URINARY TRACT INFECTION IN FULL-TERM NEWBORN INFANTS: VALUE OF URINE CULTURE BY BAG SPECIMEN COLLECTION

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SUMMARY: Objective: to evaluate the efficacy of urine culture by bag specimen for the detection of neonatal urinary tract infection in full-term newborn infants. Retrospective study (1997) including full-term newborn infants having a positive urine culture (>100,000 CFU/ml) by bag specimen collection. The urinary tract infection diagnosis was confirmed by positive urine culture (suprapubic bladder aspiration method). The select cases were divided into three groups, according to newborn infant age at the bag specimen collection: GI (< 48 h, n = 17), GII (48 h to 7 d, n = 35) and GIII (> 7 d, n = 9). Sixty one full-term newborn infants were studied (5.1 % of total infants). The diagnosis was confirmed on 19/61 (31.1 %) of full-term infants born alive. Distribution among the groups was: GI = 2/17 (11.8 %), GII = 10//35 (28.6 %), and GIII = 7/9 (77.7 %). The most relevant clinical symptoms were: fever (GI – 100 %, GII – 91.4 %) and weight loss (GI – 35.3 %, GII – 45.7 %). Urine culture results for specimens collected by suprapubic aspiration were: **E. coli** GI (100 %), GII (40 %) and GIII (28.6 %), *E. faecalis* GI (30%), *Staphylococcus* coagulase-negative GII (20 %) and GIII (42.8 %), and **Staphylococcus aureus** GII (10 %). Correlation between positive urine culture collection (bag specimen method) and urinary tract infection diagnosis, using relative risk analysis, produced the following results: GI=0.30 (CI95% 0.08–1.15), GII=0.51 (CI 95% 0.25–1.06) and GIII=3.31 (CI95% 1.8–6.06) The most frequent urinary tract infection clinical signs in the first week were fever and weight loss, while non-specific symptomatology occurred later. E. coli was most frequent infectious agent, although from the 7th day of life, staphylococcus was noted. The urine culture (bag specimen method) was effective in detecting urinary tract infection only after the 7th day of life.

DESCRIPTORS: **Urine culture. Urinary tract infection. Newborn infant.**

Urinary tract infection is generally defined as the presence of microorganisms in the urine, revealed without contamination, with or without symptoms[14].

Diagnosis of neonatal urinary tract infection is difficult due to lack of specific symptomatology. Symptoms can include the presence of fever, weight loss debilitate suction, feeding intolerance, failure to thrive, vomiting, diarrhea, abdominal distension, hypoactivity, irritability, cyanosis, hepatomegaly, splenomegaly, jaundice, and late-onset sepsis symptoms.[3] For these reasons, diagnosis depends on the urine culture[10].

Failure of urine culture to produce reliable results can most commonly be associated with improper material transport and inadequate collection methods[5,10].

Urine collection by bag specimen is widely used, since it is safe and easy; however, this method is characterized by low reliability due to bacterial contamination[8,9].

The purpose of this study was to evaluate the efficacy of urine culture by bag specimen for the detection of neonatal urinary tract infection in full-term newborn infants.

PATIENTS AND METHODS

We conducted a retrospective study in Berçário Anexo à Maternidade - Instituto da Criança "Prof. Pedro de Alcântara – Hospital das Clínicas – Faculdade de Medicina da Universidade de São Paulo, including all full-term newborn infants (gestational age – 37 to 42 weeks) having positive urine culture by bag specimen collection.

Collection was prescribed based on clinical data as follows: fever (T > 37.8 ºC)[19], weight loss > 10% of birth weight, or non-specific symptomatology (feeding intolerance, failure to thrive, hypoactivity, debilitate suction, or irritability). In these cases, culture of urine specimens collected by suprapubic bladder aspiration was conducted to confirm diagnosis.

Figure 1

Design of the study.

