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Profile of bacterial and parasitic urinary infections in Saint Louis Senegal between 2000 and 2010

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Infections of the urinary tract are important part of infectious diseases that mainly involve bacteria. In parasite endemic areas, bacterial and parasitic co-infections may occur, however in Saint-Louis region which is a Schistosoma-endemic area, little is known about this association. Here this study aim to investigate the spectrum of bacterial and parasitic urinary infections as well as co-infections with both species. Concordantly to the current algorithm at the biomedical laboratory at Saint Louis Hospital, bacterial and parasitic investigation has been performed using the conventional method of bacteriological and parasitological examination of urine. Data were collected from register records from 2000 to 2010, recorded and analysed using Epi Info 7. 17107 urines samples were recorded and among which, 2352 (14%) were positive bacterial cultures including mainly *Escherichia coli* (54%) and *Klebsiella* spp (19%). Seven hundred and forty-three parasites have been identified including *Trichomonas vaginalis* (64%), Schistosoma *haematobium* (34%) and *Schistosoma mansoni* (2%). Both parasites and bacteria were found in 55 samples with *T. vaginalis/E. coli* (79%) as main combination, followed by *T. vaginalis /Klebsiella* spp. (11%). Regarding *S. haematobium,* it was found to be associated with *E. coli* in 7 samples and *Klebsiella* spp. in 4 samples. In the region of Saint-Louis, the urinary tract infections are dominated by bacterial infections including mainly *E. coli* and *Klebsiella* spp and may, for lesser extent, be caused by *Schistosoma haematobium* and *Trichomonas vaginalis*. Thus, the evaluation of the impact bacterial and parasitic co-infection in the urinary tract should have a particular interest especially in Schistosoma endemic area and need further study to better understand the potential interactions.

Key words: Urines, bacteria, parasites, co-infection, Saint-Louis, Senegal.

INTRODUCTION

Infections of the urinary tract are important part in infectious diseases among which bacteria remain far the main causes. Among the bacteria, the Gram negative bacilli, especially the enterobacteria, represent 85% with *Escherichia coli* in first line (75 to 90%), followed by *Klebsiella spp* and *Pseudomonas spp* (Ferjani et al., 2011). The parasitic strains reaching the urinary system are mainly the schistosomes; however, other parasites

such as *Trichomonas vaginalis* or filaria can be involved in urinary tract infections, leading to renal disturbances (Bourée et al., 2007).

Urinary schistosomiasis is endemic in 76 countries, affecting 207 million harbouring the Schistosomiases and about 600 million people at risk of contracting urinary diseases (Organisation Mondiale de la Santé (OMS), 2011). Eighty percent of infected people are from sub Saharian Africa and Senegal is not unscathed from that pathology with a prevalence of 44% for *Schistosoma haematobium* (Meurs et al., 2013).

Furthermore, in certain sites of northern Senegal, the prevalence of *S. mansoni* is slightly above that of *S. haematobium* which are 61 and 50% respectively (Meurs et al., 2012a). Thus, co-infection with bacteria and parasites may occur in the urinary tract of the same individual and can lead to interactions that might have important implications on the morbidity of urinary tract infections.

However in the study context, few data regarding the co-infection prevalence in the urinary tract are available. Thus, this is a retrospective study that aims to assess the bacterial and parasitic profile in urine samples collected from 2000 to 2010 at the regional hospital center (RHC) of Saint Louis in Senegal as well identifying possible co-infections.

METHODOLOGY

Study site

This retrospective study was conducted at the Regional Hospital Center (RHC) of Saint-Louis region. Located in the Nord-East of Senegal in the outfall of the Senegal River, Saint-Louis is part of the Ferlo region and possesses a Sahalian climate. The main activities in that region are fishing and agriculture that both promote permanent water contact. Moreover, an important ecologic changes resulting from the implementation of the dam of Diama in 1989 has widespread in the distribution of schistosomes and markedly increased the prevalence of *schistosoma* infections (Meurs et al., 2012b; Southgate et al., 2001). Indeed, *Schistosoma* strains possess an intermediate life cycle that requires sweet water and involving molluscs from *Bulinus* genus (Bourée et al., 2007).

Urine collection period

Collection of urine samples used for parasitic and bacterial examination was seasonal and has been performed in two different seasons of the year: from October to June corresponding to the dry season and from June to September that coincides to the raining season.

