Methodological Concerns Comparing Buzzy to Transilluminator Device

Amy L. Baxter · M. Louise Lawson

Received: 2 August 2013 / Accepted: 6 August 2013 / Published online: 3 September 2013
© Association of Clinical Biochemists of India 2013

As the physician inventor and manufacturer of the Buzzy device, I read with interest the article by Dr. Lima-Oliveira et al., “Quality Impact on Diagnostic Blood Specimen Collection Using a New Device to Relieve Venipuncture Pain.” A coauthor and statistician also evaluated the results and methodology. We have concerns both with the methodology, analysis, and discussion of the findings presented.

The article describes that Buzzy is applied proximal to the puncture site for 1 min before venipuncture and “continued until the end of the same procedure already done in the left forearm”. It is not clear whether Buzzy was applied first for 1 min, then blood was drawn in the opposite side, then subsequently blood was drawn, but total Buzzy application time would be between 90 and 180 s. While the article does not mention that Buzzy was applied with a tourniquet, photographs show that Buzzy was applied with the tourniquet strap included in the package. One photo shows the black strap constricting the patient’s arm; as the strap is elastic, in order to maintain Buzzy’s position venous compression would be experienced. The methods do specify that the transilluminator device was applied without tourniquet. It is clear that there was no randomization between whether blood was drawn first from the right or left arm. In all cases blood was drawn from the transilluminator side first, making any impact of delay or order of draw a potential confounder.

Even assuming the lowest duration of Buzzy with tourniquet strap application, this is not how Buzzy is

instructed to be used. Rather than waiting 1–2 min, the package insert recommends application and immediate blood draw. Studies have all been conducted with placement or holding of Buzzy followed immediately by performing the phlebotomy [1–3]. In contrast to relieving the pain of IM shots, the theoretical concerns of both vasoconstriction and triggering cold agglutinins do not support prolonged application of Buzzy, and we are concerned that this article supports an incorrect usage of the device.

While we were pleased to find very few differences between the lab results between the two methods, the differences found echoed the differences Dr. Lima-Oliveira found in a previous paper comparing tourniquet versus the transilluminator device. Per the tourniquet/transilluminator paper [4], total protein, albumin, triglycerides, glucose, potassium, and calcium were variably affected depending on duration of tourniquet. Per the Buzzy/transilluminator paper, “clinical” differences were found for total protein, albumin and transferrin, similar to the differences seen with 90 s tourniquet application in the previous paper. Mean percentage differences in the two studies are shown in Table 1.

In the Buzzy study the labs are described as clinically significant, despite having lower mean difference than Dr. Lima-Oliveira’s previous study. It appears that Dr. Lima-Oliveira has determined that differences outside the allowed bias for laboratory quality control constitute clinically significant differences. In laboratory quality control, multiple analyses of the same sample are run and compared to a reference database for optimal minimum differences, which are not generally achieved in the laboratory setting [5]. In fact, according to the author of the reference database that Dr. Lima-Oliveira used, “If the laboratory’s priority is detection of random error, the specification for imprecision shown in the database can be used,” meaning that differences less than these can be considered random

A. L. Baxter (✉)
Pediatric Emergency Medicine Associates, Medical College
of Georgia, 322 Sutherland Place NE, Atlanta, GA 30307, USA
e-mail: abaxter@mmjllabs.com

M. L. Lawson
Department of Mathematics and Statistics, Kennesaw State
University, Kennesaw, GA, USA

Table 1 Comparison numbers between transilluminator versus Buzzy and transilluminator versus Tourniquet, with percentage mean difference between paired results

	Units	Trans	Buzzy	%Diff	Trans	Tourniquet	%Diff
Glucose	mmol/L	4.66 (4.33–5.11)	4.66 (4.27–5.11)	0	4.77 ± 1.0	4.83 ± 1.0	1.2
Total protein	g/L	78.9 ± 3.6	80.1 ± 4.4	1.5	76.0 ± 6.0	79.0 ± 6.0	3.8
Albumin	g/L	47.9 ± 3.4	48.9 ± 3.7	2	46.0 ± 4.0	48.0 ± 5.0	4.2
Transferrin	g/L	2.27 ± 0.3	2.31 ± 0.3	1.7	NR	NR	
AlkPhos	μkat/L	1.14 ± 0.3	1.19 ± 0.3	4.2	1.53 ± 0.37	1.56 ± 0.39	1.9
Triglyceride	mmol/L	78.9 ± 3.6	80.1 ± 4.4	1.5	1.63 ± 0.95	1.68 ± 0.96	3.0
Potassium	mmol/L	4.0 ± 0.3	4.0 ± 0.4	0	4.2 ± 0.2	4.3 ± 0.4	2.3
Sodium	mmol/L	144.3 ± 1.8	144.3 ± 1.9	0	142.2 ± 3.2	142.7 ± 3.2	0.4
Phosphate	mmol/L	1.32 ± 0.2	1.30 ± 0.2	−1.5	1.17 ± 0.16	1.18 ± 0.19	0.8
Calcium	mmol/L	2.36 ± 0.1	2.37 ± 0.1	0.4	2.35 ± 0.12	2.40 ± 0.12	2.1
Magnesium	mmol/L	0.81 ± 0.06	0.81 ± 0.07	0	0.810 ± 0.08	0.827 ± 0.08	2.0

