Hot Topic

Patient Satisfaction in the Nursery
Our speaker for this program is Dr. Darci R. Block, an Assistant Professor of Laboratory Medicine and Pathology as well as a consultant in the Clinical Core Laboratory at Mayo Clinic in Rochester, Minnesota.
Disclosures

• None

I have no disclosures
Today I’ll be sharing a process improvement project we completed about a year ago to improve patient satisfaction in our newborn nursery.

The challenge for any phlebotomy service is identifying when an error was made and having a way to stop it from perpetuating itself downstream or reoccurring in future collections that person or others may perform. There is no such thing as quality control for the preanalytic phase of testing that is equivalent to what testing laboratories run to monitor quality in the analytic phase. So we rely on surrogates of quality including quality indicators and look for trends when investigating error reports.
During our normal event review process, we noticed an increasing number of complaints of bruised heels in our newborn nursery located at the Mayo Clinic Rochester Methodist campus. In this location, blood is primarily collected for newborn screening and occasionally bilirubin.

Introduction

- Newborn nursery at Rochester Methodist Campus
- All newborns have blood collected 24-48 hours after birth
- Increasing complaints of bruised heels reported by nurses and parents
The entire heel puncture process, the standard operating procedure, and training documents were reviewed and it seemed as though nothing was amiss. We consulted with our phlebotomy education team and the only thing they could speculate was the possibility that warming the heel, which is meant to get blood flowing to that area in order to facilitate the collection, was somehow lending itself to an increased risk of causing a bruise.
After scouring the published literature on this topic, we essentially came up empty handed and did not have evidence that heel warming was, in fact, the cause.
The closest relevant study was published in 1996 where the aim was to determine whether warming a newborn heel prior to capillary puncture made the blood easier to collect. They used a randomized control trial where 81 heel punctures were performed. They measured the time to collect a standard volume of blood, the number of specimens requiring recollection, and assessed the infant’s behavior responses as a means to quantify pain in a cohort where a warm pack was applied to the heel compared to a cohort where the heel was not warmed prior to heel puncture.
In that study they concluded that the heel temperature was not an important factor in capillary blood sampling, as they did not observe significant differences in the overall ease of blood collection or pain response when the heel was warmed compared to when it was not.

<table>
<thead>
<tr>
<th></th>
<th>Unwarmed</th>
<th>Warmed</th>
<th>Notes</th>
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<tbody>
<tr>
<td>n</td>
<td>40</td>
<td>41</td>
<td></td>
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<tr>
<td>Median sampling time (sec)</td>
<td>40</td>
<td>44</td>
<td>NS</td>
</tr>
<tr>
<td>Repeats</td>
<td>20%</td>
<td>12%</td>
<td>NS</td>
</tr>
<tr>
<td>Median heel temperature (°C)</td>
<td>30.8</td>
<td>35.4</td>
<td>ΔT=+4-7 °C</td>
</tr>
<tr>
<td>Grimacing</td>
<td>80%</td>
<td>80%</td>
<td>NS</td>
</tr>
<tr>
<td>Grimacing + crying</td>
<td>25%</td>
<td>34%</td>
<td>NS</td>
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So we asked ourselves whether we should discontinue the use of heel warmers if they don’t improve the ease of collection and may be contributing to an increased risk of bruising. In theory, we could also solve the problem by not doing heel punctures, but this represented a seismic shift in the current process and not worth pursuing at the time.
We essentially set out to repeat the Barker study collecting blood from newborn heel punctures with and without prior warming. We gathered much of the same data as the original study, minus the pain assessment. In addition, we collaborated with nurses, asking them to help by assessing the heel for bruising both at baseline and postcollection. They also documented the time that the assessment was performed so we could determine the amount of time elapsed between collection and bruising assessment.

### Rochester Study

- Does heel warming increase frequency of bruising?

