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PRECISÃO DA TÉCNICA CLEAN-CATCH PARA COLHEITA DE URINA EM PEQUENOS LACTENTES: REVISÃO SISTEMÁTICA DA LITERATURA

ACCURACY OF CLEAN-CATCH TECHNIQUE FOR URINE COLLECTION IN YOUNG CHILDREN: A SYSTEMATIC REVIEW OF LITERATURE

PRECISIÓN DE LA TÉCNICA DE CLEAN-CATCH PARA LA RECOGIDA DE ORINA EN PEQUEÑOS INFANTES: UNA REVISIÓN SISTEMÁTICA DE LITERATURA

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RESUMO

Introdução: A colheita de urina em crianças deve respeitar a segurança e a eficácia do procedimento, com foco na satisfação da criança/família e qualidade dos cuidados de enfermagem.

O Clean-Catch (CCU), tem sido descrito como método de colheita de urina não invasivo, seguro e rápido, usado em crianças sem controle esfínteres, para o diagnóstico de infecção urinária (IU), em alternativa aos métodos invasivos cateterismo vesical/punção suprapúbica (CV/PV).

Objetivo: Identificar evidências científicas da precisão do Clean-Catch para o diagnóstico de infecção urinária em lactentes.

Métodos: Revisão sistemática baseada nas diretrizes do Cochrane Handbook (Higgins & Green, 2011) de estudos comparando taxas de contaminação urinária/precisão do diagnóstico entre CCU e CV/PV, selecionados nas bases eletrônicas PUBMED, EBSCO, Web of Science e Scielo, publicados entre 2000-2017 e seguindo critérios de inclusão/exclusão estabelecidos. Dois pesquisadores avaliaram a qualidade dos estudos.

Resultados: De 297 estudos iniciais, incluíram-se dois RCTs que preencheram os critérios de inclusão. No primeiro estudo (Labrosse, Levy, Autmizguine & Gravel, 2016) verificaram-se taxas de contaminação do grupo CCU de 16% versus 6% nas CV/PV, enquanto no segundo (Herreros et al., 2015) apuraram-se 5% versus 8% para CCU e CV respetivamente.

Conclusões: Precisa ser confirmada a precisão do clean-catch para a prática de enfermagem, dado o reduzido número de estudos com qualidade metodológica que utilizem esta técnica.

Palavras-chave: infecções urinárias; urinálise; lactente; cuidados de enfermagem

ABSTRACT

Introduction: Urine collection in children should respect efficacy and child safety, considering child/family satisfaction and the quality of nursing care. Clean-Catch (CCU) has been described as a non-invasive, safe and quick urine collection method used in children lacking sphincter control, for Urinary Tract infections (UTI) diagnosis in alternative to invasive methods such as urethral catheterization/suprapubic aspiration (UC/SPA).

Objective: To identify scientific evidence of the accuracy of clean-catch for the diagnosis of urinary infection in neonates.

Methods: A systematic review was conducted based on Cochrane Handbook guidelines (Higgins & Green, 2011) of studies comparing urine contamination rates/ accuracy diagnosis between clean-catch and UC/SPA. Selected studies in PUBMED, EBSCO, Web of Science and Scielo databases, published between 2000 and 2017, according to previously established inclusion/exclusion criteria. Two researchers evaluated the studies' quality.

Results: In a total of 297 studies, two RCTs were included that met inclusion criteria. In the first study (Labrosse, Autmizguine & Gravel, 2016) it was verified that the contamination rates of the CCU group were 16% versus 6% for UC/SPA, whereas in the second study (Herreros et al., 2015) it was 5% versus 8% for CCU and UC respectively.

Conclusions: The accuracy of clean-catch for nursing practice needs to be confirmed, given the small number of studies with methodological quality that use this technique.

Keywords: urinary tract infections; urinalysis; infant; nursing care

RESUMEN

Introducción: La recolección de orina en niños debe respetar la seguridad teniendo en cuenta la satisfacción del niño/familia y la calidad de la atención de enfermería. Clean-Catch (CCU) es un método no invasivo, seguro y rápido de recolección de orina utilizado en niños sin control del esfínter, para el diagnóstico de infecciones urinarias (IU) como una alternativa a métodos invasivos como cateterismo vesical/aspiración suprapúbica (CV/ASP).

Objetivo: Identificar evidencia científica de la precisión de Clean-Catch para el diagnóstico de infección urinaria en neonatos.