Bacterial examinations

Urine tests were performed using the routine procedure of bacterial examination at the laboratory of the Saint-Louis hospital. It consists of macroscopic and microscopic examination and culture in cystine-lactose-electrolyte-deficient agar (CLED). Bacterial infection was defined with a positive threshold 10^5 colonies per milliliter of urine associated with leukocyte reaction. Bacteria were identified through their morphologic, biochemistry and antigenic characteristics. Gram negative bacilli have been identified on the basis of biochemical characteristics such as oxidase, fermentation of sugars, possession of an urease, indole prodcution and the presence of tryptophan desaminase. Concerning Gram positive cocci, the study used the test to catalase, the type of hemolysis and specific agglutination tests for their identification. Antimicrobial susceptibility was performed for samples that were positive by diffusion technique on ordinary blood agar, according to the recommendations of the "Comité de l'Antibiogramme de la Société Française de Microbiologie" (CA-SFM 2010).

Parasitological examinations

After centrifuging at 3000 rpm for five minutes, specimens were tested under optical microscope in order to detect Schistosoma haematobium eggs by a terminal spine, Schistosoma mansoni by a lateral spine and Trichomonas vaginalis with the motility.

Data analysis

Recoded data arising from bacteria and parasite tests performed at the medical biology laboratory from 2000 to 2010 were analysed using Epi info version 7.

RESULTS

Overall, 17107 urine samples were analysed at the medical biology laboratory of Regional Hospital Center of Saint-Loui,s from 2000 to 2010. The prevalence of bacterial and parasitic infections were 13.7 (n=2346) and 4.3% (n=743) respectively.

Profile of bacterial infections in the urinary tract

Among identified bacteria, 84.67% were enterobacteria including *Escherichia coli* that represented 54% of them, followed by *Klebsiella spp* (18.98%), *Enterobacter spp* (5%) and *Proteus* spp (3.6%). Other bacteria such as *Pseudomonas* spp, *Enterococcus* spp and *Staphylococcus aureus* were also found (Figure 1).

Profile of parasitic infections

Parasites found in urine samples were mainly *Trichomonas vaginalis* representing 64% (n= 477) and *Schistosoma* species with 35% (n= 261) mainly *S. haematobium* (n=257). The prevalence of these parasites

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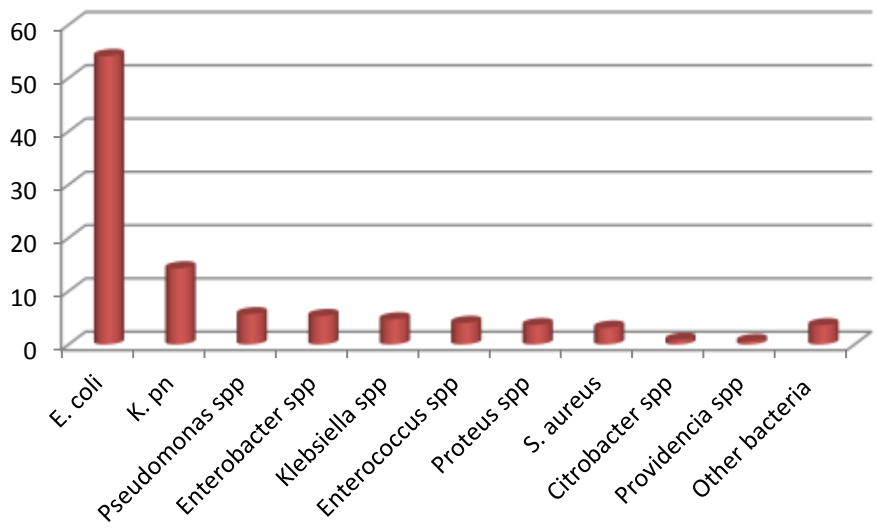

Figure 1. Distribution of bacteria according to species.

Table 1. Distribution of parasites and bacteriuria according to the season and sex.

Variable	*T. vaginalis*	*S. haematobium*	*S. mansoni*	*S. haematobium/ mansoni*	Positive cultures	Negative cultures
Saison 1	340	193	2	3	37	507
Saison 2	137	61	1	1	18	181
Total	477	254	3	4	55	688
Female	436	105	1	1	48	500
Male	35	149	2	3	7	182
Sex NP	6	0	0	0	0	6
Total	477	254	3	4	55	688

was 74% in female subjects compared to 26% in male. 73% of parasites were found in the dry season and 27% in the raining season (Table 1).

