Alternate Site Testing for Hemoglobin A1c in Children with Diabetes

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ANCC MAGNET RECOGNITION

Background

While literature supports use of alternate sites for blood glucose monitoring in euglycemic states, no information was available related to use of alternate sites for collection of Hemoglobin A1c (HbA1c). Current policy in the pediatric diabetes clinic is to obtain sample for HbA1c from fingertip regardless of what is child's usual testing site. The purpose of this study was to evaluate whether use of the palm or forearm is as reliable and accurate as the fingertip as a collection site to measure HbA1c. The intent is to support family centered care theory through listening to and honoring the patient/family perspective and choices related to HbA1c collection site.

Methods

Following IRB approval, eighty one children between ages of 5-20 with the diagnosis of type 1 or type 2 diabetes were recruited for the study from clinic. Children were randomly assigned to one of two groups for collection of HbA1c: fingertip and palm (N=41) or fingertip and forearm (N=40). Within each group HbA1c samples were obtained in random order with one sample immediately following the other. Samples were randomly assigned to one of two DCA 2000+ Analyzers ® (Bayer Corporation, Elkhart, IN) and run at the same time. Instrument linearity and calibration was verified through use of controls and proficiency samples and within acceptable allowable error.

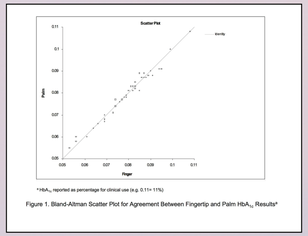
Results

Eighty-four children with the diagnosis of type 1 or type 2 diabetes participated in the study. The sample population was well distributed and reflective of the clinic population with regard to gender, ethnicity, age, and length of diagnosis. Results from 3 participants were lost due to insufficient sample, all from the forearm site.

	n	% of Sample
Age (years)		
Mean (SD)	12.96 (4.14)	
Range	5-20	
Gender		
Male	50	59.5
Female	34	40.5
Race		
Caucasian	44	52.4
Hispanic	27	32.1
Asian	4	4.8
African-American	2	2.4
Other	7	8.1
Diabetes Type		
Type 1	68	81
Type 2	16	19
Length of Diagnosis (months)		
Mean (SD)	51.01 (44.37)	
Range	2-216	
Home Testing Site		
Fingertip	77	91.7
Palm	0	0
Forearm	7	8.3

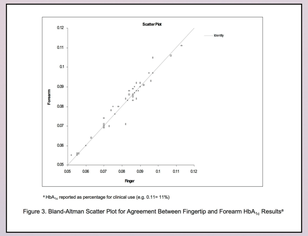
The HbA1c results from the alternate sites had a high degree of agreement with HbA1c results from the fingertip. Intraclass correlation coefficients were: 0.99 for fingertip and palm; and 0.98 for fingertip and forearm. Paired t-tests showed no differences between either set of values.

Bland-Altman bias was minimal: -0.01% (95% CI, -0.07%-0.05%) for the fingertip/palm comparison and 0.0% (95% CI -0.001 to 0.001) for the fingertip/forearm comparison.



*HbA_{1c} reported as percentage for clinical use (e.g. 0.11= 11%)

Figure 1. Bland-Altman Scatter Plot for Agreement Between Fingertip and Palm HbA_{1c} Results*

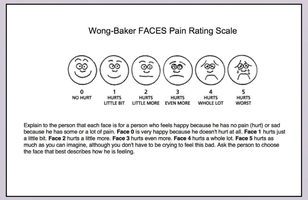


*HbA_{1c} reported as percentage for clinical use (e.g. 0.11= 11%)

Figure 3. Bland-Altman Scatter Plot for Agreement Between Fingertip and Forearm HbA_{1c} Results*

Although alternate site testing for BG levels at home has gained in popularity in recent years, only 8.3% of participants in this study stated they used an alternate site at home, and all reported using their forearm.

Pain ratings were lowest for the forearm followed by the fingertip and palm.



Overall, the fingertip was preferred by 54.8%, the forearm by 25%, and the palm by 20.2% of the children. Alternate sites received favorable reviews (rating=0-2) with regard to pain by 92% of the study participants, despite the fact that this was the first exposure to alternate site testing for the majority of participants.

Limitations/Implications

- Few participants in this study used alternate sites for BG testing at home.
- Consideration should be given to assignment of the fingertip site used for the study rather than allowing the participant to choose, to decrease bias.
- Future alternate site studies should use updated lancing devices with promise of increased ease of use and collection of blood samples and less pain sensation.
- Findings from this study are limited to the pediatric setting; further study in the adult population is warranted.

Conclusions

Findings affirm that blood samples for measurement of HbA1c are clinically equivalent from the fingertip and palm or fingertip and forearm. When obtaining blood samples for HbA1c in the ambulatory care setting, preferences of the child can be honored and family centered care supported without affecting the laboratory values.

Acknowledgements

This research was supported by the Children's Hospital of Orange County Nursing Research Fellowship Program and funding from the Walden and Jean Young Shaw Foundation. The author gratefully acknowledges the assistance of Karen Sechrist, PhD, RN, FAAN for her guidance and support as research mentor and statistician.

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