Métodos: Revisión sistemática basada en el Manual Cochrane (Higgins & Green, 2011) de estudios que compararon las tasas de contaminación urinaria/precisión diagnóstica entre la CCU y CV/ASP. Seleccionados estudios en PUBMED, EBSCO, Web of Science y Scielo, publicados entre 2000 y 2017 y de acuerdo con criterios de inclusión/exclusión establecidos. Dos investigadores evaluaron la calidad de los estudios.

Resultados: En 297 estudios, se incluyeron dos RCTs que cumplieron con los criterios de inclusión. En el primer estudio (Labrosse, Autmizguine & Gravel, 2016) se verificó que las tasas de contaminación del grupo CCU fueron de 16% versus 6% para CV/ASP, mientras que en el segundo estudio (Herreros et al., 2015) fue de 5% versus 8% para CCU y CV respectivamente.

Conclusiones: La precisión de Clean-Catch para la práctica de enfermería debe ser confirmada, dado el pequeño número de estudios con calidad metodológica que utilizan esta técnica.

Palabras Clave: infecciones urinarias; urinálisis; lactante; atención de enfermería

INTRODUCTION

Urinary tract infection (UTI) is a common pathology in childhood, so when it is suspected, its correct diagnosis is important and must be rapid. UTIs are the most common cause of serious bacterial infections in febrile infants and those with other non-specific symptomatology. Accurate and timely diagnosis of these infections is important for determining appropriate treatment and preventing long-term complications such as renal scarring or other renal disease. It is the responsibility of the nursing team to rigorously implement the urine collection technique best suited to the child's age/development and the approach that respects both the child and family emotions.

These actions ensure safe care, promotes the well-being and the health of the child, family and community, minimizing or eliminating painful experiences (OE, 2015). The primary goal is to ensure contamination-free urine samples that allow for rapid diagnosis but also provide the least traumatic experience.

The right to the best care and the defense of the best interest of the child are reflected in the Convention on the Rights of the Child, and reiterated in point 4 of children's rights in hospital, which states that "... physical or emotional aggressions and pain must be kept to a minimum possible" (Instituto de Apoio à Criança [IAC], 2008).

1. THEORETICAL FRAMEWORK

The prevalence of paediatric UTI varies by age, race/ethnicity and sex and the incidence is varied reporting different clinical settings. It is at least 2% in boys and 8% in girls in the first 6 years of life, but 1% of boys and 0,8% of girls having had a UTI before reaching 2 years of age. So, excluding the first 12 months of life, girls are more likely to be diagnosed with a UTI (DGS, 2012).

Because children with UTI often do not present the same characteristic signs and symptoms seen in the adult population, the diagnosis of UTI is made based on medical history and exam findings and confirmed with appropriately collected urine samples, that varies according to the child's age / development (National Collaborating Centre for Women's and Children's Health, 2007).

In pediatric hospital contexts the collection of urine samples for analysis is a common procedure and it is assumed as an interdependent nursing intervention, prescribed by doctors but with responsibility for technical implementation by nurses in most of the techniques, except for supra-pubic aspiration, which is the doctor's technical responsibility.

There is still some controversy regarding the most appropriate procedure for the diagnosis of UTI in young children (newborn/infant) who do not yet have sphincter control. In Portugal, in this age or developmental group it is performed using, as first option, a taped sterile bag. If a bag specimen is negative, this can be used to exclude UTI, without the need for confirmatory culture. However positive urinalysis tests from bag specimen warrant further investigation (DGS, 2012). There is still no consensus regarding the period of permanence of the bag, free from contamination. Some studies have concluded that keeping the bag up to 60 minutes does not increase the false positive (Cordeiro, 2012; Santos, 2011), however, standards of the general health department of Portugal recommend the bag replacing after 30 minutes (DGS, 2012).

Older children can provide a clean-catch midstream urine specimen, but unfortunately, this type of urine sample is not possible to obtain in newborn/infants. So, in these cases, to confirm UTI, the most commonly technique used is urethral/bladder catheterization (UC) or suprapubic aspiration (SPA) (Ouellet-Pelletier, Guimont, Gautier & Gravel, 2014; Chang S.L., Shortliffe L.D., (2006)). Both of these methods are supposed to be invasive and each has benefits and limitations. Despite several studies (Chu, Wong, Luk & Wong, 2002) show that the best way for a sterile urine sample collection is SPA, because of the lower rating of contamination, the success of this technic needs experience skills and expertise and the main limitation is the associated pain and the subsequent adverse neurodevelopmental consequences in the newborn (Badiee, Sadeghnia & Zarean, 2014).