NR not reported

error [6]. The laboratory imprecision (i.e. random error) allowable for laboratory quality control for total protein, albumin and transferrin are 1.4, 1.6 and 1.5 respectively, which are higher than the differences of 1, 1 and 0.04 shown in the paper. The differences shown in the paper are also smaller than the analytic coefficients of variation reported for the laboratory used in the study, again indicating that the differences are less than the differences expected due to random variation in the laboratory assays.

According to the authors of the reference database, there is a measure appropriate for clinical differences. Specifically, “The numerical value that delineates medically significant changes between two results, classically named “critical difference” [7] and today called reference change value (RCV), comes from the formula: $RCV = k \times \sqrt{2} \times \sqrt{CV_A^2 + CV_I^2}$, with $k = 1.65$ for a one tail test and a probability risk α of 95 %, and CV_A and CV_I the analytical and the within-subject (or intraindividual) coefficients of variation, respectively [7].” The RCV values for total protein, albumin and transferrin based on the CV_A values reported in the paper are 7.7, 6.9 and 7.5. Thus, the differences reported by Dr. Lima-Oliveira would not be considered medically significant.

While both transilluminator papers refer to the device as the “Gold Standard”, traditional lab value textbooks presumably used tourniquet samples rather than this new device. As such, the term “Gold Standard” is possibly premature. That said, Dr. Lima-Oliveira’s work demonstrating variability with prolonged application of tourniquet may support preference for a non-tourniquet method with new reference lab values in the future.

Finally, the discussion of the genesis of the purported clinically significant differences is lacking. Dr. Lima-Oliveira has published five papers discussing the differences between constricted blood draws and free flowing blood draws using the

transilluminator device. For this reason, omission of the discussion of the contribution of the prolonged tourniquet application of Buzzy is perplexing, as his other transilluminator papers were published prior to the current Buzzy/transilluminator article.

The knowledge that few labs were in any way different despite the prolonged application is useful, and we appreciate the time of the author in conducting this study.

Conflict of interest Dr. Baxter invented Buzzy and is the CEO of MMJ Labs, the manufacturer of Buzzy®. This conflict of interest was disclosed to participants in the informed consent of all studies. Dr. Baxter was not present for data collection. Analysis was performed by Dr. Lawson, who has no financial conflict of interest to disclose. Dr. Lawson has previously collaborated with Dr. Baxter as work for hire and as a colleague.

References

1. Inal S, Kelleci M. Relief of pain during blood specimen collection in pediatric patients. *MCN Am J Matern Child Nurs.* 2012;37(5):339–45.
2. Baxter AL, Cohen LL, McElvery HL, Lawson ML, von Baeyer CL. An integration of vibration and cold relieves venipuncture pain in a pediatric emergency department. *Pediatr Emerg Care.* 2011;27(12):1151–6.
3. Baxter AL, Leong T, Mathew B. External thermomechanical stimulation versus vapocoolant for adult venipuncture pain: pilot data on a novel device. *Clin J Pain.* 2009;25(8):705–10.
4. Lima-Oliveira G, Lippi G, Salvagno GL, Montagnana M, Mangiera CL, Sumita NM, et al. New ways to deal with known preanalytical issues: use of transilluminator instead of tourniquet for easing vein access and eliminating stasis on clinical biochemistry. *Biochem Med.* 2011;21(2):152–9.
5. Ricos C, Alvarez V, Cava F. In: Westgard J, editor. *Biologic variation and desirable specifications for QC.* Westgard QC; 2009.
6. Sikaris K. Analytical quality—What should we be aiming for? *Clin Biochem Rev.* 2008;29 Suppl 1:S5–10.
7. Ricos C, Perich C, Minchinela J, Alvarez V, Simon M, Biosca C, et al. Application of biological variation—a review. *Biochem Med.* 2009;19(3):250–9.