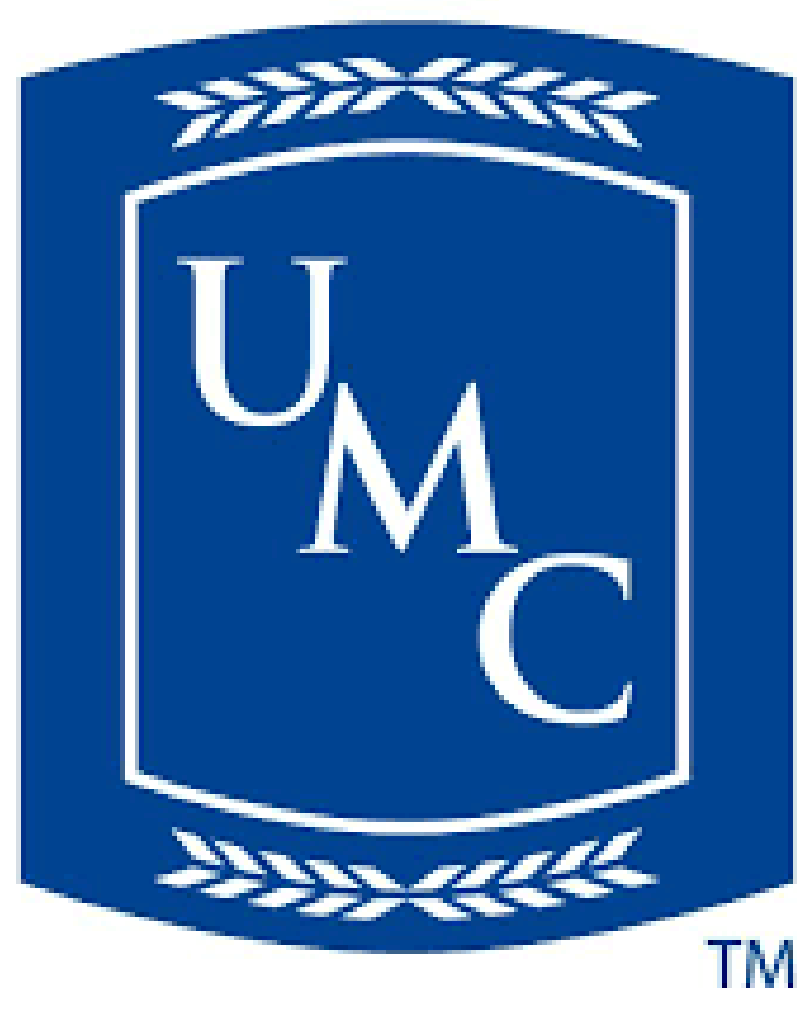




Evaluating urine pH and specific gravity: A single center experience comparing different urine testing methods in children receiving high-dose methotrexate.



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Introduction

- High-dose methotrexate (HDMTX) administration warrants monitoring of urine pH and specific gravity (SG) to avoid toxicity
- Goal during HDMTX administration was to maintain SG < 1.01 and pH of 7.0 to 9.0
- 3 urinalysis methods: manually read dipsticks (DpH/DSG), point of care (POC) automated dipsticks (ApH/ASG), and urinalysis machine testing (UpH/USG)
- Purpose: Compare reliability of dipstick and POC automated testing with urinalysis in pediatric oncology patients at our hospital
- **Hypothesis:** We predict dipstick and POC automated testing are as reliable as urinalysis. Urinalysis is the most reliable and accurate based on prior literature review

Methods

- Retrospective chart review
- We defined HDMTX as $\geq 500 \text{ mg/m}^2$
- We used Urisys 1100 Analyzer for ApH/ASG and iChem Velocity for UpH/USG (Figure 1 and 2)
- Inclusion criteria:
 - Patients treated by pediatric oncology
 - received HDMTX during the encounter
 - January 2017 to June 2020
 - ≥ 2 methods used
- Exclusion criteria:
 - < 2 methods used in an encounter

Demographics

- 17 pts (59% female, avg age 9.2 years) collected
- 11 pts (81% female, avg age 9.7 years) analyzed
- 6 pts excluded due to use of only one method

Images



Figure 1:
Urisys 1100 Analyzer used for ApH and ASG .