Recently, a noninvasive method of urine collection has been used in children lacking sphincter control, called clean-catch (CCU), comparable to the midstream urine method used in older children (Herreros et al., 2015). This technique consists on the combination of oral intake, aseptic genital hygiene and mild supra-pubic and para-vertebral stimulation, followed by midstream urine collection to a sterilized container. The technique involves the application of dry and soft strokes in the suprapubic abdominal region at a frequency of 100/ minutes for 30 seconds followed by circular massages in the lumbar para-vertebral region for 30 seconds. These tactics are repeated until urine is obtained within a maximum of 5 minutes (Herreros et al., 2015; Labrosse, Levy, Autmizguine & Gravel, 2016). The adoption of this technique implies a scientific evidence analysis, so this study aims to analyze scientific evidence of the accuracy of the method of aseptic urine collection through the clean-catch technique for the diagnosis of urinary tract infection in newborn / infants lacking sphincter control.

2. METHODS

A systematic review was conducted and the research question was formulated using the PI[C]O[D] matrix (Problem, Intervention, Comparison, Outcomes and Design), resulting in the following: "Is clean-catch urine sample collection as accurate as the suprapubic aspiration/urethral catheterization method for diagnosing urinary tract infection in newborns and infants"?

The research was based on the Cochrane Database of Systematic Reviews methodology (Higgins, & Green, 2011) and was carried out in the databases PubMed, B-ON, EBSCOhost, Web of Science and SciELO, using the search terms and Medical Subject Headings

(MeSH) "Urine specimen collection", "Infant", "newborn" in conjunction with Boolean operators "and" "or", in full texts published in Portuguese, French, English and Spanish languages, published between January, 2000 and June, 2017.

2.1 Eligibility criteria

The eligibility criteria were determined by the research question, only including studies carried out with children without sphincter control, who performed urine sample collection using the clean-catch method and studies comparing CCU with urethral catheterization or supra-pubic aspiration, measuring the contamination rates. Experimental, quasi-experimental studies and systematic reviews were included. The study selection process is shown in Table 1.

Table 1- Study selection process

Descriptors	Limited period	Limited language	Data bases	Starting results	Results after reject duplicates
#urine specimen collection AND #infant OR #infant, #newborn	January 2000 to June 2017	French	EBSCOhost	46	36
		Portuguese	B-ON	194	116
			SciELO	0	0
		English	PubMed	99	99
		Spanish	Web of Science	46	46
Total				385	297

After this process 297 studies were identified and analyzed through relevance test I, resulting in the inclusion of 28 studies to which the relevance test II was applied. 13 studies were included for analysis of methodological quality, through the critical evaluation screen of an article describing a prospective, randomized and controlled clinical trial (RCT), from the Oxford evidence-based studies center (Roque, Bugalho & Carneiro (2007). These analyze was performed by two independent researchers.

According to the accepted recommendations and considering that the methodological quality is accepted as good above 75% Bugalho & Carneiro (2004), only 2 Randomized Controlled Trials (RCTs) were included in this systematic review, with a level of recommendation A and evidence level 1b (Pereira & Bachion, 2006).

3. RESULTS

The results are presented through a descriptive synthesis of the main quality aspects of each study (Table 2 and 3). The study by Labrosse et al., (2016) sought to compare urine culture results between clean-catch urine (CCU) method and invasive catheterization (urethral catheterization or suprapubic aspiration) and also analyze predictive factors for the success of urine collection by CCU. Children were randomized to perform urine collection using CCU and whenever the urine summary analysis was positive, need to prescribe antibiotics or failure to obtain urine by CCU method, they used the invasive method, which happened in 11 children. The contamination rates were low in both methods, 16% for CCU and 6% for urethral catheterization or suprapubic aspiration (Table 2).

