the patient was still not intubated and further patient cooperation was necessary to achieve intubation, a nondepolarizing neuromuscular blocking agent could be given. Rocuronium was included as the agent of choice for paralysis, due to its rapid onset of action of 15–30 seconds and the intermediate duration of effect.[16] While the duration of effect is variable by age, rocuronium, like other aminosteroids, has a shorter duration of effect, especially compared with pancuronium, which is most commonly used in NICUs, including ours. Use of a single dose of rocuronium 0.6 mg/kg was permitted only in the presence of a staff neonatologist or an anesthesiologist. Fentanyl was withheld in patients who had received morphine within 2 hours prior as part of a chronic sedation and analgesia regimen.

Physiological Parameters

During the intubation procedure, physiological parameters, including heart rate (HR), mean arterial pressure (MAP), respiratory rate (RR), and transcutaneous oxygen saturation (SaO_2), were monitored and recorded concurrently with the nursing flow sheet on a CQI data collection sheet available at the bedside with each intubation kit. For each intubation, data were collected starting at the time of medication administration (baseline values), 10 and 5 minutes before intubation (time of preoxygenation and laryngoscope insertion), at time of tube taping (TT) after successful intubation, and every 15 minutes for 2 hours after intubation. In our NICU, the physiological data are recorded on the flow sheet by nursing staff, according to established guidelines based on severity of illness, and are also

