Family Presence During Pediatric Tracheal Intubations

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IMPORANT Family-centered care, which supports family presence (FP) during procedures, is now a widely accepted standard at health care facilities that care for children. However, there is a paucity of data regarding the practice of FP during tracheal intubation (TI) in pediatric intensive care units (PICUs). Family presence during procedures in PICUs has been advocated.

OBJECTIVE To describe the current practice of FP during TI and evaluate the association with procedural and clinician (including physician, respiratory therapist, and nurse practitioner) outcomes across multiple PICUs.

DESIGN, SETTING, AND PARTICIPANTS Prospective cohort study in which all TIs from July 2010 to March 2014 in the multicenter TI database (National Emergency Airway Registry for Children [NEAR4KIDS]) were analyzed. Family presence was defined as a family member present during TI. This study included all TIs in patients younger than 18 years in 22 international PICUs.

EXPOSURES Family presence and no FP during TI in the PICU.

MAIN OUTCOMES AND MEASURES The percentage of FP during TIs. First attempt success rate, adverse TI-associated events, multiple attempts (>3), oxygen desaturation (oxygen saturation as measured by pulse oximetry <80%), and self-reported team stress level.

RESULTS A total of 4969 TI encounters were reported. Among those, 81% (n = 4030) of TIs had documented FP status (with/without). The median age of participants with FP was 2 years and 1 year for those without FP. The average percentage of TIs with FP was 19% and varied widely across sites (0%-43%; P < .001). Tracheal intubations with FP (vs without FP) were associated with older patients (median, 2 years vs 1 year; P = .04), lower Paediatric Index of Mortality 2 score, and pediatric resident as the first airway clinician (23%, n = 179 vs 18%, n = 584; odds ratio [OR], 1.4; 95% CI, 1.2-1.7). Tracheal intubations with FP and without FP were not different in the first attempt success rate (OR, 1.00; 95% CI, 0.85-1.18), adverse TI-associated events (any events: OR, 1.06; 95% CI, 0.85-1.30 and severe events: OR, 1.04; 95% CI, 0.75-1.43), multiple attempts (>3) (OR, 1.03; 95% CI, 0.82-1.28), oxygen desaturation (oxygen saturation <80%) (OR, 0.97, 95% CI, 0.80-1.18), or self-reported team stress level (OR, 1.09; 95% CI, 0.92-1.31). This result persisted after adjusting for patient and clinician confounders.

CONCLUSIONS AND RELEVANCE Wide variability exists in FP during TIs across PICUs. Family presence was not associated with first attempt success, adverse TI-associated events, oxygen desaturation (<80%), or higher team stress level. Our data suggest that FP during TI can safely be implemented as part of a family-centered care model in the PICU.


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The merits of family presence (FP) during resuscitative efforts and invasive procedures have been advocated for nearly 30 years. The nursing community has long been a strong proponent of FP, with position statements supporting the practice from leading national organizations, such as the Emergency Nurses Association and American Association of Critical Care Nurses, with several medical organizations following suit, including the American Heart Association and the American Academy of Pediatrics. Family-centered care, which supports FP during procedures, is now a widely accepted standard at health care facilities that care for children.

There are numerous family-, patient-, clinician-, and institutional-level factors that can either hinder or facilitate inclusion of the family during procedures and/or resuscitation. Barriers to FP include concern about family interference, lack of a hospital policy, potential increase in stress for the clinicians and family, performance anxiety, and concern for litigation. Evidence supports that the emotional benefits of FP often outweigh the risks and that families should have the right to be present. Many family members want to be present during procedures and find being present comforting to themselves and the patient. These families assert they would choose to be present in the future and would recommend FP to others.

The extent of FP during pediatric procedures performed in the hospital setting is not known, especially in the pediatric intensive care unit (PICU). To enhance our understanding of FP during airway management events, we evaluated the incidence of FP during tracheal intubation (TI) across multiple centers as well as the potential effect on TI performance in terms of the family’s presence during procedures and/or resuscitation.

The NEAR4KIDS registry data in this study included all TIs performed across 22 international PICUs from July 2010 to March 2014. Encounters in which the status of FP was documented were included. We excluded tracheal tube change or routine tracheostomy cannula change.

