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Efficacy of Antibiotic Coated Clean Intermittent Catheterization in Children with Neurogenic Bladder

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Abstract

Aim: The primary goal of urologic management in children with neurogenic bladder is to reduce the risk of urinary tract infection (UTI) and associated renal injury. We aimed to evaluate the use of antibacterial-coated clean intermittent catheterization (CIC) catheters for neurogenic bladder patients in comparison with standard catheters. Material and Methods: We performed a retrospective study of 144 neurogenic bladder patients aged 6-16 years old, who received CIC at two major centers between January 2007 and June 2016. Group 1 consisted of children used antibacterial coated (chitosan) catheter (n=55), group 2 of children used standard CIC without antibacterial (n=42) and group 3 of children used standard CIC returned into antibiotic coated CIC (n=29). Febrile urinary tract infection and asymptomatic bacteriuria were evaluated among patients with antibacterial coated or standard catheters. We also focused on a subgroup of patients with high risk of urinary tract infection (grade 3> vesicoureteral reflux, previously scar formation in renal scintigraphy). Results: Totally 126 patients (89 female, 37 male) were involved in this study. The mean age of the study group was 9.6±2.6 years (range 6 to 16) and the mean follow-up 58±14 months (min: 22, max: 69). There was no significant difference between three groups for asymptomatic bacteriuria and febrile UTI frequencies. However, febrile UTI frequencies and de nova scar formation in renal scintigraphy were higher in previously defined subgroup of patients with high risk of urinary tract infection in group 2 than group1 and 3. Discussion: Both antibiotic coated and standard CIC can be used in children with neurogenic bladder with similar complication rates. Patients with high risk of urinary tract infection (higher than grade 3 vesicoureteral reflux, dilated ureter, previously de nova scar formation in renal scintigraphy) will benefit from antibacterialcoated catheters rather than standard ones.

Keywords: Clean Intermittant Catheterization; Neurogenic Bladder; Urinary Tract Infection.

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1. Material and Methods

Between the years 2007 and 2016, in Ankara University and Hacettepe University retrospectively analyzed cases of 144 patients age of 6 to 16 who have been performed on with CIC due to diagnose of neurogenic bladder in the Children's Urology Departments. However, 18 cases were left out of the study because of the lack of registrations and 126 cases were included in the study. The patients have been grouped according to CIC used. Group 1 consisted of 55 patients using antibacterial catheter (chitosan, made up of N-Acetyl-D-Glucosamine monomers joining with Beta-1,4 connections), Group 2 consisted of 42 patients using the standard catheter and Group 3 consisted of 29 patients who had used the standard catheter in the past and changed to the antibacterial coated catheter at least 6 months ago. Age, sex, clinical findings, culture results, the presence of febrile urinary tract infections and asymptomatic bacteriuria were retrospectively analyzed using data. Also among patients who underwent CIC due to the neurogenic bladder, the patients that were high risk for pyelonephritis according to European Urology Guidelines (VUR higher than Grade 3 or appearance of scarring on nuclear scanning) were analyzed for CIC [1]. In the study, it was found that the patients who underwent CIC for neurogenic bladder were a total of 88 (%69.8) whereas patients who had CIC performed for non-neurogenic etiologies (non-neurogenic bladder, exotropia vesica, posterior urethral valve and other etiologies) were a total of 38 (%30.2). We did not give routine antibiotics to CIC patients, patients who underwent CIC but suppressive antibiotics were given to patients with VUR comorbidity. Clinically relevant patients who had a fever and 10^5 colonies per ml in the urinary culture were accepted to have urinary tract infection (UTI). Patients who did not have UTI symptoms and also did not have urinary culture colonization were accepted to have asymptomatic bacteriuria [2]. Urinary collection in patients who did not have urinary control was performed by catheterization. SPSS was used to analyze the results. Frequency, mean and standard deviation (SD) was analyzed. When comparing ratios, Ki-Kare test was used. Continuous variables were compared using Mann-Whitney Test and Anova.