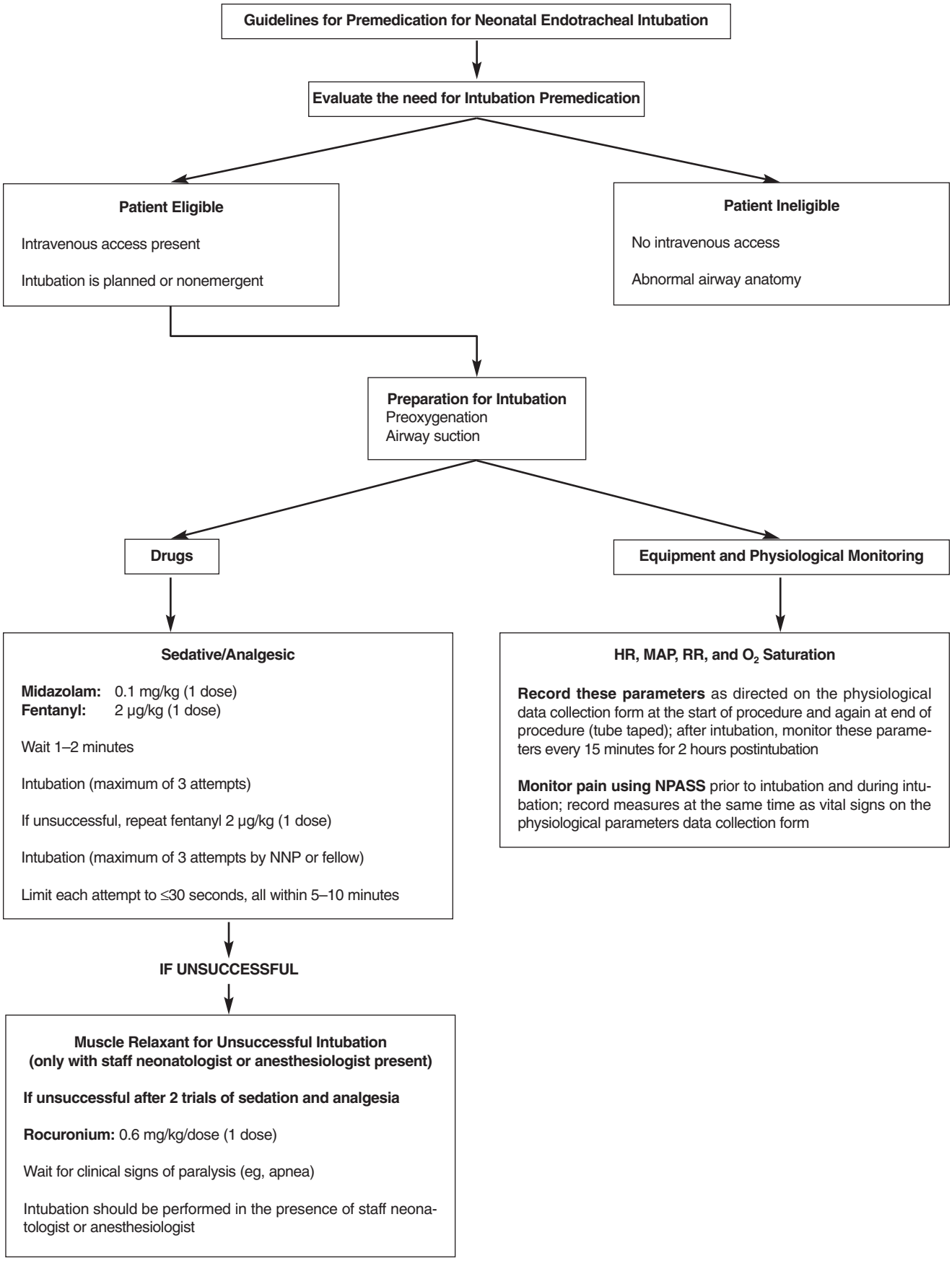

Figure 1. Premedication algorithm. HR = heart rate; MAP = mean arterial pressure; NNP = neonatal nurse practitioner; NPASS = Neonatal Pain, Agitation, and Sedation Scale; RR = respiratory rate.

automatically recorded by the cardiorespiratory monitor every 60 seconds. The data on the cardiorespiratory monitor are stored for each previous 24 hours. A continuous printout of the data was obtained from the bedside cardiorespiratory monitor starting immediately after drug administration and continuing during the intubation procedure (ie, data from laryngoscope insertion up to the point of TT were printed for each patient the following morning). Thus, physiological data that were missed by the observer (ie, not recorded on the CQI form) at any time during the procedure were retrieved from this monitor printout and/or the nursing flow sheet.

In our NICU, the Neonatal Pain, Agitation, and Sedation Scale (NPASS) has been used routinely for many years to assess pain in neonates, and the nursing staff is very familiar with the system.[17] For this reason, it was chosen as a pain assessment tool for this CQI initiative. The frequency of scoring was based on an existing policy for severity of illness in our NICU. In general, NPASS scores were available for assessment of the intensity of pain at baseline and at completion of intubation (ie, when tube was placed successfully and taped). While significant pain may be experienced during the intubation procedure, it was not practical to assess the NPASS scores during this time and we relied on the change in physiologic parameters captured by the cardiorespiratory monitor to determine any stress during this time. Thus, no changes to the preexisting nursing policy were requested.

Staff Education

The protocol was developed by a clinical pharmacist and 2 staff neonatologists. Extensive input was sought from neonatology fellows and other neonatal–perinatal medicine faculty not originally involved with protocol development before a final protocol was produced. Prior to introduction of the protocol into practice, several in-service education sessions for nursing and respiratory therapy staff, nurse practitioners, neonatology fellows, and faculty were organized. Pediatric house staff involved in the intubation procedure were educated by a supervising fellow/nurse practitioner prior to the intubation procedure. The purpose of the protocol—the stepwise approach to sedation/analgesia/paralysis, as well as the data collection process—was explained clearly by one of the investigators. Other education components included the general flow of the protocol, sequence and method of drug administration (ie, using a syringe pump to administer fentanyl over prescribed time), keeping track of the number of intubation attempts and who performed them, how to print data from the cardiorespiratory monitor, how to record data on the CQI data collection form (with previous nursing agreement for this additional workload), and the use of NPASS scores during the procedure.

OTHER DATA COLLECTION

Other data collected included general patient demographics, reason for intubation, dose and time of the administered protocol medications, number of attempts prior to successful intubation, and the vital sign parameters noted throughout the procedure as described above. The need for repeat doses of drugs and any deviations from the protocol were also noted.