**Methods**

The NEAR4KIDS registry (National Emergency Airway Registry for Children) is an international multicenter collaborative, collecting TI quality and safety data across participating PICUs. Data collection has been either approved or declared exempt by the institutional review board at each of the 22 participating sites. A central institutional review board system was not used, as a central institutional review board was not uniformly accepted at all institutions at the time of study inception and data collection. The data coordinating center was approved to use the limited data set from all participating centers by the institutional review board and through data use agreements between each site and the data coordinating center. Patient consent was not obtained because the NEAR4KIDS registry was considered a quality-improvement project.

Each site project leader developed a site-specific compliance plan to ensure greater than 95% TI encounter capture rate and the highest accuracy of the data. Two compliance officers reviewed and approved the compliance plan for each site based on the available local resources. Prospective data collection occurs shortly after intubation by the supervising attending or fellow and includes patient demographics, process information, intubating clinician demographics, equipment used, and outcomes of the TI encounter (see the eAppendix in the Supplement for the data collection form). An illness severity score: Paediatric Index of Mortality (PIM2) was captured at the time of PICU admission. For each TI, an encounter was defined as 1 completed episode of advanced airway management intervention. Within each TI encounter, a course encompassed one method or approach to secure an artificial airway while an attempt was defined as a distinct advanced airway maneuver (eg, insertion of a device, such as a laryngoscope or laryngeal mask, into the patient’s mouth).

**Inclusion/Exclusion Criteria**

The NEAR4KIDS registry data in this study included all TIs performed across 22 international PICUs from July 2010 to March 2014. Encounters in which the status of FP was documented were included. We excluded tracheal tube change or routine tracheostomy cannula change.

**Definition of Outcomes**

Our primary outcome of interest was the occurrence of any adverse tracheal–associated events, occurrence of severe tracheal–intubation–associated events, multiple attempts, oxygen desaturation, and self-reported stress level. We defined severe tracheal–intubation–associated events as a tracheostomy, or direct airway injury. Nonsurgical tracheal–intubation–associated events included mainstem bronchial intubation (confirmed by chest radiograph), esophageal intubation with immediate recognition, emesis without aspiration, hypertension requiring therapy, epistaxis, dental or lip trauma, medication error, arrhythmia, or pain and/or agitation requiring additional medication with delay in TI. Multiple TI attempts were defined as 3 or more attempts during the initial TI course. Oxygen desaturation was defined as oxygen saturation as measured by pulse oximetry less than 80% during the TI course when the initial oxygen

**Findings:**

Family presence during tracheal intubation was highly variable across the participating PICUs, with some sites reporting over 90% FP and others reporting below 50%. First attempt success rate, occurrence of any tracheal–intubation–associated events, occurrence of severe tracheal–intubation–associated events, multiple attempts, oxygen desaturation, and self-reported team stress level were not significantly different between the groups with and without family presence.

**Meaning:**

Family presence during tracheal intubation can safely be implemented as part of a family-centered care model in the pediatric intensive care unit.
saturation after preoxygenation was greater than 80%. A clinician with a supervising role during the TI encounter documented the self-reported team stress level from 1 (high stress) to 7 (low stress). The team stress level was scored on a Likert scale based on the composite of the supervising attending, fellow, charge nurse, and senior respiratory therapist’s assessment as long as they were not the actual laryngoscopist and included input from as many team members as possible.

**Statistical Analysis**

The primary exposure of interest was TIs with FP vs without FP. The primary outcome was occurrence of any TIAEs for each TI course. Secondary outcomes included occurrence of severe TIAEs, need for multiple TI attempts, and oxygen desaturation less than 80%. Summary statistics are provided as percentages for categorical variables or median and interquartile range (IQR) for nonnormally distributed variables. Dichotomous categorical variables were analyzed using x² test, while continuous variables were compared using Wilcoxon rank-sum test. Statistical analysis was performed with Stata version 11.2 (StataCorp). A random-effect multivariate logistic regression model was developed with clustering by site and occurrence of any TIAE as a dichotomous outcome. Factors associated with FP status in the univariate analysis (P < .10) and also those known to be associated with TIAEs in previous studies, a priori, were included as covariates in this model. P values of less than .05 were considered statistically significant.

