Suctioning of the Neonate on Bubble Nasal Continuous Positive Airway Pressure: Building the Evidence

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Funding

Study funded through a grant from the National Association of Neonatal Nurses-Small Grants Award Program

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Faculty Disclosure

Faculty Name	Esther Chipps
Conflict of Interest	None
Employer	The Ohio State University
Sponsor/Commercial Support	National Association of Neonatal Nurses

Goals and Objectives

- **Session Objectives**
  - **To provide an overview of steps involved in building clinical evidence.**
  - **To share the results of a pilot study testing a clinical guideline of suctioning of the neonate on Nasal Continuous Positive Airway Pressure.**

Background and Significance

- **Nasal CPAP provides a means of respiratory support for spontaneous breathing neonates with respiratory distress syndrome.**
- **Maintenance of a patent airway while the neonate is on Nasal Continuous Positive Airway Pressure (NCPAP) requires vigilant monitoring and oral/nasopharyngeal suctioning.**

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Background and Significance

- **NCPAP results in better outcomes than mechanical ventilation with less barotrauma and decreased bronchopulmonary dysplasia.**
- **The success of bubble NCPAP is linked to scrupulous airway management and management of increased secretions.**
- **Currently, there are no evidence-based practice guidelines for suctioning while neonates are on Bubble NCPAP.**

Previous Study: Nasal Continuous Positive Airway Pressure. A Multisite Study of Suctioning Practices within NICUs.

- **Mann and colleagues[1] conducted a cross-sectional multi-site (8 NICUs) descriptive survey to evaluate suctioning techniques of RNs and RTs caring for infants on NCPAP.**
- **Survey focused on**
  - **frequency of suctioning practice**
  - **assessment parameters**
  - **suctioning techniques**

1. Mann, B. et al. (2013). Nasal continuous positive airway pressure. A multisite study of suctioning practices within NICUs. *Advances in Neonatal Care, 13*(20), E1-9.

Findings from Preliminary Mann Study

- **Wide range of suctioning practices among RNs/RTs (n=322) and even among clinicians in the same NICU.**
- **Differences noted in frequency of suctioning, gloving, the use of saline, number of catheters used and hyperoxygenation techniques.**

Specific Aim

- **To characterize the clinical and behavioral response of neonates on Bubble Nasal CPAP (NCPAP) in a Level III following routine oral and nasopharyngeal suctioning.**

Design/Methods

- **Pilot study using a one sample repeated measure design in which neonates (n=16) served as their own control.**
- **Data collected included heart rate (HR), respiratory rate (RR), O_2 saturation and Premature Infant Pain Profile (PIPP).**
- **Study conducted in a 49 bed Level III NICU in a large academic medical center/ Children's Hospital.**

Sample

- **Convenience sample of 16 neonates**
- **Inclusion criteria**
  - **On Bubble NCPAP**
  - **27-32 weeks gestation**
  - **Older than 3 days of life and less than 7 days of life**
  - **Had legally authorized representative**
  - **Clinical stable as determined by NICU team**
- **Exclusion criteria**
  - **Facial/cranial abnormalities**
  - **Chromosomal/genetic abnormalities**
  - **Congenital heart abnormalities**
  - **Chest tube**