Figure 2:
iChem Velocity used for UpH and USG.

Statistics

- Pearson product-moment correlation model used to explore relationships
- Paired sample t-tests used and reported
- Sample size and missing data prevented the use of mixed model to account for variabilities in encounter/block/patient

TABLE 1: Paired Samples Correlations				
Correlation Pairs		N	Correlation	Sig.
Pair 1	DpH & ApH	7	-.422	.345
Pair 2	ApH & UpH	19	.647	.003
Pair 3	DpH & UpH	23	.378	.076
Pair 1	DSG & ASG	4	.833	.167
Pair 2	ASG & USG	17	-.454	.067
Pair 3	DSG & USG	21	.034	.882

Results

- Correlation:
 - Each pair of all 3 pH methods correlated but **only** ApH-UpH reached significance ($r = 0.65$, $p=0.003$) (Table 1)
 - DSG-ASG and ASG-USG correlated but **neither** reached significance (Table 1)
- Difference:
 - ASG was significantly higher than USG ($\alpha=0.011$, $p\leq 0.05$) (Table 2)
 - None of the other pairs were statistically different
- Sample size was small with multiple missing measurements among encounters for each method

Discussion

- Cost efficiency should not compromise reliability
- We attempted to confirm the reliability of cost efficient POC methods of measuring urine pH and SG
- Despite our long enrollment period and data diligence, our sample size was too small and we had missing data
- This impacted our ability to demonstrate correlations and differences between the used methods
- Our statistically significant findings may not be clinically significant
- This is a descriptive exploratory study to get insights on a potentially larger study in the future

References

1. Ahmed, Al, et al., Urinalysis: The Automated Versus Manual Techniques; Is it Time To Change? Clinical Laboratory, 2016. 62: p. 49-56.
2. Costlow. Maintenance Intravenous Fluids in Children: AAP Provides Recommendations. American Family Physician, 2019. 100: p. 251.
3. Galimany et al., European multicentre evaluation of the Super Aution SA-4220 urinalysis analyser. Clinical Chemistry and Laboratory Medicine, 1998. 36: p. 947-958.
4. Howard Scott C., et al., Preventing and Managing Toxicities of High-Dose Methotrexate. The Oncologist, 2016. 21: p. 1471-1482.
5. Loria et al., The second biennial of the External Quality Evaluation Program in Urinalysis (PEECU). Revista de Investigacion Clinica, 2002. 54: p. 226-230.
6. Wu, Xiaohua, et al., Urinalysis: A review of Methods and Procedures. Critical Care Nursing Clinics of North America, 2010. 22: p. 121-128.
7. Zaman et al., Evaluation of Aution Max AX-4280 automated urine test-strip analyser. Clinical Chemistry and Laboratory Medicine, 2001. 39: p. 649-657.

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TABLE 2: Paired Samples Test: Differences								
Difference Pairs		Mean Difference	St. Dev	St. Error Mean	95% Low	95% High	t	Sig. (2-tail)
Pair 1	DpH - ApH	-.666671	1.28019	.4838667	-1.850650	.5173077	-1.378	.217
Pair 2	ApH - UpH	.3026316	.640232	.1468793	-.0059504	.6112135	2.060	.054
Pair 3	DpH - UpH	.142857	.748013	.175634	-.548940	.834654	.505	.631
Pair 1	DSG - ASG	.003000	.002449	.001225	-.000898	.006898	2.449	.092
Pair 2	ASG - USG	.003706	.005289	.001283	.000987	.006425	2.889	.011
Pair 3	DSG - USG	.001190	.005896	.005896	-.001493	.003874	.925	.366