**Results**

A total of 4969 TI encounters were reported from July 2010 to March 2014 across 24 academic and private PICUs (median, 118 TI encounters per site; IQR, 56-277). The median time from admission to TI was 20 hours (IQR, 2-114 hours). Data regarding FP were missing in 837 TIs (17%). One site had no documentation of FP and all TIs (n = 99) were removed from the data set. Another site had just initiated the data collection and only 3 TIs were recorded; therefore, these data were removed from the analysis. Thus, FP status (with/without) was documented for 4030 TI encounters (81%) from 22 PICUs and these encounters were included for analysis. The average percentage of FP during TI was 19% (762 of 4030); however, this varied widely across the 22 participating PICUs (median, 12%; IQR, 2%-31%; range, 0%-43%; P < .001) (Figure).

**Patient Characteristics**

The median age of children for TI encounters with FP was 2 years (IQR, 0-7 years) compared with 1 year (IQR, 0-6 years) for TI encounters without FP (P < .04) (Table 1). The PIM2 scores were significantly lower for the children with FP vs without FP (1.6% vs 2.5%; P < .001). The most common primary diagnosis was respiratory in nature in both groups (Table 1). Tracheal intubations performed for a procedural indication were similar in both groups (16%, n = 123 vs 17%, n = 568). Time of day (daytime vs nighttime) was not associated with FP status (P = .08) (Table 1). Among the 12 ICUs with the highest FP rates (>10%), the patient age was higher in TIs with FP (median age, 2 years; IQR, 0-7 years) compared with TIs without FP (median age, 1 year; IQR, 0-6 years; P = .02). The PIM2 score was similar between TIs with FP vs without FP (1.5% for both). The indications between TIs with FP and without FP were similar to the overall analysis with the exception of procedure: 17% of TIs with FP were for procedural indication, and 20% of TIs without FP were for procedural indication (P = .04).

**Clinician and Practice Characteristics**

A pediatric resident was more commonly the first airway clinician in TIs with FP vs TIs without FP (23%, n = 179 vs 18%, n = 584; odds ratio [OR], 1.4; 95% CI, 1.2-1.7) (Table 2). Direct laryngoscopy was used most frequently as the first device in both groups (Table 2). With regard to sedating medications, fentanyl was used more often in cases with family absent vs FP (63%, n = 2060 vs 56%, n = 428; P < .001), whereas midazolam was used more often when the family was present vs absent (63%, n = 477 vs 56%, n = 1821; P = .001) (Table 2).
Neuromuscular blockade use was common in both groups without significant difference.

**Tracheal Intubation Success and Adverse Tracheal Intubation–Associated Events**

First attempt success rate (OR, 1.00; 95% CI, 0.85-1.18), occurrence of any TIAEs (OR, 1.06; 95% CI, 0.85-1.30), occurrence of severe TIAEs (OR, 1.04; 95% CI, 0.75-1.43), multiple attempts (>3) (OR, 1.03; 95% CI, 0.82-1.28), and oxygen desaturation (<80% oxygen saturation as measured by pulse oximetry) (OR, 0.97; 95% CI, 0.80-1.18) were not significantly different between the 2 groups (Table 3). The self-reported team stress level was also not significantly different between FP vs no FP (Table 3). After adjusting for patient and clinician factors and clustering by site, FP again was not associated with first attempt success (OR, 1.04; 95% CI, 0.86-1.26), occurrence of any TIAEs (OR, 0.94; 95% CI, 0.73-1.19), occurrence of severe TIAEs (OR, 0.92; 95% CI, 0.63-1.33), multiple attempts (>3) (OR, 0.90; 95% CI, 0.70-1.16), oxygen desaturation (<80%) (OR, 0.90; 95% CI, 0.72-1.12), or self-reported team stress level (OR, 1.11; 95% CI, 0.90-1.36) (Table 4).

**Discussion**

To our knowledge, our study is one of the few to report on FP specifically during TIs and to assess associations between FP and procedural outcomes in the PICU setting. Our large prospective study across 22 PICUs demonstrated that FP is highly variable, ranging from 0% to 43%. Interestingly, the presence of a family member was most common when the resident was the first clinician attempting TI. In addition, FP was more likely when the median age of the child was a little older (2 years vs 1 year) and when children had a lower risk for mortality as estimated by the PIM2 score. There was no significant association between FP and TI performance as assessed by first attempt success, the need for multiple attempts (>3), adverse TIAEs, oxygen desaturation (<80%), or self-reported team stress level.