Bacterial and parasitic co-infection

Simultaneous presence of bacteria and parasites were found in 55 samples. The bacteria found in association with parasites were *E. coli* (62%), *K. pneumoniae* (16%), *Enterobacter spp* (7%), *Enterococcus* spp (5%), *and Streptococcus spp* (4%). Other bacteria such as *Klebsiella spp*, *Pseudomonas* spp., *Staphylococcus* spp., *Moraxella spp* and *Proteus vulgaris* were also associated once with parasites (Table 2).

Regarding parasites, *T. vaginalis* was found in association with *E. coli* in 27 subjects (49%) and *Klebsiella* spp. in six patients (10.9%). *S. haematobium* was found in association with *E. coli* in seven urine samples and with *Klebsiella* spp. in four patients. Presence of both *Enterobacter* spp. and *T. vaginalis* was found in four subjects, all female. *Enterococcus spp* strains were found associated to *T. vaginalis* in three positive cultures of which two were polybacterial (*E. coli* for the one and *Klebsiella* the other). *S. haematobium* and ectopic *S. mansoni* eggs was found in four samples, all free from bacteria.

Table 2. Co-infections bacteria/parasites.

Bacteria	Parasites		Total
	T. vaginalis	*S. haematobium*	
E. coli	27	7	34
Klebsiella spp.	6	4	10
Enterococcus spp.	3	-	3
Enterobacter spp.	4	-	4
Pseudomonas spp.	-	1	1
Streptococcus spp.	-	2	2
Moraxella spp.	-	1	1
Total	40	15	55

Table 3. Percentage of susceptibility to antimicrobial agents.

Bacteria	C3G	Fluoroquinolones	Trimethoprim/Sufamethoxazole
E. coli	100	12	0
Klebsiella spp	90	90	70
Enterobacter spp	100	100	50
Pseudomonas spp	100	100	-
Enterococcus spp	67	67	0

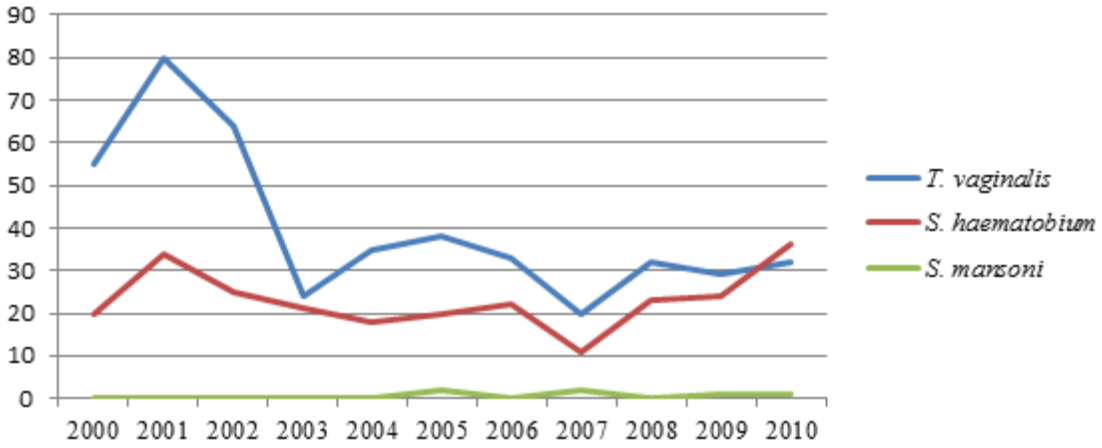

Figure 2. Annual distribution of parasites.

Antibiogram

The results of susceptibility testing are summarized in Table 3.

DISCUSSION

Bacterial and parasitic infections are important part of infectious disease. However in this context, the possible interactions between the microorganisms in the urinary tract remain unknown. Among 17107 microbilogical urines tests that have been performed between 2000 and 2010, the study found a frequency of 13.7% for bacteria. The study data along with higher prevalence of bacteria in urines reported in Ethiopia between 2003 and 2010 (22,7%), and the study of Kibret and Abera (2014) suggested quite a high prevalence of bacterial urinary infection in tropical and sub-tropical settings.