STATISTICAL ANALYSIS

Demographic data and the relationship between the number of intubation attempts and the NPASS were analyzed, using descriptive statistics. The physiological data consisted of 10 repeated measurements of HR, RR, MAP, SaO_2, and NPASS on each patient. Because significant patient-to-patient variations in response were expected due to substantial baseline differences in clinical status, we applied longitudinal data analysis methods using linear mixed-effects models for continuous outcome measures. A mixed-effects model that accounted for fixed effects of the administered drugs and intubation process on the physiologic parameters, while taking into account random patient effects and random errors within each subject, was fitted using SAS PROC MIXED (SAS 9.1, SAS Institute Inc., Cary, NC). The mixed-effects model is also suitable for handling longitudinal data that are missing at random, which was fairly common in this noninterventional study originally designed as a CQI project.

The mixed-effects model was fitted using an iterative maximum likelihood estimation process (implemented in SAS PROC MIXED). An initial (simple) model included fixed time point effects, random intercepts for the infants, and random errors with constant variance and no correlation. The fit of this initial model was compared statistically with the fit of a model allowing the error variance to vary over time, using likelihood ratio tests, to determine whether a model with heterogeneous variance over time had a significantly improved fit. The final mixed-effects model that best fit the data for each outcome was the one with nonconstant (heterogeneous) error variance over time. This final model was used for subsequent analyses to determine the change in all physiologic parameters over time after drug administration and intubation. Assumptions of normality for the random errors were assessed in all final models, with no apparent violations of the assumptions found. In all tests of significance, a p value less than 0.05 was considered to be significant. We performed post hoc tests comparing means with baseline values at various time points, and used the Tukey–Kramer adjustment for multiple comparisons when comparing means with baseline at the different time points .

Results

The premedication algorithm was used in 102 patients, 90 of whom had data available for pre- and postintubation physiologic parameters and were included in the analysis. Mean ± SD birth weight and postnatal age at treatment were 2040 ± 961 g and 14 ± 17 days, respectively. Thirty-two infants weighed less than 1500 g, and 58 weighed 1500 g or more. The mean change in physiological parameters between the 2 groups did not achieve statistical significance during initial analysis. The groups were thus combined to achieve a larger sample size for subsequent analysis.

The total number of intubation attempts was recorded for 66 patients. Fifty-two (79%) infants required 3 attempts or fewer for successful intubation, with an additional 4 (6%) intubated on the fourth attempt and 6 (9%) on the fifth attempt. Only 4 (6%) infants required 6 attempts or more (maximum 8). The median number of intubation attempts required was 2, and the mean time from beginning of intubation to successful completion was 7.2 ± 5.6 minutes (n = 45).

The average dose of fentanyl used was 1.92 ± 0.53 µg/kg. Only 2 patients were documented as having received a second dose of fentanyl, with one receiving a total of 3 doses. The average midazolam dose was 0.096 ± 0.026 mg/kg. One patient received 2 doses of midazolam, and 2 others received no midazolam prior to intubation. Rocuronium was not used in any infant; however 3 received a single dose of pancuronium 0.1 mg/kg. The reason that pancuronium was chosen over rocuronium, as specified in the protocol, was not documented. However, the nursing and medical staff in our unit is most familiar with pancuronium and could have chosen this agent based on their comfort levels.

The results from longitudinal analysis of the data for physiologic parameters are presented in Figure 2 and Table 1. Preliminary data analysis suggested little change in physiologic parameters 30 minutes after intubation. Thus, subsequent analysis was limited to 6 time points, starting at baseline (ie, time of drug administration) to 30 minutes after successful intubation.