Family-centered care is at the forefront in the medical management of pediatric patients. Several studies have evaluated the role of FP in the context of pediatric procedures and during resuscitation. One study assessed the effect on relatives during resuscitations in an emergency department (ED) setting. Many
relatives who were present demonstrated a trend toward lower
degrees of intrusive imagery, posttraumatic avoidance behavior,
and symptoms of grief when assessed 3 months after the
resuscitation.21 Bauchner et al22 observed that 62% of parents
remained present for an ED procedure (venipuncture or intra-
venous cannulation) largely owing to the perception that they
could provide support to their child; importantly, 42% of the par-
ents who were not present would have preferred to be present
if given the chance. In pediatric studies that included TIs, many
parents and families felt that their presence benefited the child
in regard to providing relief for anxiety and assisting the health
care team.23-25 One study performed in a PICU reported both
nurses and parents thought the family’s presence was helpful
during invasive procedures including TI.25

The wide variability of FP in our data set, without obvi-
ous association with other patient or clinician factors, is con-
sistent with other investigations that observed that clinicians
do not universally support the practice of FP during invasive
procedures. Many factors, such as clinician years of experi-
ence in nursing or critical care, physical environment (eg, lo-
gistics of ICU design and room size), and supportive institu-
tional policy, play a critical role in shaping clinicians’ percep-
tions of FP.26 Although supported as a best practice by
leading national organizations, support for FP varies among
clinicians and settings. In university-based PICUs in the United
Kingdom and the United States, most nurses and physicians
believed that parents should be given the option of being
present during resuscitation.27 In contrast, our findings sug-

### Table 2. Clinician and Practice Characteristics Along With Family Presence (N = 4030)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Family, No. (%)</th>
<th>P Value *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Present (n = 762)</td>
<td>Absent (n = 3268)</td>
</tr>
<tr>
<td>First airway clinician</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pediatric resident</td>
<td>179 (23)</td>
<td>584 (18)</td>
</tr>
<tr>
<td>Pediatric CCM fellow</td>
<td>222 (29)</td>
<td>1326 (41)</td>
</tr>
<tr>
<td>CCM attending physician</td>
<td>112 (15)</td>
<td>363 (11)</td>
</tr>
<tr>
<td>Other</td>
<td>249 (33)</td>
<td>995 (30)</td>
</tr>
<tr>
<td>Attending physician presence, %</td>
<td>663 (87)</td>
<td>2822 (86)</td>
</tr>
<tr>
<td>Medication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fentanyl</td>
<td>428 (56)</td>
<td>2060 (63)</td>
</tr>
<tr>
<td>Midazolam</td>
<td>477 (63)</td>
<td>1821 (56)</td>
</tr>
<tr>
<td>Ketamine</td>
<td>203 (27)</td>
<td>839 (26)</td>
</tr>
<tr>
<td>Propofol</td>
<td>125 (16)</td>
<td>467 (14)</td>
</tr>
<tr>
<td>Neuromuscular blockade</td>
<td>685 (90)</td>
<td>3006 (92)</td>
</tr>
</tbody>
</table>

### Table 3. TI Process and Outcomes Categorized by Family Presence (N = 4030)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Family, No. (%)</th>
<th>Unadjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Present (n = 762)</td>
<td>Absent (n = 3268)</td>
</tr>
<tr>
<td>First attempt success*</td>
<td>463 (61)</td>
<td>1985 (61)</td>
</tr>
<tr>
<td>TIAEs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any</td>
<td>136 (18)</td>
<td>558 (17)</td>
</tr>
<tr>
<td>Severe</td>
<td>52 (7)</td>
<td>215 (7)</td>
</tr>
<tr>
<td>Multiple attempts (≥3)*</td>
<td>117 (15)</td>
<td>491 (15)</td>
</tr>
<tr>
<td>Desaturation (&lt;80%)</td>
<td>167 (22)</td>
<td>733 (22)</td>
</tr>
<tr>
<td>Clinician stress level, median (IQR)</td>
<td>6 (5-7)</td>
<td>6 (4.5-7)</td>
</tr>
</tbody>
</table>

