Study of Type 1 Fimbriae of *Escherichia coli* in Diabetic and Non Diabetic Female Patients With Urinary Tract Infection

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Abstract

Ninety nine isolates of *Escherichia coli* have been isolated and detected from un married female patients with UTI, (55) isolates were related to diabetic female and (44) isolates were related to non diabetic female during the period between February and June 2008 in Hilla province. The patients ages ranged from (11–30) years. Haemagglutination assay (HA) has been used to detect the ability of *E. coli* isolates to produce colonization factor (Type 1 fimbriae). It has been found that 45 (81.8 %) among (55) isolates from diabetic female with urinary tract infection have ability to produce Type 1 fimbriae, while 20 (45.5 %) among (44) isolates of non diabetic female with urinary tract infection have ability to produce this factor. The effect of such antibiotics as (Ampicillin, Ciprofloxacin, Ceftazidime and Nitrofurantion) on colonization factor (Type 1 fimbriae) has also been studied and it has been found that these antibiotics causes complete inhibition to this factor.

الخلاصة

تم عزل وتشخيص (99) عزلة عائدة لبكتريا *Escherichia coli* من الإناث الغير متزوجات المصابة بالتهاب المجاري البولية, (55) عزلة كانت تعود للإناث المصابة بداء السكري و (44) عزلة كانت تعود للإناث الغير مصابة بداء السكري وللفترة التي استمرت من شباط إلى حزيران 2008 في مدينة الحلة كان معدل أعمارهن يتراوح من (11 – 30) سنة. استخدمت طريقة التلازن لكريات الدم الحمراء لتشخيص قابلية *E. coli* على إنتاج عامل الاستيطان (Type 1 fimbriae). وجد أن (81.8 %) 45 من مجموع (55) عزلة العائدة للإناث المصابة بداء السكري المصاحب لالتهاب المجاري البولية لها القابلية على إنتاج Type 1 fimbriae)) في حين (45.5 %) 20 عزلة من مجموع (44) عزلة العائدة للإناث الغير مصابة بداء السكري المصاحب لالتهاب المجاري البولية لها القابلية على إنتاج هذا العامل.

كما درس تأثير بعض المضادات الحياتية مثل (الامبسيلين, سبروفلوكساسين, سفتازيديم ونايتروفيورانتوين) على مستضدات عامل الاستيطان ((Type 1 fimbriaeحيث وجد أن تلك المضادات لها تأثير مثبط لهذا العامل.

Introduction

Urinary Tract Infection (UTI) is one of the most common bacterial infections in women, and it is estimated that as many as 60 % of all women report having had a UTI at least once in their life time (Sita, *et.al*., 2006). *Escherichia coli* is the most frequently isolated urinary pathogen, which accounts for 5 to90 % of all uncomplicated urinary tract infections. It is now recognized that there are subsets of faecal *E. coli*,which can colonize periurethral area, enter urinary tract and cause symptomatic disease.These are currently defined as uropathogenic *E. coli*.These isolates express chromosomally encoded virulence markers (Raksha, *et.al.,* 2003).

Virulence determinants such as type 1 fimbriae and siderophore production have been shown to more frequent in *E. coli* from patients with UTI than in faecal isolates (Vagarali, *et.al.,* 2008). Type 1 fimbriae is important in the pathogenesis of urinary tract infection, they play an important role in enterobacterial communicability, but the role of it in enteric infections remains unclear (Krogfelt, 1991). Fimbriae mediate the ability of *E. coli* to adhere to the uroepithelium, there by resisting elimination by the flow of urine. Adhesion is therefore considered to be an important step in the pathogenesis of UTI (Struve and Krogfelt, 1999). Diabetic women have bacteriuria more often than nondiabetic women. The cause of this increased prevalence, however, is not yet clear. The adherence of *E. coli* (the most common causative microorganism

in bacteriuria) to uroepithelial cells is the first step in the pathogenesis of UTIs (Geerlings, *et.al.*, 2002). Several researchers have pointed out that no relationship between the ability of a female subject's cells to bind bacteria and her age, postmenopausal status, or the duration or presence of secondary diabetes complications(e.g., retinopathy, neuropathy and microalbuminuria) (Aly,*et.al.*,1991).

On the other hand, subinhibitory concentration (sub-MICs) of various antibiotics are able to modify the molecular architecture of the external surface of bacteria and some bacterial functions, such as the ability to adhere to the host cells, the surface bacterial energy, motility etc., thus influencing bacterial virulence (Braga, 1994).

Materials And Methods

Specimens and Strains

Ninety nine of *E. coli* strains were isolated from urine samples of unmarried female patients with or without diabetes who suffering from urinary tract infection, their ages ranged from (11- 30) years who admitted to hospital in Hilla province.

Haemagglutination Assay (HA)

Haemagglutination test was achieved according to method of (Vidya, *et.al.*, 2005) to detect the ability of *E. coli* isolates to produce Type 1 fimbriae.The haemagglutination assay was done in the presence of an equal volume of different antibiotics. The antibiotics used are (Ampicillin, Ciprofloxacin, Ceftazidime and Nitrofurantion). The haemgglutination assay in the presence of antibiotics is done only to *E. coli* isolates which have the ability to produce type 1 fimbriae.

Results

Out of the total (99) isolates, (55) isolates were related to diabetic female with UTI and (44) isolates were related to non diabetic female with UTI.

It was found that out of among 55 isolates from diabetic female with UTI, only 45 (81.8 %) isolates have the ability to produce type 1 fimbriae and among 44 isolates from non diabetic female with UTI, only 20 (45.5 %) have the ability to produce type 1 fimbriae (Table 1).

Table (2) shows the effect of some antibiotics on the colonization factor (Type 1 fimbriae) haemgglutination assay in the presence of antibiotics is done only to *E. coli* isolates which have the ability to produce type 1 fimbriae from diabetic and non diabetic female with UTI.

Table 1. Prevalence of Type 1 fimbriae of *E. coli* isolates from diabetic and non diabetic female with UTI

Isolates No.	Diabetic female with UTI			Non Diabetic female with UTI		
	Isolates No.	Agg *E.coli* isolates No.	%	Isolates No.	Agg *E.coli* isolates No.	%
99	55	45	(81.8 %)	44	20	(45. 5 %)

Agg *E. coli*	Ampicillin	Ciprofloxacin	Ceftazidime	Nitrofurantion

		without	with	without	with	without	with	without	with
Diabetic female with UTI	45	+	-	+	-	+	-	+	-
Non diabetic female with UTI	20	+	-	+	-	+	-	+	-

Table 2. Agglutination technique results in the presence and absence of some antibiotics

Ampicillin : 2 mg / ml **Ciprofloxacin :2.5 mg /ml** **Ceftazidime : 2 mg / ml**
Nitrofurantion :2.5 mg /ml

Discussion

In this study, type 1 fimbriae was investigated in 45 (81.8 %) isolates among 55 isolates from diabetic female with UTI, and 20 (45. 5 %) isolates among 44 isolates from non diabetic female with UTI (Table 1).

These results showed that Type 1 fimbriated *E.coli* adhered to the uroepithelial cells from diabetic women with UTI more than from non diabetic women with UTI.

Adhesion is considered to be the first step in the sequence of events leading to colonization, is an important determinant of virulence and subsequent infection, and the relationships between disease and the adherence of microorganisms to patients cells have been investigated before by other researchers (Darwazeh, *et.al.*, 1990).

This result agrees with the result obtained by (Johnson, 1991) who have indicated that the isolation rate of Egg *E.coli* for type 1 fimbriae is (86) and (59 %) isolated from diabetic and without diabetic women with UTI, respectively .

Also, (Geerlings, *et.al.*, 2002) have pointed that female with diabetes have bacteriuria more often than female without diabetes, so *Escherichia coli* which have type 1 fimbriae adhere more to the uroepithelial cells of diabetic female than to those of female without diabetes,that related to the various substances (e.g., albumin, glucose) are present in the urine of diabetic patients or by the difference in the uroepithelial cells, also the diabetic uroepithelial cells have a different glycosylation of the receptor on their cells, which results in a higher adhere capacity and these receptors for the type 1 fimbriae of *E. coli* are glycoproteins (uroplakins that line the bladder mucosa) (Wu, *et.al.*, 1996).

The effect of some antibiotics on the type 1 fimbriae has also been studied when the haemagglutination assay is carried out in the presence of an equal volume of some antibiotics. It was found that all these antibiotics used generally inhibit the bacterial adhesiveness (Table 2).

These observation are compatible with the hypothesis that the adhesion of *E.coli* to eukaryotic cells is mediated by the bacterial proteinaceous adhesions and the synthesis of such membrane associated protein factors can be differentially inhibited by low concentration of antibiotics. Similar finding was also reported by (Vidya, *et.al.*, 2005) who has pointed that sub inhibitors concentration of many antibiotics do not kill bacteria, they are able to interfere with some important aspects of bacterial cell function and these ability of antibiotics to interfere with many bacterial pathogenecity factor may be one of the main criteria for choosing one drug over another.

On the other hand (Shibl, 1995) stated that sub inhibitors concentration of antibiotics can exert their antiadhesive effects by inhibition of synthesis or expression of adhesions on the bacterial cell surface which leads to the formation of functionally aberrant adhesions or due to release of adhesions from the surface of bacterial cells, or modify bacterial shape in such away as to interfere with the ability of the microorganisms to approach receptors on animal cell surface.

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