Table 2 - Description and research evidence of Labrosse, Levy, Autmizguine & Gravel (2016) study

Methods	Prospective cohort study comparing the number of contaminated specimens of urine samples using bladder stimulation technique (clean-catch urine method) and invasive techniques (urethral catheterization or suprapubic aspiration), performed after, in the same infants, if positive urinalysis. Analysis the success of clean-catch (CCU) between 4 predictive factors (age, sex, low oral intake, and recent voiding)
Participants	126 infants with less than 6 months (64 boys) with an average age of 55 days needing a urine sample for culture and/or analysis requested for urinary tract infection diagnosis.
Interventions	A CCU sample was collected using bladder stimulation technique by trained research nurses. The technique involves a combination of fluid intake (infants are fed during 20-minutes), genital cleaning and noninvasive bladder stimulation maneuvers for a maximum of 300 seconds. After, infants were held under their arms by a parent, legs dangling in males and hip flexed in females. To allow comparison for bacterial contamination, an invasive method was performed after CCU procedures in one of these situations: (1) positive urinalysis by test strips, (2) decision to prescribe antibiotics, or (3) unsuccessful CCU sampling.
Results	A total of 66 (52%) infants provided a urine sample within 5 minutes (average = 45 seconds) after stimulation procedure. CCU was successful in 61%. Age group (less than 89 days) was a strong predictor of success ($P < .001$) Sex and low oral intake were not. Eleven participants provided both CCU and invasive samples for culture. Among those, seven had concordant culture results, including four with the same bacteria. The remaining culture showed discrepancies between contaminated and negative culture results. In the all sample UTI was present in 11 children (9%) The contamination proportion was 16% (9 of 57) in CCU group, compared with 6% (4 of 62) in the invasive method group. Proportion of male patients in the contaminated CCU sample group seemed lower than in the uncontaminated group (3 of 9 [33%] and 32 of 48 [67%], respectively).
Conclusions	Clean-Catch technique is classified as a quick and effective way of obtaining urine samples in infants, especially for those aged less than 90 days. The contamination proportion of CCU specimens was comparable to contamination reported in the literature for urethral catheterization. Studies considered that even possible adverse events related to invasive methods, CCU procedure could be a good alternative to invasive methods in some circumstances.
Practice Implications	<i>Clean-catch</i> technique seems to be an interesting noninvasive method that could be used, instead of invasive methods, for UTI diagnosis. Contamination proportions were similar to those reported in the literature for urethral catheterization.
Evidence level	As a Randomized controlled Trial the study (RCT) is a recommendation A, evidence level 1b.

In the Herreros et al. (2015) study, authors compared the results of urine obtained by the clean-catch method and urethral catheterization. Children were randomized to both urine collections, using the non-invasive clean-catch method and the invasive method of catheterization. The study shows low levels of contamination in both methods, with 5% and 8% respectively. Authors consider that the results of sensitivity and specificity (97% and 89% respectively) of urine cultures obtained by clean-catch show low contamination rates (Herreros et al., 2015) (Table 3).

Table 3 - Description and research evidence of the Herreros et al (2015) study

Methods	Cross-sectional study with two matched samples of urine, obtained using CCU stimulation technique and urethral catheterization in infants with less than 90 days with a suspected UTI. For CCU they used three steps: encouraging oral intake, a genital cleaning protocol and stimulation of voiding (suprapubic and lumbosacral percussion). Catheterization was considered to be the gold standard for urine culture-collection. Sensitivity and specificity of CCU was calculated compared with the gold standard.
Participants	60 infants with less than 90 days, mean age of 44 days. Forty-two (70%) were male (all uncircumcised), admitted because of fever without a source and 120 matched samples were obtained.
Interventions	Compare the accuracy of CCU in infants, with urine collected using catheterization for UTI diagnosis. Urine was immediately sent to the laboratory
Results	The culture results from CCU samples included 37 positive (62%), 20 negative (33%) and three contaminated (5%). The results from catheterization samples included 34 positive (57%), 21 negative (35%) and five contaminated (8%). The CCU resulted in two false-positive (10%) and one false-negative (7%), corresponding to a sensitivity of 97%. Specificity was 89%. The prevalence of UTIs was 63% and Clean-catch and catheterization founded the same bacteria in 32 patients. The post-test probability of having a UTI if the CCU culture was positive was 94%.
Conclusions	Sensitivity and specificity of cultures from CCU was accurate and presented low contamination rates. These suggest that this noninvasive technique is a safe, valuable alternative method for the diagnosis of UTIs in infants less than 90 days.
Practice implications	The contamination rates using CCU were lower than those obtained by the urethral catheterization, so this technique is a valuable and noninvasive alternative method for urinary tract infection diagnosis in children without sphincters control.
Level of evidence	As a Randomized Controlled Trial (RCT) the study is a recommendation A, level of evidence 1B.