**Methods**

<table>
<thead>
<tr>
<th>Patient</th>
<th>Heel Assessment</th>
<th>Equipment</th>
<th>Specimen</th>
</tr>
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<tbody>
<tr>
<td>Newborns at Methodist Hospital (Rochester)</td>
<td>Prior bruising</td>
<td>Heel puncture device</td>
<td>Volume collected</td>
</tr>
<tr>
<td>Age (days)</td>
<td>Postcollection bruising (at least 1 hour)</td>
<td>Heat pack</td>
<td>1st attempt success</td>
</tr>
<tr>
<td>Weight (kg)</td>
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<td>Rate blood flow</td>
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The patient demographics of the study population were matched for age, weight, volume of blood collected, and amount of time postcollection that the bruising assessment was performed. The number of phlebotomists doing collections during the time period was also held fairly constant. The only significant difference in the population was gender, with more females being collected without prior heel warming, which is not expected to impact the results.
The results of our study demonstrated a trend toward more bruising in the nonheated group, compared to the baseline bruising rate and to the group where the heel was warmed prior to collection, though the p-values did not reflect statistical significance.
Similar to the Barker study, we observed trends toward easier collections when the heel was warmed prior to puncture, however, as they also reported, the differences did not reach statistical significance despite including over double the number of subjects in each group.
From this study we concluded that the bruising rate was not significantly improved, and in fact suggested the opposite when heels weren’t warmed prior to collection. As a result, we’ve continued the practice of warming newborn heels prior to puncture. However, in comparing the results of our study to the 1996 study it appears that there is one dramatic difference worth mentioning. The standard volume of blood collected 20 years ago was reported as 0.15 mL, which is quite a bit less than the 0.5 mL we found we needed to fill 5 spots on the newborn screen filter paper. This is not all that surprising considering the amount of growth in the field of newborn screening programs and the corresponding increase in blood volume and number of spots needed to complete that testing.
What seemed like a laughable solution earlier started losing its humor and we started to wonder whether we should, in fact, be doing more venipunctures than heel punctures. Which is more painful for the baby? Which is least likely to result in the need for a second poke due to an unsuccessful collection attempt or due to poor specimen quality and need for recollection?
A meta-analysis in 2011 analyzed the results from 6 studies where pain was assessed in newborns both with and without administering sucrose prior to venipuncture and heel puncture procedures. The results demonstrated a larger difference in pain response for those babies who did not receive sucrose, suggesting venipuncture was the less painful collection method. Venipuncture was also less painful when sucrose was given, but the magnitude of the difference in the pain response was not as large comparing a standardized mean difference of -0.34 to -0.75 without sucrose. This supports the practice of administering sucrose solution to newborns prior to an invasive procedure as a pain-reducing method. The authors stated venipuncture is preferred over heel puncture, though qualified that statement by saying it is important to recognize this may only be true if the phlebotomist is highly skilled at performing venipuncture in that pediatric patient population.
In order to assess the skill level of our pediatric phlebotomists we turned toward our quality indicators. The one we focused on was the rate in which the phlebotomist obtains a sample successfully on the first attempt. At the time, we only monitored venipuncture success since it is their primary skill, so we began and continue to monitor heel puncture success rates, which you can see compared to venipuncture success rates in our NICU and PICU population as well as an outpatient pediatric unit, indicates very similar success rates despite the differences in population and setting.
Since venipuncture is less painful, the required volume for a standard collection is larger than it was decades ago, and we are equally successful at collecting blood with either method, it begs the question whether venipuncture should be used more often or possibly even exclusively. The answer is actually complicated. It turns out that heel puncture is the preferred collection route to obtain capillary blood for newborn screening collections, at least in the state of Minnesota, so unless that changes the answer is probably no.
In conclusion, we reassured ourselves that the current heel puncture process is not flawed; however, the volume of blood collected per puncture seems to be an important factor in increasing the risk of bruising. In response, we have changed our policy to perform venipuncture in the event of 2 unsuccessful heel puncture attempts. We also work with the unit to schedule the newborn screen collection separate from when other tests might be collected. This minimizes the volume of blood collected by heel puncture and the phlebotomist will often collect those other tests by venipuncture. Both changes do mean those babies get 2 pokes, however, allowing venipuncture to collect the blood needed for the other lab tests has led to a decrease in complaints of bruised heels. We had the support of nursing to implement these changes since we used an evidence-based approach that demonstrates venipuncture is less painful than heel puncture, and performing venipuncture doesn’t increase the number of pokes needed to obtain the necessary blood. We are also in the process of updating the patient education materials so we can clearly communicate the updated process for collecting blood in newborns to include venipuncture, which will help manage any possible gaps between parental expectations and reality.
I would like to acknowledge the pediatric phlebotomy team for all they do every day as well as the following members of our team, listed here, who helped with this project:

- Methodist Campus Pediatric Phlebotomy team
- Twyla Rickard, Operations Manager
- Linda Backus, Supervisor
- Colleen Pederson, former Supervisor
- Jesica Foster, Assistant Supervisor
- Laurie Griesmann, Quality Specialist
- Mohammed Mustafa, Systems Engineer
I also want to invite you to mark your calendar for April 20th to the 21st, when we will be hosting the Phlebotomy Conference 2017, where we will be focusing on guidelines, generations, and good practices. See you there.
References

- Shah VS, Ohlsson A: Venipuncture versus heel lance for blood sampling in term neonates. Cochrane Database Syst Rev 2011;10(figures 1, 2)
Questions or requests…

Email to: MMLHotTopics@mayo.edu

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