Title: Predictive Ability of Difficult Intravenous Access Score on IV Cannulation Failure

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Introduction: Establishing intravenous (IV) access is a common and sometimes frustrating procedure. In pediatric patients, the veins are often small and embedded in subcutaneous fat; furthermore, visible veins may have been exhausted in previous IV insertion attempts. Yen et al.¹ created a 4-variable proportionally weighted predictive rule based on a study 615 patients age 0-21 years old. The aim of this study is to evaluate the ability of their Difficult Intravenous Access Score (DIVA) to predict failed IV starts in children.

Methods: With IRB approval, we enrolled 167 pediatric patients with non visible veins, 0-17 years old. Potential difficulty of IV insertion was evaluated with a modified DIVA score in which 3 points were given for prematurity, 3 points for age ≤ 1 year, 1 point for age 1-2 years, and 2 points when veins were not palpable. The IV catheters were inserted by an experienced team of nurses; about half were positioned using routine technique and about half of the IV starts were facilitated with a VeinViewer (VV) system. Gender, age, previous IV, previous hematoma, location of cannulated vein, and race were considered covariables in our analysis. DIVA score was also included as a continuous predictor in a logistic regression model to estimate its independent association with IV starts failure. The predictive ability of the DIVA score alone, of the covariables alone, and of all predictors (DIVA score + covariables) combined, was measured by using C-statistics. Also, 95% Mann-Whitney confidence limits for the C-statistic were estimated for each model.

Results: Three patients were excluded due to missing data; 81/164 (49.4%) had failed IV start. DIVA score was not associated with IV start failure, either univariately (P=0.35, chi-squared test; OR [95% CI] of 1.08 [0.92, 1.28] for relative increase of 1 unit) or after adjusting for covariables (P=0.44, 1.08 [0.89, 1.33]. ROC curves for the three predictive models are given in Figure 1. The C-statistic [95% CI] was 0.56 [0.48, 0.65] using DIVA score alone, 0.642 [0.558, 0.727] for the model including only the covariables, and 0.66 [0.57, 0.74] using DIVA score and covariables combined. These C-statistics were not significantly different (Table 1).

Discussion: The DIVA score poorly predicted IV start failure in our patients, possibly due to differences in patients (i.e., none of whom had visible veins), providers experience, and smaller sample size.


<table>
<thead>
<tr>
<th>Covariates† alone - DIVA Alone</th>
<th>Difference (95% CI*)</th>
<th>P-Value*</th>
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<tbody>
<tr>
<td></td>
<td>0.079 [-0.063, 0.221]</td>
<td>0.55</td>
</tr>
<tr>
<td>(Covariates and DIVA) - DIVA alone</td>
<td>0.095 [-0.017, 0.207]</td>
<td>0.13</td>
</tr>
<tr>
<td>(Covariates and DIVA) - Covariates Alone</td>
<td>0.016 [-0.032, 0.064]</td>
<td>&gt;0.99</td>
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</tbody>
</table>

*Confidence limits and P-values adjusted using the Bonferroni method. †Covariates include gender, age, previous IV, previous hematoma, location of cannulated vein, and race

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**Table 1**

**Comparison**

**Comparison**

**Comparison**

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**Fig 1**