There appears to be random fluctuation in HR across the 6 time points. HR at baseline was not significantly different from that at 30 minutes after intubation. The maximum fluctuation in HR occurred at the time point of TT, where there was a significant increase in HR ($p = 0.01$). While statistically significant, this difference was on average 5 beats per minute higher than the value obtained 10 minutes prior to the procedure. No significant differences were found between baseline values and TT values for MAP. There was a steady but significant reduction in MAP after the premedication administration and time points before TT ($p < 0.05$). No overt hypotension occurred. At the time of TT, the MAP increased slightly, but the increase was not significant when compared with baseline. Thereafter, the MAP continued to decrease at 15 and 30 minutes after TT. The NPASS scores showed a consistent and significant decline from baseline to 30 minutes after intubation, suggesting effectiveness of pain medications ($p < 0.001$). There was a significant increase in SaO_2 from baseline to TT ($p < 0.002$).

Overall, the results indicate that, when compared with baseline, the HR, SaO_2, and NPASS scores are significantly different at TT, with an overall downward trend for HR, NPASS scores, and MAP and an upward trend for SaO_2, all of which are desirable effects indicating stabilization of physiologic parameters. Six patients who received premedication under this protocol had complications that may have been due to medications, since the events occurred around the time of drug administration. The complications varied in severity from moderate to severe. Three patients exhibited possible signs of chest wall rigidity, but the events were short lived and none required the use of a paralytic agent to reverse the adverse effects. One patient had unexplained oxygen desaturation to less than 30%. Two other patients had a prolonged time to successful intubation (ie, 25 and 30 min, respectively). One of the 2 had significant vocal cord swelling and 7 attempts were required to place the endotracheal tube. Seven attempts were also required for a confirmed endotracheal tube placement in the other patient, although that infant was described as having significant airway secretions, which may have complicated the determination of whether endotracheal tube placement was successful. Only one patient had a life-threatening event that required chest compressions. Nursing and respiratory therapy staff believed that this event resulted from fentanyl administration. However, these infants required nonemergent intubation due to underlying deteriorating respiratory conditions, and the contribution of these underlying conditions to the adverse effects is unknown.

Discussion

It appears that, after accounting for inter- and intraindividual variations, premedication had a beneficial effect on the intubation procedure. The NPASS scores decreased during the course of intubation, suggesting that sedation and analgesia were successful. The small rise in HR noted cannot be interpreted as clinically significant; fluctuations in HR were small and did not occur consistently during the procedure. This nonspecific marker of distress does not appear to provide any useful information regarding pain or agitation due to the procedure. Mean blood pressure decreased, but not by a clinically significant amount. A stress response would entail acute increases in blood pressure. Hence, our findings could represent a desired effect showing that the medications may be working in favor of the

patient and reducing stress related to increase in MAP.

Over the past several years, numerous studies have addressed the use of premedication for the relief of pain and anxiety during nonemergent intubation.[18-26] A variety of regimens to effect adequate sedation and analgesia have been explored. Some drugs, including methohexital and thiopental, have been found to be of limited value in the NICU setting.[18,19] Other studies have used either a sedative or an analgesic with a paralytic in their regimen,[20-25] or only an analgesic. Two randomized studies evaluated morphine versus a placebo[12] or another analgesic[26] for premedication for intubation in the NICU. In the study that used morphine