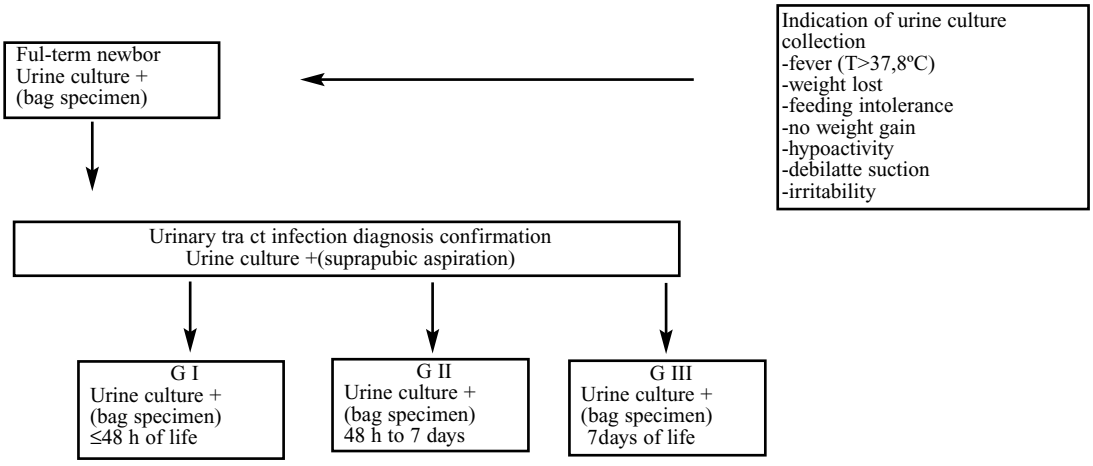

Table 1 – Population of the study.

	GI n=17	GII n=35	GIII n=9
Birth weght (g) – average	3324	3452	2957
Gestational age (weeks) – average	39 1/7	38 6/7	39 2/7
Nutritional status			
Adequate for gestational age	14 (82.3 %)	26 (74.3 %)	6 (66.6 %)
Small for gestational age	2 (11.8 %)	5 (14.3 %)	2 (22.2 %)
Large for gestational age	1 (5.9 %)	4 (11.4 %)	1 (11.2 %)
Male/female relation	7/10	14/21	5/4
Rupture membrane time			
< 24 h	14 (82.3 %)	28 (80.0 %)	7 (77.8 %)
24 h	3 (17.7%)	7 (20.0 %)	2 (22.2 %)
Asphyxia	1 (5.9 %)	1 (2.9 %)	1 (11.1 %)**

** p<0.05

Table 2 – Clinical data.

	GI n=17	GII n=35	GIII n=9
Fever	17 (100.0%)	32 (91.4%)	4 (44.4%)**
Weight loss	6 (35.3%)	16 (45.7%)	1 (11.1%)**
Non-specific symptomatology	2 (11.8%)	6 (17.1%)	6 (66.6%)**

** p<0.05

The select cases were divided into three groups, according to newborn infant age at the bag specimen collection: GI (< 48 hours), GII (48 hours to 7 days) and GIII (> 7 days) (See Figure 1).

The finding of 100,000 CFU/ml of the same microorganism constituted a positive test for the bag specimen collection. The finding of any CFU/ml rate constituted a positive test for specimens collected by suprapubic aspiration[5,7,14] .

The study population was characterized by gestational age, birth weight, sex, perinatal asphyxia (Apgar score < 6 at 5 minutes), and membrane rupture time (< 24 hours and > 24 hours).

The procedure for collection of the bag specimens was: antisepsis, followed by fitting of a sterile plastic bag on the genitalia. If diuresis did not occur within 30 minutes, the procedure was repeated until successful specimen collection[20].

Suprapubic aspiration of the urine specimen required a full bladder. The overlying skin was disinfected, the bladder was puncture above the symphysis pubis with a 25-gauge needle on a syringe, and about 2 ml of urine was aspirated[20].

All urine specimens were transported promptly to the laboratory. Urine specimens were processed onto CLED, Mac Conkey, Thayer-Martin, thioglycolate and blood agar plates. Culture plates were incubated at 35–37 °C and read at 24–48 hours; if results were positive an antibiotic susceptibility was determined. The absence of microorganisms within 48 hours characterized the culture as negative[21].

Data were analyzed through chi-square, Fischer exact test, Student's t test and relative risk. Statistical significance was defined as $p < 0.05$.

RESULTS

Sixty-one full-term newborn infants were included in this study, representing 5.1% of the total infants born alive in the study period.

The infants were distributed into three groups according to age at the time of sampling (Figure 1): GI (< 48 hrs, n = 17), GII (48 hrs – 7 days, n = 35) and GIII (> 7 days, n = 9) (Table 1)

The most relevant clinical symptoms were fever (GI – 100 %, GII – 91.4 %) and weight loss (GI – 35.3 %, GII – 45.7 %). shows the study population (Table 2).

The diagnosis was confirmed on 19/61 (31.1%) of full-term infants born alive. Distribution of positive diagnosis among groups was: GI = 2/17 (11.8%), GII = 10//35 (28.6%) and GIII = 7/9 (77.7%). No complication occurred from specimen collection by the suprapubic method.

