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Incidence of renal stone disease among urinary tract infection patients and antimicrobials susceptibility

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ABSTRACT

To determine incidence of renal stone disease among urinary tract infection patients and antimicrobials susceptibility this cross sectional study was undertaken at Ibb city of Yemen between December 2008 and May 2009. The total study population was 70 patients that chosen from free different hospitals (Alqadree hospital, Alnasr hospital, and Clinical laboratory). Both male and female patients with age range of <20 to >40 years, with renal stones, urinary tract infection and antimicrobial susceptibility were included. The data was obtained and analyzed by filling a specially designed proforma for each patient. In all 70 patients infection was present in 78.6% of cases. The age group that suffered most from infection renal stones disease among the 20-40 year-old group with 67.1% (47/70), distributed between men and women as following: 59.6% (28/47) for women and 40.4% (19/47 for men. The commonest organisms isolated according to culture report were E. Coli (71%), with 66.7%,(16/24) for women and 33.3% (8/24) for men, Klebsiella (12%), with 66.7% (2/3) for women ,and 33.3% (1/3) for men, Proteus (7%), with 66.7% (2/3) for men, 33.3% (1/3) for women. The frequency of renal stones disease in patients with urinary tract infection was 32.7 %. however, Ofloxacin (OF) was more sensitivity for (24/41) E.coli with a ratio 58.5% , (8/9) Klebsiella with a ratio 88.9% and (5/8) Proteus with a ratio 62.5% , Ciprofloxacin (CL) for (21/41) E.coli with a ratio 51.2% ,(5/9) Klebsiella with a ratio 55.6% and (5/8) Proteus with a ratio 62.5% ,and Gentamycin (J) for (19/41) E.coli with a ratio 46.3% ,(8/9) Klebsiella with a ratio 88.9% and (5/8) Proteus with a a ratio 62.5%. With strong back ground we can colculsion that renal stone disease makes an important group among urinary stone diseases. Urinary tract infection with certain bacteria plays an important role in the synthesis of renal stones. A high incidence can be prevented by adopting a variety of simple conservative measures

Keywords: Renal stone, Urinary tract infection and Antimicrobial susceptibility, Yemen.

INTRODUCTION

Renal stone disease has been recognized in many parts of the world since antiquity. It is one of the most painful and commonest urological disorders. The evidence of urinary calculi (presumably bladder) has been found in 7000 years old Egyptian mummy [1]. Its incidence has increased considerably during the 20th century. Renal stones are polycrystalline aggregates which are often associated with crystalluria and urinary tract infection. In most instances the precipitation of crystals occurs in little quantities. Infection has a dual role. Urea splitting organism promotes precipitation of phosphates and oxalates in alkaline media [2]. Secondly, the sharp edges of oxalate calculi damage the urinary tract epithelium and encourage the growth of organisms by forming the nidus to the infectious agents. Persistent Urinary tract infection with urea splitting or non- splitting bacteria may be the initial factors in the synthesis of infection renal stones. In metabolic stones bacterial superimposition may be responsible for the recurrent urinary tract infections. A definite association is seen between urinary stones and urinary tract infection ,

positive cultures are not only found with struvite stones, but also with apatite and calcium oxalate stones, . Zanetti Get al [3]. Struvite and apatite stones are often associated with urinary infection, especially with urea-splitting bacteria [4]. Griffith et al. showed that bacterial urease is a primary cause of infection stones [5]. The driving force behind struvite stones is infection of the urine with urease-producing bacterria. It has been proposed that the urease hydrolyses urea, resulting in ammoniacal urine, alkalinity and stone formation [6]. A second mechanism by which bacterial infection may induce stone formation is by increasing crystal adherence. Parsons et al. demonstrated that ammonium damages the glycosaminoglycan layer that covers the normal bladder mucosa and allows bacterial adherence to the mucosal surface [7]. Bactterial infection may, in a similar manner, damage the glycosaminoglycan layer within the renal collecting system [8]. This facilitates bacterial adherence, tissue inflammation, production of an organic matrix and crystal–matrix interaction.

Unfortunately, patients with infection stones have a high incidence of new stone growth and persistent infection, especially if residual stone fragments remain. The importance of complete eradication of these organisms needs constant emphasis [9]. Cure is achieved by the removal of all foreign bodies (stones, matrices and catheters) and by eradication of infection. Postoperatively, long-term antimicrobial therapy with agents known to be effective against the specific organism involved was needed in most cases to eradicate infection. High resistance rates may be a result of abuse of antimicrobials, which leads to the development of resistant strains. Infection of urinary stones with multidrug-resistant bacteria necessitates their removal to ensure complete cure. Antimicrobial therapy can sterilize the urine and reduce urinary pH and thus render urine under-saturated with respect to struvite. This results in complete or partial dissolution of the stone. Antimicrobial agents can be used to prevent stone recurrence or growth after operative procedures [10].