Suctioning Protocol

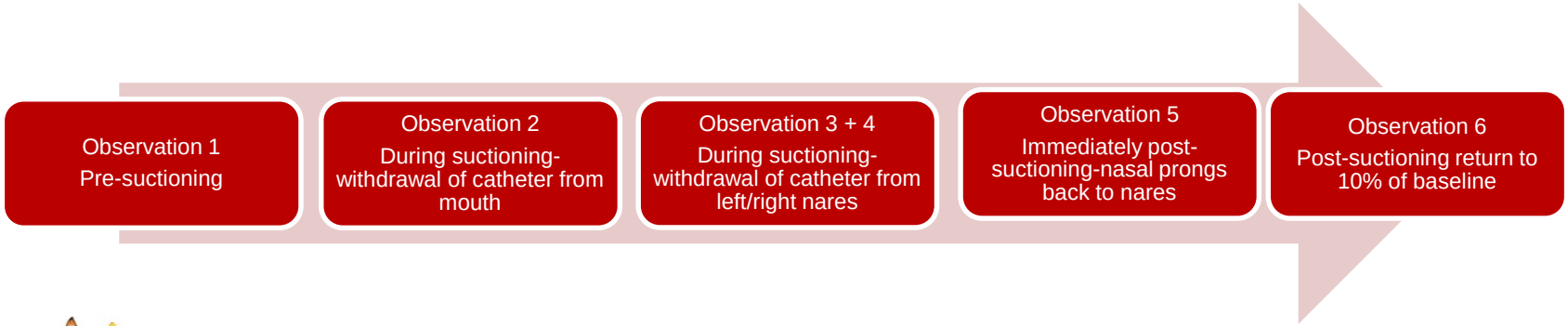
- An oral and nasopharyngeal NCPAP suctioning guideline was developed based on findings of our initial survey of RN and RT practices.
- This was taken to focus groups of clinical neonatal experts.
- The clinical experts came to consensus on best practices.
- This was the protocol that was tested.

Suctioning Procedure

- Perform hand hygiene and don non-sterile gloves.
- Increase Fi02 by 5-10% via blow-by or CPAP, to maintain $Sa0_2$ targets.
- Remove chin strap, if in use, and remove CPAP prongs from nares.
- Assess nares and columella redness, breakdown or visible secretions.
- Infant assessed and prepared for procedure (swaddling and sucrose pacifier).
- Oropharyngeal suctioning performed first followed by nasopharyngeal suctioning.
- Reassess infant immediately post suctioning.
- Return nasal prongs and wean oxygen to pre-procedure amount.

Suctioning Sequence

- **The designated study RNs (established IRR) and collaborating care giving RN determined and recorded the start of the suctioning periods.**
- **Other team members included 2 SNs and NNP who were study recorders/observers.**



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Outcome Measures

- **Heart Rate**
- **Respiratory Rate**
- **SaO_2**
- **Premature Infant Pain Profile (PIPP)**
  - **Seven indicators - gestational age, behavioral state, HR max, SaO_2 min, brow bulge, eye squeeze, and nasolabial furrow**
  - **Range 0-21; 0-6=no/mild pain; 7-12 moderate pain; ≥ 13 severe pain**

Premature Infant Pain Profile

Process	Indicator	0	1	2	3
Chart	Gestational age	36 weeks and more	32-35 weeks, 6 days	28-31 weeks, 6 days	Less than 28 weeks
Observe infants for 15 sec	Behavioral state	Active/awake; eyes open; facial movements	Quiet/awake eyes open; No facial movements	Active/asleep; eyes closed; facial movements	Quiet/asleep; eyes closed; no facial movements
Observe baseline HR and O_2 sat for 30 sec	Heart Rate Max	0 bpm increase	5-14 bpm increase	15-24 bpm increase	25 or more bpm increase
Observe baseline HR and O_2 sat for 30 sec	O_2 Saturation Min	92-100%	89-91%	85-88%	Less than 84%
Observe infants facial actions -30 sec	Brow Bulge	None	Minimum	Moderate	Maximum
Observe infants facial actions -30 sec	Eye Squeeze	None	Minimum	Moderate	Maximum
Observe infants facial actions -30 sec	Nasolabial furrow	None	Minimum	Moderate	Maximum

Data Analysis

- **Descriptive statistics to describe sample characteristics and neonates physiological and behavioral measures.**
- **Mixed effects modeling for repeated measures.**

Results

Sample Characteristics		
Characteristics	**Statistics**	**All (n=16)**
Gestation age	**Mean**	**29.76**
	SD	**1.49**
	Median	**29.6**
	Min	**27.6**
	Max	**31.6**
Days of life	**Mean**	**3.44**
	SD	**1.15**
	Median	**3**
	Min	**2**
	Max	**7**