As previously shown (Daza et al., 2001; Kibret and Abera, 2014), the enterobacteria were largely predominant in the urines with *E. coli* reprensenting more than half of isolated bacteria. Indeed, several studies reported that *E. coli* remain the main enterobacteria identified in urinary tract followed by *K. pneumoniae* and *Pseudomonas spp* or *P. mirabilis* (Daza et al., 2001; Kibret and Abera, 2014; Meiland et al., 2004). This high prevalence might be related to the proximity of the cutaneous and mucosal microbiata to the genital mucosa as well as the ascendant physiopathology of urinary tract microorganism deriving from uretral microbiota. Regarding parasitic infections the study found a prevalence of 4.3 (including mainly *T. vaginalis* and *S. haematobium)* and 0.94% for *S. mansoni*. This ectopic release of *S. mansoni* eggs through the urines takes particular importance because of its association with the severity of urinary schistosomiasis. Despite a similar trend, the frequency of *T. vaginalis* was higher than those of *S. haematobium* from 2000 to 2009. However from 2010, a slight increase of the frequency of Schistosomes compared to *Trichomonas* has been observed (Figure 2).

Several studies have shown that the prevalence and infection intensity are function of environmental conditions and age of the hosts (Ibikounlé et al., 2013; Meiland et al., 2004; Sy et al., 2011). In South Benin, a *S. haematobium* prevalence of 32.78% along with high infection intensity has been reported in school children 7 to 8 years old, especially in males (Ibikounlé et al., 2013). We were not able to analyse the data according to age which was missing from the study data. According to the season, Sy et al. (2011) have reported that *S. haematobium* was not detected at the beginning of the raining season in the Eastern part of Senegal whilst its prevalence was 7.6%; this prevalence was higher in

school children compared to adults (Sy et al., 2011). The same study has shown that in the dry season, *S. haematobium* was associated to females compared to males (Sy et al., 2011). However, other investigations did not show any difference in the prevalence of schistosomiasis according to the sex (Dabo et al., 2011). It appears that the prevalence of S. haematobium changes following the season and would be higher the raining season because of ecoclimatic conditions promoting parasite transmission (Clements et al., 2008).

The study found a *T. vaginalis* prevalence of 4.3% with 91% in female; this prevalence was lower than what has been reported by Schwebke et al. (2003) in men having sex with men. We found that prevalence of schistosomes were higher in males compared to females. These results are not consistent with others showing higher prevalence in male school children compared to females; however reverse phenomenon was observed in adults (Schwebke et al., 2003).

Regarding bacteria and parasite co-infection, the study data have shown that *E. coli* was the main bacteria associated to parasites in over 50%, followed by *K. pneumoniae*, *Enterobacter* spp, *Enterococcus* spp and *Streptococcus spp. S. haematobium* was associated to *E. coli* in 12.7% of urine samples and *Klebsiella* spp in 7%. However, we did not find any co-infection with *Neisseria* and *Trichomonas* though Jane et al. () have reported such association in 9.4% of urinary infections (Schwebke et al., 2003). Good sensitivity was obtained with the third generation of cephalosporin for all isolates and fluoroquinolones (except *E. coli*). The high resistance of *E. coli* with quinolones was obtained by Kibret and Abera (2014), unlike Daza et al. (2001) who showed acceptable levels of activities for quinolones with gram negative bacilli (Daza et al., 2001).

To the best of the study knowledge, any study investigating the co-infection with bacteria and parasites has been conducted in Senegal. Interactions between these microorganisms may result in potentialization of transmission of one or other microorganisms; inversely, such interaction may lead to suppression of virulence or proliferation of one species at the expense of the other (Hoffman et al., 2006). This thus justify the need of conduction prospective study on parasitic and bacterial infections in co-endemic settings.

A limitation in this study is that the analysis of the age of which prevalence depend and morbidity of urinary schistosomiasis is missing.

Conclusion

In Saint Louis region, bacteria, particulary the enterobacteria, remain far the main causes of urinary tract infections. Nevertheless, because of its geographical specificity promoting schistosomiasis infections, the prevalence of *S. haematobium* remain high in such setting. The bacterial and parasitic co-infection might lead to interactions able to influence the pathology of urinary tract infection. Further investigations need to be conducted for better understanding of the interactions between bacteria and parasites in the urinary tract infections.

Conflict of Interests

The authors have not declared any conflict of interests.

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REFERENCES

Bourée P, Djibo N, Bisaro F (2007). Parasitoses génito-urinaires. Afr. J. Urol. 13(3):206-218.