2. Findings

126 patients who underwent CIC for neurogenic bladder between January 2007 and June 2016, who had detailed patient files, regularly came to follow-ups and patients who took treatment for UTI or was defined as asymptomatic included in the study. Mean follow up was 56±14 months (min 22, max 69). Mean patient age was 9.6±2.6 years(6-16). Out of 126 patients, 37 were male (%29.3) and 89 were female (%70.6). Group 1 consisted of 55 patients who used an antibacterial coated catheter, Group 2 consisted of 42 patients who used the standard catheter and Group 3 consisted of patients who used the standard catheter in the past and afterward used antibiotics for a minimum of 6 months. Between these three groups, no relevant difference was found for age (p=0.32) or sex (p=0.55). 48 patients in Group 1 (%87), 37 patients in Group 2 (%88) and 23 patients in Group 3 (%79) was found to have asymptomatic bacteriuria whereas 7 patients in Group 1 (%12), 8 patients in Group 2 (%19) and 3 patients in Group 3 (%10) had febrile UTI. Between the groups, no statistically relevant difference was found for asymptomatic bacteriuria (p=0.18) and febrile UTI (p=0.12). In the subgroups 14 patients in Group 1 (%66), 11 patients in Group 2 (%68) and 7 patients in Group 3 (%58) had symptomatic bacteriuria; and 3 patients in Group 1 (%14), 7 patients in Group 2 (%43) and 2 patients in Group 3 (%16) had febrile UTI; and 2 patients in Group 1 (%9), 6 patients in Group 2 (%37) and 1 patient in Group 3 (%8) had new

scar formation. There was no statistically relevant difference for asymptomatic bacteriuria between the three groups (Ki-Kare Test, p=0.43), febrile UTI (Ki-Kare Test p=0.012) and denovo scar formation (Ki-Kare test p= 0.014). The difference between Group 1 and 3 using antibiotic catheter was statistically relevant but very low.

3. Discussion

Since the day CIC was found, up to now there has been a dramatic improvement in the proservation of upper urinary tract and the quality of life in patients with neurogenic bladder and urinary dysfunction. Because CIC lowers high intravesical pressure, helps both bladder compliance and upper urinary tract functions, CIC has become a very important method in lowering both morbidity and mortality in patients with both neurogenic and non-neurogenic urinary problems. However, there are complications to this procedure. Most common unfavored side effect are UTIs [6]. The factors affecting UTI incidance are; several methods being used for the diagnosis of UTIs, CICs being made of different materials, urinary analyses being done at different frequencies, different criteria being used to define the infection, and the use of an antibiotic for suppression [3]. In the study where 39 patients with neurogenic bladder who were transferred from using classic catheter to hydrophilic catheter were analyzed, Wyndaele and his colleagues showed that the use of hydrophilic catheters are easier and more tolerable [4]. Also, the problems seen with patients using classical catheter for a long period, was not seen in these patients. Even though hydrophilic catheters have these advantages, some patients are not able to use them due to economical problems. In the yearly follow up of 407 patients (252 patients with neurogenic bladder, 136 with detrussor myopathy and 19 with infravesical obstruction) the frequency of clinically unrelevant UTI was %24.5, minimal symptomatic UTI was %58.6, frequently symptomatic UTI was %14.3 ve patients with major symptoms was shown as %2.6 [5). In another study, the incidance of pyelonephritis was %14-37, and the incidance of urosepsis was around %3 [6]. It was reported that in patients who underwent CIC, the UTI was due to the urethral trauma during the procedure [7]. Also, the bladder wall is more sensitive to the bacteria within the residual urine. Since the bladder is being stretched due to residual urine, capillary occlusion takes place and so the recycle of both metabolic and immune substrates through the bladder wall is disrupted [8]. In another study, complications due to CIC are low but a majority of the complications are due to the catheterization not being applied at enough frequencies [9]. UTIs can also occur due to bacteria producing biofilm within the inner wall of the catheter. Especially when these catheters are being re-used, the bacteria can easily pass to the urine and cause symptomatic UTI [10]. Within 2 clinical centers, patients with neurogenic bladder having CIC, patients with hydrophilic catheter and patients with antibacterial (chitosan) catheter were compared. Despite retrospective studies on the UTI caused by different types of CICs, this was one of the rare studies. It was found that there was no difference on asymptomatic bacteriuria and febrile UTI rates due to using antibacterial catheters or changing to a antibacterial catheter. Patients who have VUR bigger than Grade 3, patients with a dilated ureter or have a pyelonephritis scar, were accepted as high risk for febrile UTIs [11-12]. In patients who have dilation due to VUR, emptying residual urine using CIC is harder. And so, due to this residual urine, bacterial colonization is much easier. In a study analyzing Gram (+) Staphylococcus Aureus and Gram (-) Pseudomonas Aeruginosa and Escherichia Coli, the antiseptic activity of chitosan covered catheters was shown [13]. Routine antibacterial catheterization could lower the rates of colonization. There is no study comparing these catheters within the litarature. In this study, patients with high risk for UTI and pyelonephritis, patients who used antibiotic catheter had less febrile UTI and also less new scar formation compared to patients

using standard catheter. These findings need to be supported with expanded controlled clinical studies.

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