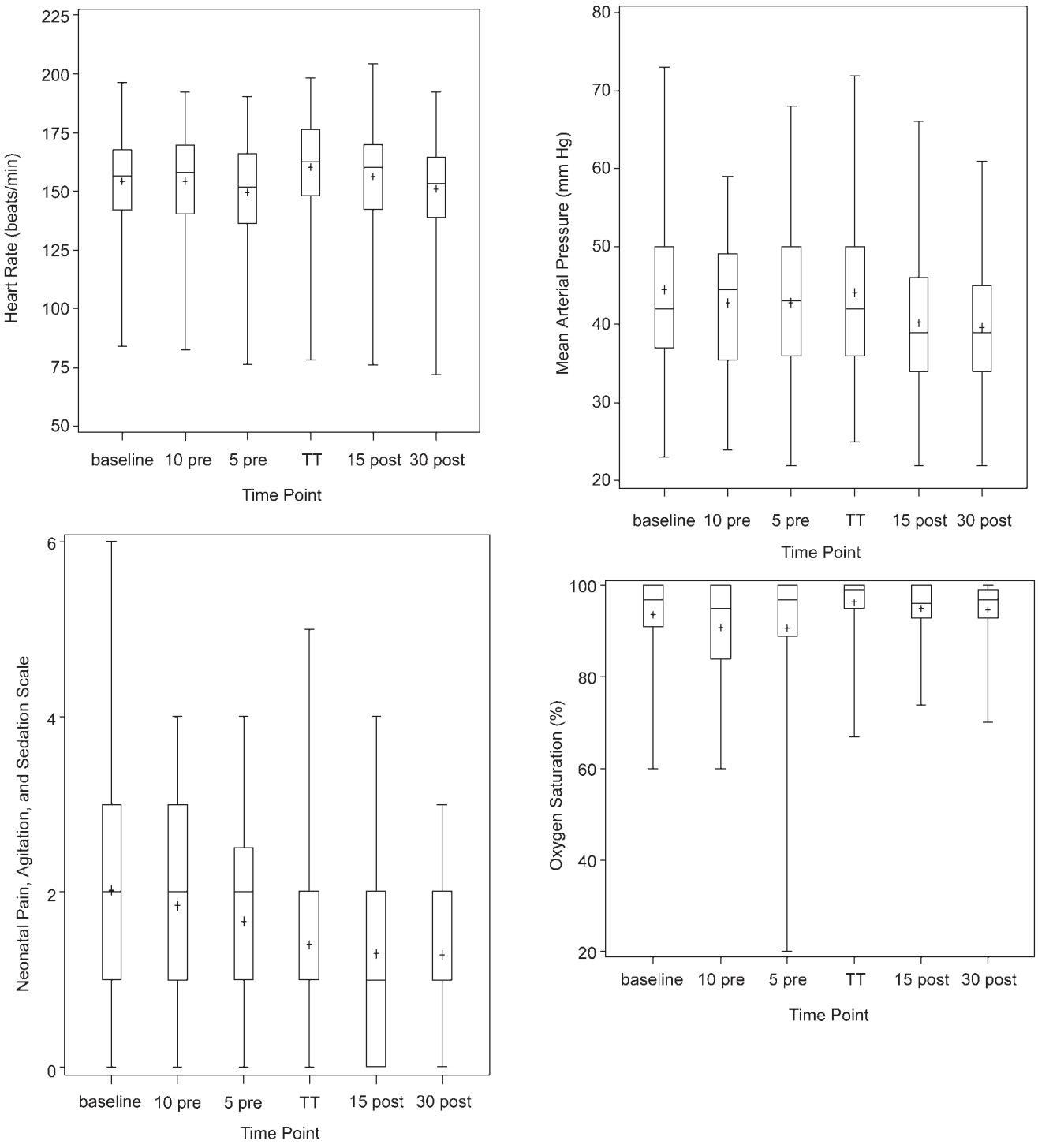

Figure 2. Changes in heart rate; mean arterial pressure; Neonatal Pain, Agitation, and Sedation Scale score; and oxygen saturation are stabilized 45 minutes postintubation.

as a single agent compared with placebo, the investigators concluded that morphine failed to reduce physiologic instability.[12] They hypothesized that morphine's slower onset of action may have led to a delayed sedative/analgesic effect prior to initiating the procedure, causing it to fail. Thus, while many proposed regimens have been explored, to date there is no single regimen that has been successfully used to overcome the physiological changes during intubation.

We attempted to overcome some of the shortcomings of previously reported regimens by including fentanyl, midazolam, and rocuronium—agents with a faster onset of action—to provide simultaneous analgesia and sedation and offer a paralytic that could be used in a stepwise fashion. The intent was to not overmedicate the infant but to have the appropriate drugs available as part of the systematic approach in the protocol. Our subsequent analysis has shown that this regimen was successful in minimizing changes in the observed physiological parameters; additionally, a paralytic agent was not necessary in the majority of infants provided there was efficient analgesia and sedation in place prior to the procedure.

