When to Transfer: Predictors of High Flow Nasal Cannula Failure in Children at a Community Hospital

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BACKGROUND

- To safely implement High Flow Nasal Cannula (HFNC) in community hospitals without an ICU, it is important to identify patients at risk for failure, enabling early transfer before deterioration
- Based on prior literature, partial pressure of carbon dioxide (pCO2) > 50 mmHg may predict failure, but less is known about other risk factors or the impact of a pCO2-driven protocol in the community setting

AIM

- **To determine factors associated with HFNC failure among children presenting to a community hospital**

METHODS

- **Design:** Retrospective cohort study
- **Population:** Patients < 18 years who received HFNC at a community hospital
- **Outcome:** HFNC failure = patient needs greater than floor limit per age policy, non-invasive positive pressure, or mechanical ventilation
- **Statistics:** Multivariable Poisson regression to calculate the risk of HFNC failure

RESULTS

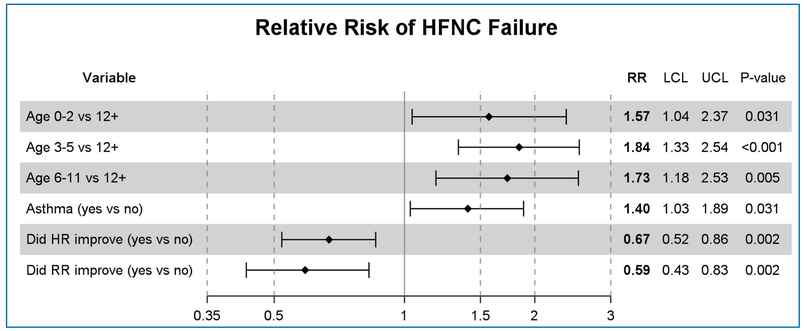
Table 1: Bivariate Analysis

- 194 patients received HFNC, and of those, 98 experienced failure
- Children in the HFNC failure group were more likely to have lower median weight, an asthma diagnosis and no improvement in vital signs
- Only 6 of the 98 patients who failed HFNC had pCO2 > 50 mmHg
- Demographic covariates (gestational age and race) were not predictors of failure
- Additional clinical covariates (viral lower respiratory tract infection, bacterial pneumonia, day of illness, initial O2 saturation) were **not** predictors of failure

Variable	Total n=194	No Failure n=96	Failure n=98	P-value
Weight (kg)	10.7 (7.9-12.6)	11.1 (8.9-12.8)	10.2 (7.2-12.0)	0.044
Age (months)				0.123
0-2	9% (17)	38% (6)	63% (10)	
3-5	12% (24)	33% (8)	66% (16)	
6-11	14% (28)	43% (12)	57% (16)	
12+	65% (127)	56% (70)	44% (56)	
Gestational Age (months)				0.657
Pre-term	10% (19)	58% (11)	42% (8)	
Term	49% (96)	47% (45)	53% (51)	
unknown	41% (81)	51% (40)	49% (39)	
Race				0.942
Non-white/other	20% (40)	50% (20)	50% (20)	
White	80% (156)	49% (76)	51% (78)	
Viral lower respiratory tract infection				0.719
No	4% (7)	57% (4)	43% (3)	
Yes	96% (189)	49% (92)	51% (95)	
Bacterial pneumonia				0.801
No	81% (158)	49% (77)	51% (80)	
Yes	19% (38)	51% (19)	49% (18)	
Asthma				0.042
No	74% (145)	54% (77)	46% (66)	
Yes	26% (51)	37% (19)	63% (32)	
Day of illness	3 (2-4)	3 (2-4)	3 (2-5)	0.370
Initial O2 saturation	87 (85-91)	87 (85-91)	87 (85-91)	0.574
Did HR improve?				0.001
Deteriorated or stay >90%ile for age	35% (69)	34% (23)	66% (45)	
Improve or stay <90%ile for age	65% (127)	58% (73)	42% (53)	
Did RR improve?				0.001
Deteriorated or stay >90%ile for age	60% (118)	40% (47)	60% (70)	
Improve or stay <90%ile for age	40% (78)	64% (49)	36% (28)	
pCO2 >50				0.031
No	96% (129)	48% (62)	52% (67)	
Yes	4% (6)		100% (6)	
PCO2 Value	38 (34-43)	38 (34-41)	39 (35-44)	0.108

Figure 1: Forest Plot

- Adjusted relative risk (aRR) of failure was highest in those < 12 months of age and those with concurrent asthma.
- aRR of failure was lowest in those who had improvement (defined as <90% for age) in their HR or RR after HFNC initiation



CONCLUSIONS

- Patients who were younger, had asthma or did not have an improvement in heart rate (HR) or respiratory rate (RR) after HFNC initiation were more likely to experience HFNC failure
- Few patients had pCO2 > 50

IMPLICATIONS

- **When implementing HFNC in community settings without an ICU, consider age, asthma status and change in vital signs (HR, RR) to identify children at risk of HFNC failure; pCO2 > 50 has limited utility as a screening tool for HFNC failure in the clinical setting**

LIMITATIONS / NEXT STEPS

- This is a single-center study
- Patients with medical complexity were excluded
- Further studies assessing weight based protocols for HFNC use may assist in clinical decision making

DISCLOSURES

- The authors of this poster have no conflicts of interest to disclose