The microbial content of cultures of urine specimens collected by suprapubic aspiration were: E. coli GI (100 %), GII (40 %) and GIII (28.6 %), E. faecalis GI (30 %), **Staphylococcus** coagulase-negative GII (20 %) and GIII (42.8 %), and **Staphylococcus aureus** GII (10 %) (Table 3).

Correlation between positive urine culture collection (bag specimen method) and urinary tract infection diagnosis, using relative risk analysis, produced the following results: GI = 0.30 (CI95% 0.08–1.15), GII = 0.51 (CI95% 0.25–1.06) and GIII = 3.31 (CI95% 1.8–6.06) (Table 4).

DISCUSSION

Urinary tract infection in the neonatal period has non-specific symptomatology, so its diagnosis is based on laboratory data[3] .

All urine specimens should be transported and should be processed within two hours after collection, because at room temperature (25 ºC), Gram-negative microorganisms proliferate quickly. If a delay in transport or processing can not be avoid, specimens may be refrigerated (4 ºC) up to 24 hours[7].

Urine collected during the neonatal period can be obtained by bag specimen, suprapubic bladder aspiration, or urethral catheterization[18].

Culture results after bag specimen collection are rarely false negative, and therefore can be used as a screen for urinary tract infection; however, false positive results are frequent[6]. Therefore, positive results should be confirmed by one of the other methods mentioned above. With bag specimen collection, several variables may affect the results, including: improper antisepsis, mainly in male newborn infants; difficulty with preputial hygiene; the requirement for replacement of the bag after 30 minutes in the absence of diuresis; pernicious skin lesions, occurrence of colonized distal urethra, mainly by Gram-negative

Table 3 – Bacterial data.

	GI n=2	GII n=10	GIII n=7
Escherichia coli	2 (100.0%)	4 (40.0%)	2 (28.6%)
Enterococcus faecalis	0	3 (30.0%)	0
Staphylococcus coagulase-negative	0	2 (20.0%)	3 (42.8%)
Staphylococcus aureus	0	1 (10.0%)	1 (14.3%)
Klebsiella pneumoniae	0	0	1 (14.3%)

Table 4 – Relative risk (RR) - positive urine culture by bag specimen collection.

			GI	GII	GIII
RR			0.30	0.51	3.31
CI 95%			0.08 – 1.15	0.25 – 1.06	1.8 – 6.06

bacteria; inadequate antiseptic methods[20]. Incomplete soap removal from the perineal skin can inhibit bacterial growth[20].

As previously shown, urine collected by the suprapubic bladder aspiration method is the best approach for diagnosis of neonatal urinary tract infection because of its reliability, simplicity, and safety[1].

The study population had a 1.6 % urinary tract infection frequency, a rate close to the low incidence limit of this pathology in the neonatal period. This finding may be due to the low risk factors in the study population. In terms of urinary tract infection, the majority of newborns was admitted to low or medium risk units. It is worth noting that long confinement periods, associated pathologies, or massive use of antibiotics and invasive procedures increase the rate of urinary tract infection[11].

There were no differences in birth weight, gestational age, nutritional status, and membrane rupture time (table 1) ($p>0.05$) in the three groups studied. Differences between groups related to perinatal asphyxia only. Theoretically, asphyxia might indirectly increase the risk of urinary infection, but none of the asphyxiated infants required long confinement in the nursery.

The incidence of fever in groups GI (100 %) and GII (92 %) was higher than that reported in the literature (about 50 %), whereas GIII had and incidence of fever (44 %) close that that reported in literature[4,14]. Weight loss and non-specific symptomatology were slightly below the incidence reported in the literature results[14]. These findings emphasize that the urinary tract infection in the newborn infant has poor symptomatology, since several neonatal pathologies present same clinical findings. Roughly 7.5% of newborns have fever as a unique symptom that progresses to urinary infection and eventually can develop to late-onset sepsis[14].

In order to confirm the diagnosis, culture of urine collected by suprapubic bladder aspiration was performed with positive results in 31 % of the total, distributed as: GI = 12 %, GII = 29 %, and GIII = 78 %. These results merit discussion because confirmation of the urinary tract infection diagnosis occurred in only one-third of those cases that had positive tests on bag specimen cultures. Infants would be exposed to unnecessary antibiotics if bag specimen collection were used as the only diagnosis technique. Because the health and financial costs of unnecessary antibiotic exposure are significant, a more reliable method such as suprapubic bladder aspiration is recommended[2].