There are potential dangers associated with the use of paralytic agents as the first-line agent in a premedication regimen, especially at the hands of inexperienced staff, as might happen in a training institution or where neonatologists are not on staff in an NICU. A paralytic drug as the primary component in such scenarios would set up a potential situation in which a previously spontaneously breathing infant would then lack any respiratory drive or muscle tone, making bag-mask ventilation more difficult with no established airway. For this reason, a regimen that does not utilize a paralytic drug as a first-line agent may be more useful in such situations.

A second possible complication of using muscle relaxants as first-line therapy for premedication is that infants may not have adequate sedation and analgesia in place prior to the administration of the paralytic agent and initiation of the procedure. This is especially true if a drug such as atropine is used to blunt the physiological responses of the infant. In this situation, the infant, while avoiding the negative consequences of large swings in the physiologic parameters, has still been exposed to a potentially traumatic and painful event without sufficient analgesia. Because this is one of the primary reasons for instituting a premedication protocol, masking the clinicians' ability to identify and respond to this situation may be counterproductive.

Although these may be indications for not using a muscle relaxant as a first-line agent for premedication, there is definitely a role for such agents. One of the potential complications associated with the use of fentanyl is muscular rigidity, particularly of the chest wall, or of muscles that control the vocal cords, leading to laryngospasm.[27-29] This particular complication is seen with some regularity with the use of fentanyl. In the event of this complication, the need to use a paralytic agent may arise to allow adequate oxygenation and ventilation of the infant. Therefore, using a muscle relaxant as a second-line drug to treat the complications that may arise during the procedure would be appropriate.

Six (6.6%) of the 90 infants had adverse events identified and recorded prospectively at the time of intubation. It may be speculated that difficulty with intubation (eg, multiple attempts) may have been lessened by paralysis. However, in several instances, there was preexistent cord swelling or secretions that paralysis would not have changed. There was some concern among caregivers over the potential for complications related to the protocol medication and apparent chest wall rigidity. Three patients had clearly described chest wall rigidity after the administration of fentanyl, as reported by nursing or respiratory therapy staff. Chest wall rigidity with fentanyl administration has been reported[12-14]; it is generally associated with rapid administration. Investigation of the cases of chest wall rigidity in our NICU did not reveal any clear cause. There was no record of how quickly the drug was given or whether there was deviation from the protocol and the reason for it. Because the retrospective nature of the analysis of these data prohibited any further "in time" investiga-

Table 1. Variations in Physiological Parameters over Time

Parameter	Time Measured (mean ± SE)	p Value[a]
Heart rate	baseline: 154.27 ± 2.42	
	10 pre: 157.05 ± 2.31	0.19
	5 pre: 153.04 ± 2.82	0.64
	TT: 159.98 ± 2.43	0.01
	15 post: 156.20 ± 2.12	0.31
	30 post: 150.88 ± 2.12	0.07
Mean arterial pressure	baseline: 44.24 ± 1.17	
	10 pre: 40.93 ± 1.67	0.05
	5 pre: 41.27 ± 1.45	0.049
	TT: 43.5 ± 1.13	0.55
	15 post: 40.1 ± 0.95	<0.001
	30 post: 39.7 ± 0.91	<0.001
Oxygen saturation	baseline: 93.78 ± 0.83	
	10 pre: 90.5 ± 1.79	0.08
	5 pre: 90.52 ± 2.25	0.16
	TT: 96.44 ± 0.62	0.002
	15 post: 94.99 ± 0.56	0.145
	30 post: 94.54 ± 0.69	0.411
NPASS	baseline: 2.01 ± 0.14	
	10 pre: 1.495 ± 0.13	<0.001
	5 pre: 1.60 ± 0.15	<0.005
	TT: 1.38 ± 0.11	<0.001
	15 post: 1.29 ± 0.1	<0.001
	30 post: 1.25 ± 0.11	<0.001

5 pre = 5 minutes before intubation; 10 pre = 10 minutes before intubation; 15 post = 15 minutes after intubation; 30 post = 30 minutes after intubation; NPASS = Neonatal Pain, Agitation, and Sedation Scale; TT = time when tube was successfully placed and taped.

[a]p Value is from a *t*-test for a given fixed effect, which represents a contrast with baseline.

tions, it was decided to suspend the protocol temporarily after 1.5 years until such time as the results of this and further analysis became available.

Limitations

This study was initiated as a CQI study. Many data points were missing due to patients' conditions being too unstable to allow time for recording the physiologic parameters, lack of appropriate paperwork at the bedside, or staff simply not being aware of what data should be recorded (despite our best efforts to educate almost every nurse who worked on the unit). As a result, there could be bias during data analysis. Use of neuromuscular blocking agents outside of the algorithm was due purely to lack of experience with rocuronium, resulting in elimination of these infants from some part of data analysis.

Conclusions

The systematic approach to premedication for nonemergent intubation, using fentanyl and midazolam for analgesia and sedation prior to and during the procedure, showed no clinically significant changes in HR, MAP, SaO_2, and NPASS scores. This protocol appears to be successful in minimizing the physiological changes that could be potentially detrimental to the long-term neurologic outcomes of neonates. The ideal regimen for premedication prior to elective intubation should contain a sedative and an analgesic agent with a muscle relaxing agent as a third-line option. Use of a pain and sedation scale such as the NPASS may provide better assessment of the success of sedative/analgesic regimens during such procedures. These conclusions remain to be confirmed in a prospective study.

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Evaluación de un Algoritmo de Premedicación para Intubación Electiva en una Unidad de Cuidado Intensivo Neonatal

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EXTRACTO

TRASFONDO: Es deseable prevenir la desaturación significativa de oxígeno e hipotensión a través de analgesia y sedación adecuadas durante intubación electiva en neonatos. Sin embargo, en muchas unidades de cuidado intensivo neonatal ocurren intubaciones electivas sin premedicación adecuada. Cuando se utilizan, existe una variación significativa en la selección de agentes y dosis. No se ha desarrollado un régimen de premedicación ideal para uso en intubación electiva.

OBJETIVO: Evaluar la eficacia de un algoritmo desarrollado para analgesia y sedación durante intubación electiva en neonatos.

MÉTODOS: Se hizo un análisis prospectivo de datos de un programa de Mejoramiento Continuo de Calidad de un algoritmo de premedicación para intubación electiva. Este estudio fue aprobado por la Junta de Revisión Institucional. Se administró midazolam 0.1 mg/kg y fentanilo 2 µg/kg (si no estaban recibiendo morfina para sedación) previo a la intubación electiva. Se documentó la frecuencia cardíaca (FC), saturación de oxígeno (sat O_2), respiraciones, presión arterial promedio (PAP), e índices de dolor durante y hasta 2 horas después del procedimiento. Se obtuvieron datos fisiológicos del monitor cardiorespiratorio al lado de la cama del paciente durante el proceso de intubación. Se permitió el uso de fentanilo adicional en casos de más de 3 intentos de intubación y rocuronium 0.6 mg/kg en mas de 5 intentos. Los cambios fisiológicos a través del tiempo fueron comparados con los datos iniciales. Se presentan el número de intentos de intubación, tiempo para la intubación y fármacos usados.