Clements AC, Barnett AG, Nyandindi U, Lwambo NJ, Kihamia CM, Blair L (2008). Age and gender effects in self-reported urinary schistosomiasis in Tanzania. Trop. Med. Int. Health 13:713-21.

Dabo A, Badawi HM, Bary B, Doumbo OK (2011). Urinary schistosomiasis among preschool-aged children in Sahelian rural communities in Mali. Parasit. Vectors 4:21.

Daza R, Gutierrez J, Piedrola G (2001). Antibiotic susceptibility of bacterial strains isolated from patients with community-acquired urinary tract infections. Int. J. Antimicrob. Agents 18(3):211-215.

Ferjani A, Mkaddemi H, Tilouche S, Marzouk M, Hannechi N, Boughammoura L, Boukadida J (2011). Caractéristiques épidémiologiques et bactériologiques des bactéries uropathogènes isolées dans un milieu pédiatrique. Arch. Pédiatr. 18(2):230-234.

Hoffman LR, Deziel E, D'argenio DA, Lepine F, Emerson J, McNamara S, Gibson RL, Ramsey BW, Miller SI (2006). Selection for *Staphylococcus aureus* small-colony variants due to growth in the presence of *Pseudomonas aeruginosa*. Proc. Natl. Acad. Sci. USA. 103(52):19890-19895.

Ibikounlé M, Satoguina J, Fachinan R, Tokplonou L, Batcho W, Kindé-Gazard D, Mouahid G, Moné H, Massougbodji A, Courtin D (2013). Epidémiologie de la bilharziose urinaire et des géohelminthiases chez les jeunes scolaires des zones lacustres de la commune de So-Ava, sud-Bénin. J. Appl. Biosci. 70:5632-5639.

Kibret M, Abera B (2014). Prevalence and antibiogram of bacterial isolates from urinary tract infections at Dessie Health Research Laboratory, Ethiopia. Asian Pac J Trop Biomed. 4(2):164-168.

Meiland R, Geerlings SE, Langermann S, Brouwer EC, Coenjaerts FE, Hoepelman AI(2004). Fimch antiserum inhibits the adherence of *Escherichia coli* to cells collected by voided urine specimens of diabetic women. J. Urol. 171(4):1589-93.

Meurs L, Mbow M, Boon N, Van den Broeck F, Vereecken K, Dièye TN, Abatih E, Huyse T, Mboup S, Polman K (2013). Micro-Geographical Heterogeneity in Schistosoma mansoni and S. haematobium: Infection and Morbidity in a Co-Endemic Community in Northern Senegal. PLoS Negl. Trop. Dis. 7(12):e2608.

Meurs L, Mbow M, Vereecken K , Menten J, Mboup S, Polman K (2012a). Epidemiology of mixed Schistosoma mansoni and Schistosoma haematobium infections in northern Senegal. Int. J. Parasitol. 42(3):305-311.

Meurs L, Mbow M, Vereecken K, Menten J, Mboup S, Polman K (2012b). Bladder Morbidity and Hepatic Fibrosis in Mixed Schistosoma haematobium and S. mansoni Infections: A Population-Wide Study in Northern Senegal. PLoS Negl. Trop. Dis. 6(9):e1829.

OMS-Organisation Mondiale de la Santé (2011). Agir pour réduire l'impact mondial des maladies tropicales négligées: Premier rapport

de l'OMS sur les maladies tropicales négligées. ISBN 978 92 4 256409 9 (Classification NLM: WC 680). (http://apps.who.int/iris/bitstream/10665/44694/1/9789242564099_fre.pdf)

Schwebke JR, Edward W, Hook III (2003). High Rates of *Trichomonas vaginalis* among Men Attending a Sexually Transmitted Diseases Clinic: Implications for Screening and Urethritis Management. J. Infect. Dis. 188(3):465-468.

Southgate VR, Tchuenté TLA, Sène M, De Clercq D, Théron A, Jourdane J, Webster BL, Rollinson D, Gryseels B, Vercruysse J (2001). Studies on the Biology of Schistosomiasis with Emphasis on the Senegal River Basin. Mem. Inst. Oswaldo Cruz. 96:75-78.

Sy I, Balde Y, Ndao B, Barbier D, Georges P, Ndir O (2011). La bilharziose au Sénégal oriental. Eur. J. Water Qual. 42(1):1-5.