The suprapubic bladder aspiration method was first used in the 50's, and was first used during the neonatal period in the 60's[1.5]. Through improved techniques, this method has became safe, even for preterm newborn infants[1]. We emphasize that the procedure is very simple, since when bladder is full-sized, it stays closer to abdominal wall, making the puncture easier and leading to 90 % success on first puncture attempt[14.] Ultrasonography for orientation should be conducted in the presence of abdominal distension or urinary tract anomalies, increasing efficacy to 96 %[13]. Transient hematuria caused by the puncture has been reported in only 0.6 % of cases, with no consequences[14]. Although gross hemorrhage, hematoma, bowel perforation, peritonitis, abdominal wall abscess, and bacteremia have been reported as more serious complications[17] , no complications were noted in the present study, supporting the safety of this method.

Urethral catheterization could be used if suprapubic aspiration is not indicated (because of a clinical condition or several unsuccessful attempts), but it is associated with the risk of inducing an infection (4 to 6 %) and is technically more difficult, particularly with male preterm newborn infants[3].

Gram-negative bacteria occurred at higher frequencies in the first days of life followed later by the presence of gram-positive microorganisms *(Staphylococcus* coagulase-negative and *Staphylococcus aureus)*. These results are in accordance with the literature, indicating a changing urinary tract infection diagnosis, in which E. *coli* is not the predominant agent, being replaced to the *enteroccocus, staphylococcus*, and fungi. This may be explained by the increasing use of invasive procedures and long-term confinements in neonatal intensive care units, predisposing *staphylococcus* and fungi urinary tract infections[12].

Correlation between positive urine culture collection (bag specimen method) and urinary tract infection diagnosis using relative risk analysis showed that concordance between methods is higher, the higher the age of the infant. This finding is probably due to greater technical ease in collecting bag specimens from older infants, resulting in more reliable data.

In conclusion, the most frequent urinary tract infection clinical signs during the first week were fever and weight loss, while non-specific symptomatology manifested later. *E. coli* was most frequent microbial agent, although *Staphylococcus* was noted from the 7th day of life. Results of urine culture from bag specimens were reliable only after 7 days of age.

Thus, the suprapubic bladder aspiration method is recommended for making accurate etiologic diagnoses. The negative culture of specimens collected using bag collection can be used as a screen to exclude a diagnosis of urinary infection.

RESUMO

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FALCÃO, M. C. e col. - Infecção urinária em recém-nascido de termo: valor da cultura de urina obtida através de saco coletor. **Rev Hosp Clín Fac Med S. Paulo, 54** (3) 91 - 96,1999

Objetivo: avaliar a eficácia da cultura de urina obtida através de saco coletor na detecção de infecção do trato urinário no período neonatal.

Estudo retrospectivo (1997), englobando recém-nascidos de termo com urocultura positiva (>100000UFC/ml) colhida em saco coletor. Nesses recém-nascidos foi realizada punção suprapúbica, coletando-se urina para cultura, para confirmação diagnóstica. Os recém-nascidos foram divididos em três grupos, de acordo com a idade do recém-nascido na ocasião da coleta: GI-n=17 (< 48h de vida), GII-n=35 (entre 48h e 7dias) e GIII-n=9 (> 7dias).

Foram estudadas 61 crianças (5,1% dos recém-nascidos de termo). A confirmação diagnóstica pela punção suprapúbica mostrou: GI=2/17 (11,8%), GII=10/35 (28,6%) e GIII=7/9 (77,7%). Quanto ao quadro clínico, nos GI e II a febre (100 e 91,4%) e a perda de peso (35,3 e 45,7%) foram os sinais clínicos mais freqüentes. No GIII as alterações do estado geral (66,6%) e a febre (44,4%) destacaram-se. Dentre os agentes etiológicos, obteve-se: *E coli* GI (100%), GII (40%) e GIII (28,6%), *E faecalis* GI (30%), *S coagulase*-negativa GII (20%) e GIII (42,8%) e *S aureus* GII (10%) e GIII(14,3%). A análise do risco relativo da positividade da cultura de urina obtida por saco coletor corresponder à infecção urinária foi de: GI=0,3 (IC95% 0,08-1,15), GII=0,51 (IC95% 0,25-1,06) e GIII=3,31 (IC95% 1,8-6,06).

Os resultados sugerem que os sinais clínicos mais importantes da infecção do trato urinário na primeira semana de vida foram a febre e a perda de peso, enquanto as alterações do estado geral ocorreram mais tardiamente; a E coli foi o agente mais freqüente e, a partir do sétimo dia, houve o aparecimento de *S aureus* e *S coagulase* negativa. A cultura de urina através de saco coletor teve maior capacidade de detecção de infecção urinária a partir do setimo dia.

DESCRITORES: **Cultura de urina. Infecção urinária. Recém-nascido**.

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