RESULTADOS: Se incluyeron 90 pacientes evaluables. El peso al nacer y la edad post natal al momento del tratamiento fueron 2040 ± 961 g y 14 ± 17 días, respectivamente. La FC disminuyó y la sat O_2 aumentó significativamente (FC 160 vs 154, p = 0.01, sat O_2 96.4 vs 93.8, p = 0.002; n = 90) desde el inicio hasta completar el procedimiento. La PAP no demostró diferencia significativa (44.9 vs 44.7, p = 0.85; n = 68). Cincuenta y dos de 66 pacientes a los cuales se les documentó el número de intentos requirieron 3 o menos intentos para una intubación exitosa (mediana = 2). El tiempo promedio para una intubación exitosa fue 7.2 ± 5.6 min (n = 45). Las dosis promedios de fentanilo y midazolam fueron 1.92 µg/kg y 0.096 ± 0.026 mg/kg, respectivamente. Ningún paciente recibió rocuronium.

CONCLUSIONES: Un acercamiento sistemático a la premedicación durante intubación electiva previno exitosamente cambios fisiológicos agudos.

Traducido por Juan F Feliú

Efficacité d'un Algorithme de Pré-Médication lors d'Intubation Non-Urgente à l'Unité des soins Intensifs Néonatalogiques

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RÉSUMÉ

INTRODUCTION: La prévention d'une désaturation et d'une hypotension significatives à l'aide d'une analgésie et d'une sédation adéquates lors d'intubation non-urgente chez les nouveaux-nés est souhaitable. Cependant, dans plusieurs unités de soins néonatalogiques, les intubations électives ont lieu sans pré-médication. Lorsqu'utilisée, il existe une grande variabilité dans le choix de l'agent et dans les doses utilisées. Une prémédication idéale lors d'intubation élective n'a pas encore été développée.

OBJECTIF: Evaluer l'efficacité d'un algorithme d'analgésie et de sédation lors d'intubation non urgente auprès des nouveaux-nés.

MÉTHODOLOGIE: L'analyse de données collectées de façon prospective lors d'un projet d'amélioration continue de la qualité basé sur un algorithme de pré-médication lors d'intubation non-urgente a été effectuée suite à l'approbation du comité d'éthique et de la recherche. Le midazolam 0.1 mg/kg et le fentanyl 2 µg/kg (si le patient ne reçoit pas déjà la morphine comme sédatif) furent administrés avant une intubation non urgente. La fréquence cardiaque (FC), la saturation en oxygène (sat O_2), la respiration, la pression artérielle moyenne (PAM), et le niveau de l'échelle de douleur furent évalués durant et jusqu'à 2 heures après la procédure. Les données durant la laryngoscopie et jusqu'au moment de stabiliser le tube endotrachéal furent obtenues à l'aide du moniteur cardiorespiratoire au chevet. Des doses additionnelles de fentanyl furent permises lors de plus de 3 essais d'intubation et le rocuronium à une dose de 0.6 mg/kg fut permis lors de plus de 5 essais. Les changements physiologiques en fonction du temps furent comparés par rapport au niveau de base. Le nombre d'essais, le temps requis pour l'intubation, et les médicaments utilisés sont présentés.

RÉSULTATS: Quatre-vingt-dix patients furent évaluables. Le poids moyen à la naissance et l'âge post-natal au moment du traitement étaient de 2040 ± 961 g et de 14 ± 17 jours. La FC a diminué et la sat O_2 a augmenté significativement (FC 160 vs 154, p = 0.01; sat O_2 96.4 vs 93.8, p = 0.002, n = 90) entre le début et le moment où le tube endotrachéal a été stabilisé. La PAM n'a pas montré de différence significative (44.9 vs 44.7, p = 0.85; n = 68). Cinquante-deux sur 66 patients ayant eu compilé le nombre d'essais d'intubation ont eu besoin de 3 essais ou moins pour une intubation réussie (médiane = 2). Le temps moyen pour une intubation réussie était de 7.2 ± 5.6 minutes (n = 45). Les doses moyennes de fentanyl et de midazolam furent de 1.92 µg/kg et de 0.096 ± 0.026 mg/kg. Aucun patient n'a reçu du rocuronium.

CONCLUSIONS: Une approche systématique de la pré-médication lors d'une intubation non-urgente prévient avec succès les changements physiologiques associés.

Traduit par Marc M Perreault