MATERIALS AND METHODS

The study was undertaken at Ibb city of Yemen between December 2008 and May 2009. The total study population was 70 patients that chosen from free different hospitals (Alqadree hospital, Alnasr hospital, and Clinical laboratory). Both male and female patients with age range of <20 to >40 years, with renal stones and urinary tract infection were included. Midstream urine was collected in a sterilized wide mouthed container after necessary precautions. After physical examination for colour, a commercially available reagent strip (Uric 3.V, Uricon Biotec Korea) was used for the detection of pH, proteins and sugar in urine. Then microscopy was done for the detection of pus cells, red blood cells, epithelial cells, Casts and crystals. In case of pyurea, urine was cultured for 24 hours on standardized blood Agar or Mac-Conkey Agar, at a temperature of 37 □C for the growth of microorganisms. Pure isolates of bacterial pathogen were preliminary characterized by colony morphology, gram-stain, and catalase test. A standard biochemical procedure was used for full identification of gram- positive and gram negative bacteria. Antimicrobial susceptibility testing was performed for bacterial isolates by using agar diffusion method described by Bauer et al., 1966 on Mueller-Hinton agar (oxoide) [11].

RESULTS

A total of 70 midstream urine specimens were collected from patient during the period from December 2008 to May 2009, for renal stones disease, (29/70), (41.4%) were males, and (41/70),(58,57%)females Table 1. Out of 70 patients examined for renal stones disease, (55/70), patient showed positive urine cultures with a ratio (78.6%) while (15/70) showed no significant growth with a ratio (21.4%) Figure 1. Out of 55 patients with urinary tract infection 18 patients were having renal stone disease. So the frequency of renal stones disease in patients with urinary tract infection was 32.7 % (Figure2). The findings of this study showed that (41/55) of the total positive growth were Gram negative bacilli predominant organisms with a ratio (55%) and the gram positive bacteria isolates were (14/55) with a ratio (55%) (Figure. 3). In the present study showed that the age group that suffered most from infection renal stones disease among the 20-40 year-old group with 67.1% (47/70), distributed between men and women as following: 59.6% (28/47) for women and 40.4% (19/47) for men.

Table 1: Distribution of renal stones patients according to age

Age (in years)	NO. of patients	Male		Female	
		NO.	%	NO.	%
< 20	10	4	40	6	60
40 - 20	47	19	40.42	28	59.75
>40	13	6	46.15	7	53.84
Total	70	29	41.4	41	58.57

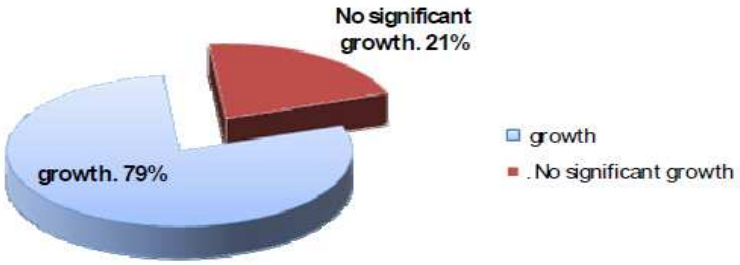

Fig 1: percentage of positive growth for renal stones specimens

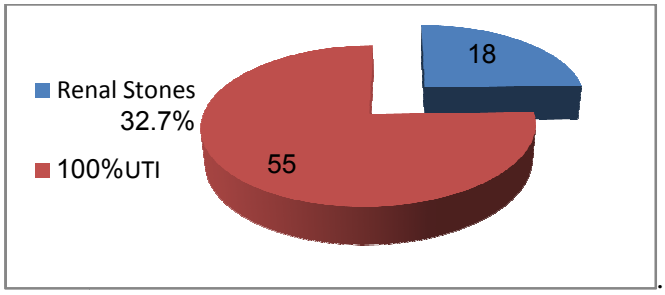

Figure2: Frequency of renal Stones in Patients with UTI

Fig (3): percentage of Gram positive and Gram negative isolates for renal stones specimens

The commonest organisms isolated according to culture report were E. Coli (71%), with 66.7%,(16/24) for women and 33.3% (8/24) for men, Klebsiella (12%), with 66.7% (2/3) for women ,and 33.3% (1/3) for men, Proteus (7%), with 66.7% (2/3) for men, 33.3% (1/3) for women as shown in table 2 and figure4.

Table 2: Distribution of Enterobacteriaceae isolates with sex of the patients

NO	Bacterials isolates	Total		Male		Female	
		NO.	%	NO.	%	NO.	%
1	*E. coli*	29	71	11	37.93	18	62.06
3	*Proteus*	5	12	2	40	3	60
4	*Klebsiella*	3	7	1	33.33	2	66.66
6	Other	4	10	3	75	1	25
8	Total	41	100	17	41.5	24	58.5

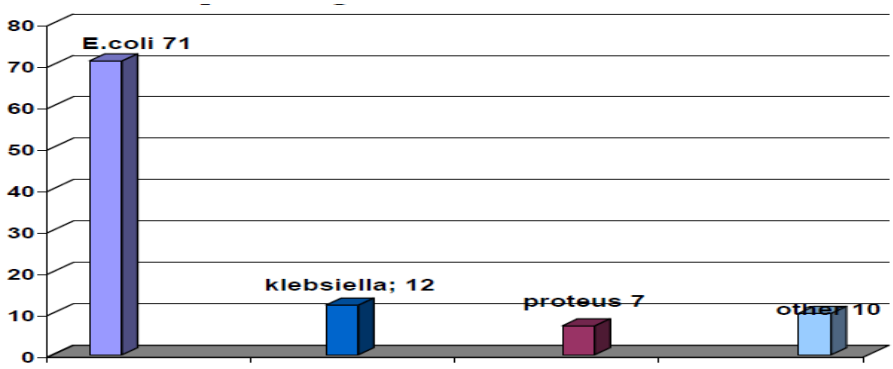

Fig (4): percentage of Enterobacteriaceae for renal stones specimens

The sensitivity testing was done to Enterobactericeae isolates (41/55) for investigate the sensitivity of Enterobactericeae in specimen of urinary tract infection isolates. The disc diffusion method was employed by used several antibiotics, were used for the sensitivity test Gram negative bacteria. 12 discs ring antibiotic were obtained from Research & Development Oriented Comp. India. These antibiotics include : Amikacin (AK) ,Amoxicillin (AM) , Ampicillin (I) , Cefotaxime (CX) ,Ceftazidime (CZ) ,Ceftriaxone (XO) ,Cefuroxime (CR), Cephalexin (CP) ,Ciprofloxacin (CL) ,Gentamycin (J) ,Ofloxacin (OF). In presnt study shown that the Sensitivity test Ofloxacin (OF), Ciprofloxacin(CL), and Gentamycin (J) were the most effective antibiotics in vitro, against enterobacteriae and the least effective antibiotics in vitro were Ampicillin (I), Cephalexin (CP), and Amoxicillin (AM) (Table3) .In current investigation found that the Ofloxacin (OF) was more sensitivity for (24/41) E.coli with a ratio 58.5% , (8/9) Klebsiella with a ratio 88.9% and (5/8) Proteus with a ratio 62.5% , Ciprofloxacin (CL) for (21/41) E.coli with a ratio 51.2% ,(5/9) Klebsiella with a ratio 55.6% and (5/8) Proteus with a ratio 62.5% ,and Gentamycin (J) for (19/41) E.coli with a ratio 46.3% ,(8/9) Klebsiella with a ratio 88.9% and (5/8) Proteus with a a ratio 62.5% (Figure 5).

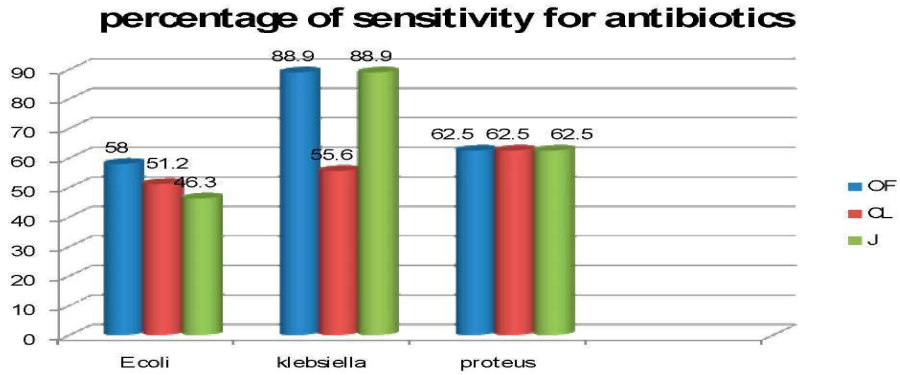

Fig5. Percentage of sensitive for antibiotic

However the Ampicilln(I)was more resistant for (18/41) E.coli with a ratio 43.9% , (8/9) Klebsiella with a ratio 88.9% and (6/8) Proteus with a ratio 75% , (AM) for (15/41) E.coli with a ratio 36.6% ,(8/9) Klebsiella with a ratio 88.9% and (6/8) Proteus with a ratio 75% ,and (CP) for (11/41) E.coli with a ratio 26.8% ,(7/9) Klebsiella with a ratio 77.8% and (5/8) Proteus with a ratio 62.5% (Figure 6).

Table 3.The percentages of susceptibility of the different Enterobacteriaceae isolates to the different antibiotics

Bacteria / Ab		E.coli		Klelbsiella		Proteus	
		NO.	%	NO.	%	NO.	%
Amikacin [AK]	S	7	17.1%	5	55.6%	6	75%
	R	2	4.9%	4	44.4%	-	-
Amoxycillin [AM]	S	1	2.4%	_	-	_	_
	R	15	36.6%	8	88.9%	6	75%
Ampicilln [I]	S	2	4.9%	-	-	-	-
	R	18	43.9 %	8	88.9%	6	75%
Cefotaxme [CX]	S	8	19.5 %	2	22.2%	2	25%
	R	7	17.1%	4	44.4%	3	37.5%
Ceftrazdme [CZ]	S	-	-	-	-	2	25%
	R	8	19.5 %	5	55.6%	3	37.5%
Ceftraxone [XO]	S	9	21.9%	1	11.1%	5	62.5%
	R	3	7.3%	3	33.3%	3	37.5%
Cefuroxime [CR]	S	15	36.6%	_	_	2	25%
	R	6	14.6%	7	77.8%	4	50%
Cephalein [CP]	S	2	4.9%	-	_	2	25%
	R	11	26.8%	7	77.8%	5	62.5%
Ciprofloxacim [CL]	S	21	51.2%	5	55.6%	5	62.5%
	R	3	7.3%	1	11.1%	-	-
Gentamycin [J]	S	19	46.3%	8	88.9%	5	62.5%
	R	5	12.2%	-	-	-	-
Ofloxacin	S	24	58.5%	8	88.9%	5	62.5%
	R	5	12.2%	-	-		

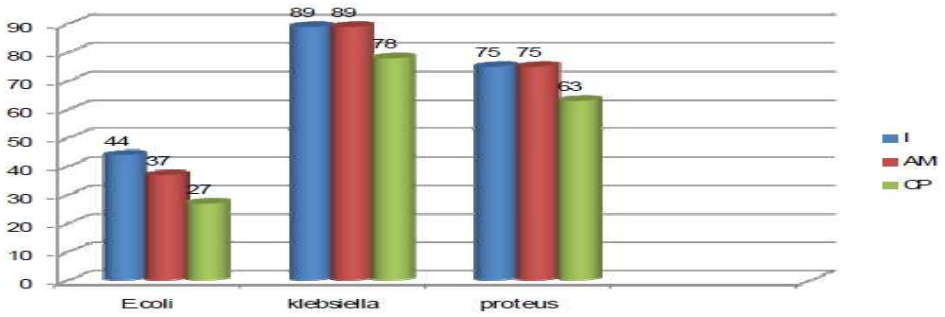

Fig6. Percentage of resistance for antibiotics

DISCUSSION

Urinary stones are the third most common affliction of the urinary tract. They are exceeded only by urinary tract infections and pathologic conditions of the prostate. Out of 70 renal stone patients examined for UTI, showed (55/70), positive urine cultures with a ratio (78.6%) while (15/70) showed no significant growth with a ratio (21.4%). In the present study found that the age group that suffered most from infection renal stones disease among the 20-40 year-old group with 67.1%. Similar findings were also reported by T. Ogata et al [12] performed a study in which renal stones were mostly seen in 3rd and 4th decades of life. Other studies done by Baker et al.[13] who found that the peak age for the development of infection renal stones most commonly in women between the ages of 20 and 55 years and second peak is seen, particularly in men, between 55 and 70 years of age. In present investigation found that the renal stones infection observed in women with 59.6% (28/47) and men with40.4% (19/47). Similar study observed by Baker et al[14]. who reported that Women were at greater risk of infection stones with58%. In a separate study by Gault and Chafe in Canada, women were also found to be more likely to produce calcium phosphate stones than men[15]

The urinary tract infection was present in 79% of cases. While the observed frequency of renal stones in this study was 32.7% in patients with urinary tract infection. Huchereiter [16] and Bichler [17] , showed a frequency of 10–15% of infection stones. In our study found that infection of urinary tract by E.Coli accounted for 71%, Klebsiella constituted for 12%, Proteus constituted for 7%. (Table 2) which indicates, persistent urinary tract infection with urea splitting or non- splitting bacteria may be the initial factors in the synthesis of infection renal stones. In metabolic stones bacterial superimposition may be responsible for the recurrent urinary tract infections. It shows association between renal stone and urinary tract infection. Similar findings were also reported by Madhavi et al [18] who found that urinary tract infection with certain bacteria plays an important role in the synthesis of renal stones. Infection stones are calculi that occur following urinary tract infections (UTIs) caused by urease-producing gram-negative organisms. They consist of magnesium ammonium phosphate, carbonate apatite and mono ammonium urate and alkaline urine is most favorable to their formation of these stones. Moreover urinary tract infection with E.Coli shows the conversion of commensal population into pathogenic organisms this may be due to decreased intake of water leading to the concentration of urine and also injury caused by the peculiar characteristics of the calculi to the urinary tract epithelium, thus forming a nidus for growth of bacteria thus acting as a good media for pathogenic organisms to grow. Increasing resistance against antimicrobial agents is a worldwide problem [19]. This study revealed that there is a higher prevalence rate of resistance against commonly prescribed antibiotics in Yemen. A considerable reduction is also found in the activity of nitrofurantoin among the commonly used drugs in treatment of UTI. These findings are supported by other studies done in Kuwait [20] and also in the U.S., southern Europe, Israel, and Bangladesh with up to 50% of E. coli strains being resistant to antibiotics used [21]. The most useful antibiotics in this study were Ofloxacin (OF), Ciprofloxacin(CL), and Gentamycin (J) in 69.8% ,56.4% and 65.9% overall cases respectively. These drugs are relatively low cost when compared to other antibiotics used. These findings differed from other reports where quinolones are the most effective antimicrobial agent against UTI causing bacteria [22, 23, 24, 25]. The findings have no doubt there is an urgent need for constant monitoring of susceptibility of pathogens in different populations to commonly used anti-microbial agents. The data of this study may be used to determine trends in antimicrobial susceptibilities, to formulate local antibiotic policies and overall to assist clinicians in the rational choice of antibiotic therapy to prevent misuse, or overuse, of antibiotics. However, there was a high prevalence of resistant bacteria to a number of antimicrobials tested in this study. A large number of the isolates were to Ceftrazdme (CZ), Ampicillin (I), Cephalexin (CP), and Amoxicillin (AM). Similar findings have been reported in Iran and Aligarh [26]. This observed resistance to these drugs is a probable indication of earlier exposure of the isolates to these drugs, which may have enhanced resistant development. These drugs are very common due to low cost and often purchased without prescription in different areas.

CONCLUSION

In all 70 patients infection was present in 78.6% of cases. The age group that suffered most from infection renal stones disease among the 20-40 year-old group with 67.1% (47/70), distributed between men and women as following: 59.6% (28/47) for women and 40.4% (19/47 for men. The commonest organisms isolated according to culture report were E. Coli (71%), with 66.7%,(16/24) for women and 33.3% (8/24) for men, Klebsiella (12%), with 66.7% (2/3) for women ,and 33.3% (1/3) for men, Proteus (7%), with 66.7% (2/3) for men, 33.3% (1/3) for women. The frequency of renal stones disease in patients with urinary tract infection was 32.7 %. however, Ofloxacin (OF) was more sensitivity for (24/41) E.coli with a ratio 58.5% , (8/9) Klebsiella with a ratio 88.9% and (5/8) Proteus with a ratio 62.5% , Ciprofloxacin (CL) for (21/41) E.coli with a ratio 51.2% ,(5/9) Klebsiella with a ratio 55.6% and (5/8) Proteus with a ratio 62.5% ,and Gentamycin (J) for (19/41) E.coli with a ratio 46.3% ,(8/9) Klebsiella with a ratio 88.9% and (5/8) Proteus with a a ratio 62.5%. The renal stone disease makes an important group among urinary stone diseases. Urinary tract infection with certain bacteria plays an important role in the synthesis of renal stones. A high incidence can be prevented by adopting a variety of simple conservative measures.

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