Abbreviations: IQR, interquartile range; OR, odds ratio; TI, tracheal intubation; TIAEs, tracheal intubation–associated events.
* No. of attempts was missing in 2 encounters.
interferes with usual resuscitation procedures, negatively affects patient outcomes, or increases clinicians’ stress. In a study of 197 pediatric patients treated in a trauma ED who required many interventions including TIs, only approximately 10% of the family members needed to be excluded from the ED, primarily for emotional reasons. Moreover, no family member interfered with medical care. Nigrovic et al reported no difference in pediatric lumbar puncture success rate in an ED setting with FP (87%) vs without FP (84%). With regard to the findings of differential use of midazolam and fentanyl, we can speculate whether the use of midazolam was prevalent in the FP group owing to the older children potentially having more anxiety or owing to a desire to have medications with amnestic properties in these children; however, based solely on our findings, this is not certain. Similarly, it is unclear why a higher percentage of patients with no FP received fentanyl. Did these patients seem to have more pain or the need to preserve good hemodynamics? Given the preponderance of evidence that FP is beneficial during pediatric medical care combined with our evidence that there are no significant negative effects associated with FP during TIs in the PICU setting, we should further evaluate the specific risks and benefits of FP.

Our study had several limitations. This was an observational study and there was no randomization of FP for the TIs. It is likely that there was some subjective selection bias for participation in FP by clinicians and by families. We do not have data about the presence of a formal policy for all study sites stating criteria of when families were allowed to be present, whether families declined after being given the opportunity to be present, or whether support personnel were available to offer explanations and answer questions during TIs. Consequently, we were unable to demonstrate a causal association. It is unclear whether there were site-specific cultural influences or biases related to allowing families to be present or not during TI based on patient acuity, physician concerns, or perceived urgency, which could have influenced the observed outcomes. Team stress level was assessed using a Likert scale by a composite of the supervising attending, fellow, charge nurse, and senior respiratory therapist after gathering feedback from all the team members; however, there was no specific formula used in quantifying each team member’s level of stress in determining this overall stress level. Thus, there is the possibility of supervising clinician bias in the reported team stress levels. In addition, specific feedback was not gathered from clinicians regarding their experiences with FP during TIs. Seventeen percent of the TIs were without documentation of FP (missing data). The TI encounters without documentation occurred in less sick patients, with a similar occurrence of TIAEs and less frequent severe TIAEs. This could have biased our results.

Institutional or unit-based policies are needed to support clinicians’ acceptance and use of FP. Clinicians in an ICU setting viewed FP more favorably following an education session and guideline development about the risks and benefits of FP, and more families were invited to be present at resuscitations and invasive procedures following that education. In future studies, the perspective of all clinicians involved with pediatric TIs with FP needs to be understood in order to effectively institute improvements. Determining patient acuity just prior to TI will also provide more insight into the factors that may affect FP. In addition, interviewing family members after pediatric TIs will provide invaluable insight on the perceptions of the care being provided.

Conclusions

Wide variability exists in FP during TI across PICUs. Family presence was not associated with worse first attempt success, adverse TIAEs, oxygen desaturation (<80%), or higher team stress level. Our data suggest that FP during TI can safely be implemented as part of a family-centered care model in the PICU.
and Michelle Hoot, PhD (Children’s Hospital of Richmond at VCU); Philip C. Spinella, MD, and Allan Dowling (University of Virginia School of Medicine); Emily Wasserman, MD, and Steven Pon, MD (Weill Cornell Medical College/New York Presbyterian Hospital); Aabraar Qaasim, MD, and Ryan Breuer, MD (Women and Children’s Hospital of Buffalo); Lee A. Polkoff, MD, and Josep Paniello, MD (Yale-New Haven Children’s Hospital); James Schneider, MD (MD Cohen Children’s Medical Center); Katherine Biagas, MD (Columbia University Medical Center); and Aileen Kirby, MD (Oregon Health and Science University/Doernbecher Children’s Hospital).

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REFERENCES


