The Effectiveness of Electrocardiogram Tip Confirmation System As Compared to Chest Radiography in Peripherally Inserted Central Catheter (PICC) Placements.

BACKGROUND
- The goal in inserting a central venous catheter (CVC) is to have the catheter tip in optimal location thus avoiding catheter-related complications.
- The most appropriate PICC tip location is the lower one third of the SVC close to the junction of the SVC and the right atrium, also known as Cavo-Atrial Junction (CAJ).
- At SJO, most patients (~72%) with PICC inserted by the Vascular Access Team (VAT) are confirmed by ECG tip confirmation method. The only exception is critical care where the Intensivists order chest X-ray (CXR).

PURPOSE
- Evaluate the success rate and malposition rate of PICC placement using the ECG tip confirmation system.
- Reduce the cost of care by eliminating radiographic confirmation and decreases patient exposure to radiation.
- The goal of this project was to adopt ECG technique for eligible patients as the preferred method for PICC tip confirmation at SJO.

METHODS
- Sample: 350 adult patients (>18 yrs.) in critical care with successful PICC placement by VAT from January 2017 to December 2019 were enrolled.
- Eligibility: Normal surface ECG with P wave present, identifiable and consistent.
- Retrospective chart review of 350 PICC placements in critical care by VAT nurses. ECG confirmation record and post-insertion CXR report reviewed and compared for accurate tip placement.

RESULTS
- ECG tip confirmation method had a tip positioning accuracy of 92.86% (325/350) success rate as verified by CXR report.
- Of the 350 PICCs positioned with ECG technique, malposition of the PICC was observed in 25 cases (7.14%), 3% in sub-optimal and 4% in aberrant position.

<table>
<thead>
<tr>
<th>Accuracy and Malposition Rate of ECG confirmation</th>
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<tbody>
<tr>
<td>Confirmed by 3CG and CXR</td>
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<tr>
<td>2019</td>
</tr>
<tr>
<td>2018</td>
</tr>
<tr>
<td>2017</td>
</tr>
<tr>
<td>Total</td>
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Comparison of Cost & Time to use Between Methods

<table>
<thead>
<tr>
<th>Estimated cost of placement verification</th>
<th>Confirmed by ECG</th>
<th>Confirmed by CXR</th>
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<tbody>
<tr>
<td>Released for use of PICC</td>
<td>$0</td>
<td>$400.00 (does not include radiologist fee)</td>
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<tr>
<td>Upon completion of insertion</td>
<td>49 minutes (time to stat report)</td>
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LIMITATIONS
- Assessment of catheter tip position on CXR is subject to observer variability and leads to treatment delay.

DISCUSSION
- This project demonstrated that ECG tip confirmation offers a high success rate and low malposition rate leading to more successful PICC placements.
- ECG method reduces cost of care because unnecessary confirmatory X-ray is eliminated.
- ECG tip confirmation allows the PICC to be used immediately as compared to waiting time for CXR (~ 49 minutes).
- It reduces treatment delays and delays caused by repositioning.
- Shared data with management and intensivists. Small changes in progress.
- ECG method is a safe, accurate, and inexpensive method for verifying PICC tip location at the bedside. It allows for real-time placement verification and eliminates the need for CXR.

REFERENCES
References available upon request: Ricardo.Guinto@stjoe.org