Physiological Measures During Suctioning Sequence

		N	Mean (SD)			
			Heart Rate	Respiratory rate	O2 Saturation	PIPP Score
Baseline		16	158.9 (9.7)	45.5 (10.4)	97.4 (2.6)	4.2 (1.2)
After suctioning of the right naris						
	1st pass	14	160.0 (13.9)	41.5 (8.8)	93.3 (6.0)	7.7 (2.1)
	2nd pass	1	160.0 (n/a)	39.0 (n/a)	79.0 (n/a)	10.0 (n/a)
After suctioning of the left naris						
	1st pass	14	154.7 (17.5)	40.0 (9.5)	94.4 (4.4)	7.1 (2.0)
	2nd pass	2	167.5 (3.5)	57.0 (18.4)	94.0 (4.2)	8.0 (2.8)
After suctioning of mouth						
	1st pass	16	158.6 (16.9)	42.8 (10.9)	94.4 (4.4)	7.7 (3.4)
	2nd pass	8	157.5 (23.8)	45.5 (15.9)	93.1 (6.4)	7.5 (2.9)
	3rd pass	2	171.5 (0.7)	43.0 (9.9)	87.5 (4.9)	8.0 (n/a)
Immediate post procedure						
	1st pass	15	166.8 (17.5)	43.4 (13.8)	94.4 (4.3)	7.2 (2.4)
	2nd pass	16	160.7 (8.2)	43.9 (11.9)	96.8 (2.8)	4.8 (1.1)
	3rd pass	8	160.3 (11.6)	43.3 (9.4)	95.6 (3.0)	4.0 (1.0)
P value$			0.51	0.79	<0.0001	<0.0001

- HR did not differ across suctioning sequences (p=0.51).
- Average HR ranged from 154.7 to 171.5 with highest after 3rd suction of mouth.
- No statistically significant changes across RR (p=0.79).
- O_2 sat decreased between baseline and after each pass (p=0.001).
- PIPP scores increased (p=0.0001).

Return to Baseline Physiological Measures

- **On average it took 9.5 minutes to complete the suctioning sequence.**
- **Mean time to return to baseline was 6 minutes.**
- **81% of neonates returned to baseline within 10 minutes of last suctioning pass.**

The Effects of Gestation Age, Days of Life, and Total Number of Passes on Time to Complete Suctioning Sequence and Time to Return to Baseline

Effect	Time to complete suctioning		Time to return to baseline	
	Coefficient (SE)	P Value	Coefficient (SE)	P Value
Gestation Age	0.08 (1.03)	0.94	1.74 (0.77)	0.05
Days of life	-0.95 (1.09)	0.40	-0.44 (0.80)	0.60
Total N of passes	2.25 (1.41)	0.14	-1.63 (1.24)	0.22

- There was no significant effect of gestational age (P=0.94) and days of life (P=0.40), and number of suctioning passes (P=0.14) with respect to time to complete the suctioning sequence.
- There was no significant effect of days of life (P=0.60) and total number of suctioning passes with respect to return to baseline (P=0.22).
- There was a significant effect of gestational age and return to baseline (P=0.05). Each one week increase in gestational age was associated with 1.7 minutes longer to return to baseline.

Conclusions

- Tested guideline is tolerated by infants and no adverse events were observed.
- Neonates did experience mild to moderate pain.
- O_2 sat remained within acceptable ranges and no clinically significant concerns were raised with RR and HR.
- For 2nd and 3rd passes there was additional drop in O_2 sat.
- Neonatal response to suctioning while on NCPAP was not highly sensitive to days of life or gestational age.

Limitations

- **Small sample (pilot)**
- **One hospital**
- **One type of NCPAP**
- **Stable neonates**

Implications for Practice

- **Our tested guideline appears safe.**
- **Guideline should be tested in a larger sample with neonates on other types of NCPAP systems.**

Thank You

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