4. DISCUSSION

Noninvasive urine collection by CCU, used for the diagnosis of UTI is a new technique in newborns and infants. Its relevance to implementation is that avoid traumatic experiences such as pain, consequences inherent in other methods (taped sterile bag, urethral catheterization and suprapubic aspiration) that had high human and material resource expenditures, high number of other means of diagnosis, parents labor abstention, risk of contracting other infections due to the high waiting time in the emergency department, delays of diagnosis and associated comorbidities (Badiiee, Sadeghnia & Zarean, 2014; El-Naggar, Yiu, Mohamed, Shah, Manley, McNamara, et al 2010). So, the importance to identify others safe, quick and effective technics to obtain a midstream urine sample in children not able to co-operate (Herreros, 2013).

In this systematic review, the contamination proportion for CCU specimens was lower in the study of Herreros et al (2015) or comparable to what is reported in the literature for specimens obtained by standard methods. In this case, because the use of urethral catheterization is an invasive method, that could be associated with adverse events in up to 20% of children (Ouellet-Pelletier, Guimont, Gauthier & Gravel, 2014). In this way, authors suggest the noninvasive CCU procedure in children up to 6 months of age with good general status, to exclude the diagnosis of UTI, and in children who require a summary urine analysis, in detriment of the taped sterile bag that is more time and resources consuming.

Labrosse, Levy, Autmizguine & Gravel (2016) found also that the bladder stimulation technique to obtain CCU was effective in 61% infants with less than 90 days, with an average time of 45 seconds. They found that age below 90 days was a strong predictor for this new technique. Only two previous studies (Herreros, Tagarro, García-Pose, Sánchez, Cañete & Gili, 2015; Chu, Wong, Luk, Wong, 2002) evaluated the effectiveness of the standardized CCU procedure but the sample was limited to infants aged below 30 days. In those studies, success proportions for CCU were 86% and 78%, respectively. Labrosse et al., referred that a possible explanation for the slightly lower difference to those previous studies, was that they did not exclude children with low oral intake. Other studies (El-Naggar, Yiu, Mohamed, Shah, Manley, McNamara, et al, 2010; Altuntas, Tayfur, Kocak, Razi, Akkurt, 2015) compared urine samples collecting using midstream urine, urethral catheterization and suprapubic aspiration and reported high results for sensitivity and specificity, however Herreros et al., stated that studies are highly heterogeneous because they include a wide spectrum of patients and little standardization in samples collection.

However, authors point out some limitations in this study, such as the small samples, with prevalence for males and inclusion of children with a strong suspicion of UTI.

Other studies published recently, after the study that supported this paper, obtained different results from those found and included in this review. This is the case of the paired-comparative study by Altuntas & Alan (2019), carried out with 90 children between 2 and 28 days of life who met the established inclusion criteria. The study aimed to compare the contamination rates of catheter specimen urine (CSU) and midstream clean-catch technique by a lumbar/sacral stimulation in newborns. From each newborn was obtained a urine sample by the two methods, with an interval of 3 hours between them and after feeding and perineal washing. The results were consistent in 61 newborns, including confirmation of urinary tract infection in thirteen of them,

with the development of the same bacteria. However, the percentage of contamination rates was 10% in samples collected by urinary catheterization, against 26.6% in those obtained by midstream clean-catch, with no significant differences between genders. The agreement rate between the two urine collection methods was 74.4%. The authors suggest that the difference in these results with other published studies were caused by differences in study design, study population, and different cutoff values defined.

CONCLUSIONS

The nurse in performing the urine collection, avoids contamination and ensures as a superior goal in the interdependent nursing care, the rapid and effective diagnosis of a urinary tract infection to guarantee your quick treatment. Therapeutic intentionality is not only related to the technical, but also in the child and family approach, since it uses support resources to reduce any traumas that the procedures entail, providing an advanced level of care, with safety, competence and satisfaction for the child and their families.

So, it is important training nursing teams for this noninvasive midstream CCU technique, given its quickness, safety and effectiveness.

This systematic review allowed us to identify the pertinence of this non-invasive technique to urine collection in non-toilet-trained children in the interdependent nursing care, and due the encouraging results in rates of contamination and effectiveness. However, more research need to be performed to confirm the scientific evidence of the method for the diagnosis of urinary tract infection, given the inconsistent results of the studies, mainly related to the differences in study designs, characteristics of the population and in the sample size and clinical cutoff values defined.

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