Foam Padding in Pneumatic Tube Carriers Reduces G-Forces and Sample Hemolysis Rates

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Background

Hemolysis can occur via acceleration from transport in Pneumatic Tube Systems (PTS); however, other sources exist.

To determine the cause and efficacy of intervention, we evaluated hemolysis rates and g-forces experienced by samples before and after foam-padded PTS carriers were implemented as part of an effort to improve specimen quality from high-rejection rate patient care areas.

Methods

Evaluation and reduction of neonatal intensive care unit (NICU) hemolysis rates

1. **Baseline**. Samples collected from neonatal patients in the NICU (n = 59) were centrifuged at the collection site and hand carried to the laboratory for clinical testing.
2. **Unpadded PTS transport**. NICU samples (n = 150) were transported to the laboratory by PTS using unpadded carriers, which was the standard practice at the time of this investigation.
3. **Foam-padded PTS transport.** In an attempt to reduce hemolysis, NICU samples (n = 56) were embedded in a foam insert within the PTS carrier prior to PTS transport to the laboratory.

Measurement of hemolysis

Sample hemolysis was determined by a combination of visual inspection by trained clinical laboratory technologists and/or laboratory information system (LIS) comments/sample rejection based on hemolysis index (Roche Diagnostics).

Evaluation of g-forces on samples

To test whether padding reduced vibration that causes hemolysis, Motryx VitalVials measured the g-forces experienced by the samples in unpadded and padded carriers during PTS transport. Automated software calculated the VitalMetric, based on the area-under-the-curve (AUC) developed by Streichert et al. 2011, which relates to indicators of hemolysis (e.g., elevated LDH and potassium). Replicate measurements for PTS transport from the NICU or Adult Emergency Department (ED) to the Chemistry Laboratory were collected (n=6) for each PTS route.

Results

- The baseline NICU hemolysis rate, without PTS transport, was 27% (0% rejection). This hemolysis rate is due to both specimen collection and intravascular hemolytic events. VitalMetric is effectively zero.
- Transporting samples by unpadded PTS carrier leads to a 61% hemolysis rate (11% rejection).
- PTS transport using foam-padded carriers showed a similar overall hemolysis rate (61%) but eliminated sample rejections (0%).
- NICU samples in foam-padded carriers experienced 30% lower g-forces compared to unpadded.
- Using foam-padding in the ED, a longer PTS route, reduced total g-forces by 26%.

Conclusion

Foam padding reduced g-forces during PTS transport which resulted in fewer hemolysis-related sample rejections.

The VitalMetric can be used to assess the safety of PTS transport for blood samples, and the efficacy of mitigation strategies to reduce hemolysis.

Evaluation of

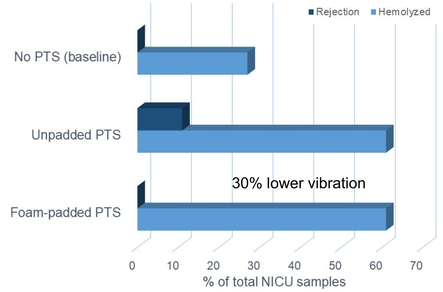
pneumatic tube system

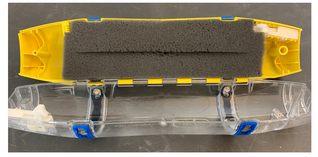
g-forces can guide solutions to

reduce sample hemolysis rates

Scan to watch our
AACC “Laborastory” on reducing NICU hemolysis rates.

Figure 1. NICU hemolysis and sample rejection rates before and after implementing foam-padded PTS carriers (right).





Foam-padded PTS carrier implemented for NICU sample transport.

Figure 2. Total g-forces from PTS transport as measured by the VitalVial (right).

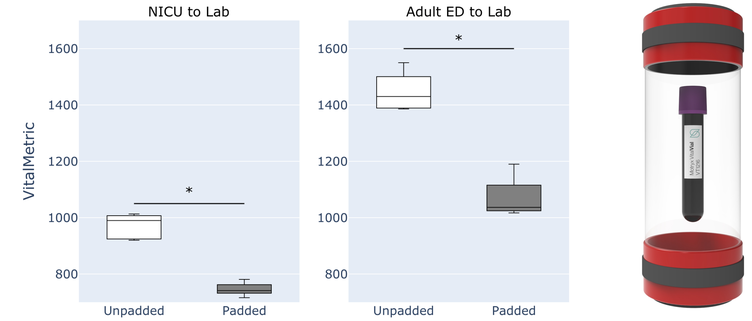


Figure 3. Acceleration records from VitalVial from transits from the NICU, Unpadded and Padded. Boxes show areas zoomed in on right.