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2017

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Recommended Citation

Hamilton, Marilyn S.; Selvarangan, Rangaraj; Fix, Michele; and Shriver, Lynn E., "An Expanded Role for Nurses in Laboratory Utilization" (2017). *Posters*. 23.
https://scholarlyexchange.childrensmercy.org/posters/23

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An Expanded Role for Nurses in Laboratory Utilization

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Introduction: The majority of laboratory testing errors occur in the pre-analytical stage, including specimen collection. Children provide special challenges including small blood volumes, small veins, and an inability to cooperate. We describe collaboration between laboratorians and nursing staff to improve specimen collection and the reliability of test results.

Methods: We identified three areas for improvement: 1) Volume of blood for culture, 2) Urine collection, and 3) Appropriate blood collection through a line. Base line data was established. Guidelines for specimen collection were updated. Nurse members of the Laboratory Utilization Committee developed educational tools.

Results: Nursing education was effective at improving collection of blood for culture and IV fluid contamination of blood specimens, processes where the nurse was the collector. There was no improvement in the urine culture contamination rate, a process which involves the patient and/or family members.

Discussion: Nursing participation in laboratory utilization efforts provides an opportunity to address specimen collection issues. Nurses are also excellent resources concerning work flow in clinics and inpatient floors. They also actively participate in the education of young doctors.

Adequate Blood Volume for Meaningful Culture

Blood culture is the gold standard for bacteremia. The single most important criterion to impact the yield of blood culture is the volume of blood inoculation. In children, our recommended volume was standardized and varies with the child's weight. Blood culture bottles were weighed before and after inoculation.

Standardized Blood Volume for Blood Culture

Weight Group	Patient weight in Kg	Blood volume to collect	Media type & inoculation volume	
			Peds plus	Aerobic plus
A	1 to 2	1ml	0.5ml	0.5ml
B	2.1 to 5	2ml	1ml	1ml
C	5.1 to 9	4 ml	2ml	2ml
D	9.1 to 12	6ml	3ml	3ml
E	12.1 to 28	8ml	4ml	4ml
F	28.1 to 36	10ml	5ml	5ml
G	36.1 to 40	14ml	7ml	14ml
H	> 40	20ml	N/A	10ml X 2bottles

Nursing education increased the adequacy of volume collected from 49% to 61% for inpatients and 33% to 42% for outpatients. As expected, adequate blood volumes resulted in a higher percent of positive cultures. In addition, there was a tendency for adequate blood volumes to result in fewer contaminated cultures.

	Pre-Inv ADQ/InADQ	Post-Inv ADQ/InADQ	P Value
Inpatient	280/293	551/356	<0.05
Outpatient	410/844	806/113	<0.05

Impact on Blood Culture Yield in Outpatient (OP) and Inpatient (IP) Pre- and Post-Intervention

	Pre OP- ADQ	Pre OP- InADQ	Post OP-ADQ	Post OP-InADQ	Pre IP- ADQ	Pre IP- InADQ	Post IP-ADQ	Post IP- InADQ
Total	410	844	806	1113	280	293	551	356
Positive	13 (3.1%)	18 (1.8%)	26 (3.2%)	28 (2.5%)	23 (8.2%)	18 (6.1%)	31 (5.6%)	19 (5.3%)
Contaminant	4 (0.9%)	12 (1.4%)	13 (1.6%)	25 (2.2%)	2 (0.7%)	2 (0.7%)	10 (1.8%)	5 (1.4%)
Negative	393 (95.8%)	816 (96.6%)	767 (95.1%)	1060 (95.2%)	255 (91%)	273 (93.2%)	510 (92.5%)	332 (93.2%)

Reference: J Clin Micro 2000; 38:2181-85

Clean Catch Urine Collection for Culture

Urinary tract infections (UTI) are a common cause of childhood fever. In toilet trained children, a clean catch midstream urine for culture is collected by the patient with the parent's assistance. In 2014, the specimens from the Emergency Department (ED) and Urgent Care (UC) areas had evidence of contamination in 52% of the specimens: ≥3 organisms, <10,000 CFU of a single organism, growth of a known urogenital/skin microbiota CFU equal to uropathogen.

Nursing intervention included interviews and re-education, the design of bathroom posters and provision of cup holders and gloves for parents. Unfortunately, there was no significant change in the culture contamination rate.

Subsequently, a UTI Screening Algorithm was introduced which as two steps. While this will not alter the contamination rate, it will minimize the absolute number of contaminated cultures by > 50%.

1. UA with reflex to microscopic examination if:
   a. Leukocytes Esterase ≥ Trace
   b. Nitrite Positive
   c. Protein > Trace
   d. Blood > Trace

2. a. Leukocyte Esterase ≥ Trace
   b. Nitrite Positive
   c. WBC ≥ 5

Applying the algorithm in a 17-month retrospective study of 7,791 urine cultures would have resulted in the culture of 3,231 (41%): 1,550/3769 contaminated, 628/2,801 negative, and 1,053/1221 positive specimens. While 168 positive cultures would not have been cultured, 82 were non-uropathogens and an additional 34 had colony counts < 50,000. A clinical review suggested that the algorithm could miss ~1 UTI/month. Clinicians have the option of requesting a culture even with a negative UA, and education was provided as to when this would be desirable: 1) Patient being given antibiotics, 2) Immunosuppressed, 3) Abnormal urinary tract, or 4) At risk for recurrent UTI's.

We recently put this algorithm into effect for children > 2 months old and for all collection methods.

Reference: Pediatrics. 2011. 128:595-609

IV Fluid Contamination of Blood Specimens

To avoid needle sticks, blood specimens from hospitalized children are drawn through lines when present. D5 dextrose in IV fluid has a glucose of 5,000 mg/dl. Using glucose > 300 mg/dl with CO2 >12 mol/L as an indicator of contamination, ~1% of line collected blood specimens and ~4% of blood gas specimens were contaminated. Intense educational efforts with ongoing, targeted education ensued. Some issues have proven intractable.

Contributing factors included: 1) Only using the pump pause button, 2) Not clamping all catheter lumens, 3) Slide clamps ineffective; stop cocks added, 4) Short wait time, 5) High negative draw pressure.

In general, nurses knew the appropriate process, but reminders were provided.

Badge Reminder Card:

Point of Material Supply Reminder: