THE EFFECT OF VINEGAR SOLUTION ON THE BACTERIA THAT CAUSE IMPETIGO

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ABSTRACT

Out of fourty six samples collected from impetigo patients, fourty-two bacterial isolates were obtained, *Staphylococcus* aureus was constitute 24 isolates, *Streptococcus pyogenes* was 14 isolates and *Proteus mirabilis* was only 4 isolates . The sensitivity of these bacterial isolates were tested against 7 different antibiotics . It was shown that the highest sensitivity of there isolates were against Erythromycin and Mithicillin , were as both Ciprofloxacin and Piperacillin were the most active inhibitors of the tested bacteria . On the other hand , the activity of vinegar solution of different concentration were tested against the different bacterial species isolated from impetigo cases, The results showed that the majority of bacterial isolates were sensitive to concentration between 2-32 mg\ml. The MIC and MBC of vinegar solutions toward the three bacterial species were as follows ; for *Proteus mirabilis* were 0.5-1.0 mg\ml , for *Streptococcus pyogenes* were 0.5-0.75 mg\ml , and for *Staphylococcus pyogenes* were 0.15-0.25 mg\ml respectively . .

Keywords: Impetigo, Bacteria, Antibiotics, Vinegar.

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الخلاصة

أجريت هذه الدراسة لاختبار فعالية محلول الخل في تثبيط نمو البكتريا المسببة لمرض القوباء، أذ جمعت 46 عينة من الأشخاص المصابين بالمرض و تم الحصول على 42 عزلة بكتيرية وبواقع 24 عزلة من بكتريا العنقودية الذهبية و 14 عزلة من بكتريا المسبحية القيحية و4 من البكتريا المتقلبة. أختبرت حساسية العزلات البكترية تجاه سبعة من المضادات الحيوية أذ أبدت العزلات البكتيرية مقاومة عالية تجاه مضاد الارثرومايسين و الميثيسيلين بينما كان مضاد الببراسيلين و السبروفلوكساسين هما الأكثر فعالية في تثبيط نمو العزلات البكتيرية أختبرت فعالية محلول الخل على الأنواع المرضية المعزولة، و أظهرت النتائج أن أغلب العزلات كانت حساسة لمحلول الخل بالتراكيز من (2-32)ملغم\مل; ثم حددت التراكيز المثبطه والقاتله الدنيا لمحلول الخل تجاه العزلات المختلفة وكانت قيم التركيز المثبط الأدنى والتركيز القاتل الأدنى للبكتريا المتقلبه (0,5-1)ملغم\مل ولبكتريا المسبحية القيحية (0,5-0,75)ملغم\مل والبكتريا العنقودية الذهبية (5 1,0-0,25)ملغم\مل على التوالي.

الكلمات المفتاحية: القوباء، البكتريا، المضادات الحيوية، الخل.

INTRODUCTION

Impetigo is a contagious superficial pyogenic infection of the skin. It is of two main clinical forms; non bullous impetigo (impetigo contagiosa of Tilburg fox) and bullous impetigo (1).

Bacteriology:- Non-bullous impetigo may be caused by both *Staphylococcus aureus* and *Streptococcus pyogens* but there has been controversy as to the relative importance of the two genera, this may be partly depend on geographical variations. The *streptococcal* form being more prevalent in warmer climits (2,3). *Staphylococcus aureus* may be seconday invader in *streptococcal* impetigo and in some cases, it may be the predominant or the the only isolate, and the evidence for *Streptococcal* involvement may be rest on serology . Red lake Indian reservation in northern Minnesota detected both *Staphylococcus aureus* and streptococci, each alone in a sizeable minority, but both together in 58% of cultures, he concluded that in many of the mixed culture cases, the disease was primarily *streptococcal* with *Staphylococcus aures* as secondary colonizer (4). Recent European publications suggest that the *Staphylococci* may be the predominant infectious agent in most cases (5).

In *streptococcal* impetigo, lance field group A is by far the commonest, but there are occasional infections with group G and C organisms (4). Bullous impetigo is accepted as a *Staphylococcal* disease (predominantly phage group II) which produce epidermolytic toxin locally, and induce epidermal splitting and blister formation in bullous impetigo, while in generalized *Staphylococcal* scalded skin syndrome , the toxin is disseminated haematogenously (2,5).

Clinical features:- non bullous impetigo occurs more commonly in preschool age children, the initial lesion is a very thin-walled vesicle or pustule on an erythematous base, that ruptures quickly and evolving to yellowish-brown (honey-camp) crusted plaque, which show gradual irregular peripheral extension, without central healing up to (2cm) and multiple lesions were coalesce, usually there are no constitutional symptoms excepted in sever cases, but regional lymphadenopathy may be present in up to 90% of patients with sever prolonged untreated infection. The face and the limbs are the sites more commonly affected, but lesions may occur anywhere on the body (1,5,6). Bullous impetigo occure commonly in newborn and in older infants, and is characterized by rapid progression of vesicles to flaccid bullae, which are less rapidly ruptured and become much larger(up to 1-2cm in diameter) and may persist for 2-3 days. Although the face is often affected, the lesions may occur anywhere on the skin, and the buccal mucous membrane may also be involved, but commonly, rather few lesions are present and regional lymphadenitis are rare(5,6).

Diagnosis: is made by clinical criteria and confirmed by gram stain and culture of exudates from lesion (6).

Treatment: in mild and localized infection, a topical antibiotic alone may be suffice (e. g imupicrocin, fucidic acid, bacitracin) for both *staphylococcus* and *streptococcus* impetigo. If the infection is wide spread or sever or accompanied by lymphadenopathy or there is a reason to suspect a nephritogenic streptococcus, an oral antibiotic (flueloxacillin or erythromycin is indicated), also(azithromycin,cephalexin,cefaelor,cefprozol, and clindamycin) are alternative therapies(7,8). Black tea (as topical ointment) ,also give good result in treatment (9). Vinegar has been used in one form or another for over 10,000 years. It is used for many purposes and

throughout the ages has served as a preservative, condiment, beauty aid, cleaning agent, and in medicine. The word vinegar comes from the Latin word venom meaning wine and Acer meaning sour. These two words eventually became one word and is now as vinegar. In 5000 B.C, the Babylonians fermented the fruit of date palms and created date vinegar. The roman made vinegar from grapes, figs, dates and rye. The armies of Julius Caesar would drink vinegar and water for its antiseptic properties (10). Many ancient cultures used vinegar and valued it for its medical benefits. It was used for disinfecting wounds and for insect bites and snake bites. Vinegar compresses were useful for healing bruises (11). The vinegar is a sour and astringent liquid consisting mainly from acetic acid, resulting from fermentation of an alcoholic beverage mainly whites and red wines. This product is cheap, easily found in the markets, and seems to have antimicrobial potential (12).The aim of this study is to test the effect of vinegar solution on the bacteria that cause impetigo.

MATERIAL AN D METHODS

Sample collection: Forty six patients were examined attending the out clinic of Baquba teaching hospital for the period, 30th of April to the 31st of July 2010. There were 28 males and 18 females, their age of 2-6years. They complained of rash on the skin, which was diagnosed clinically as impetigo. They were interrogated regarding the age, sex, address, chief complain, previous and present history of any associated disease. Sterile cotton swabs were taken from the lesions, under full aseptic conditions.

Bacterial species isolation and identification : the samples were cultured on blood and MacConkeys agar for 24 hours at under aerobic condition for bacteriological studies, the isolation and diagnosis of types of bacteria was done according to the ideal methods (13 , 14).

Bacterial sensitivity test to antibiotics : The sensitivity of bacterial isolates were determined against 7 different antibiotics (cefalexin, cefotaxime, methicilin, erythromycin, gentamycin, piperacillin, ciprofloxacin) using the method of kerby and bauer , according to this method , bacterial suspension of 0.1 x 10^6 CFU concentration was distributed on the surface of Muller-Hinton agar media for all bacterial species except *Streptococcus pyogenes* use blood

agar instead of Muller-Hinton agar, then the antibiotic disc were put on the surface of culture media by sterile forceps . the plates were incubated under aerobic condition at 37C for 24 hours, then the results were read by measuring the inhibition zones in mm (15).

Vinegar preparation: Industrial vinegar solution prepared from local Iraqi date of has been used. Concentration of 5% acetic acid (50 mg\ml) stock solution was used and graduated concentration(32, 16, 8, 4, 2) mg\ml were prepared according to (16).

Bacterial sensitivity to vinegar solution: The bacterial isolates against different antibiotics were chosen to test their sensitivity to vinegar by agar well diffusion method (17). The activity of different concentrations of vinegar solution were determined by measuring the inhibition zone.On the other hand the minimum inhibitory concentration and minimum bactericidal concentration (MIC,MBC) of the vinegar solution by agar dilution method were also determined (18) and the used dilutions were (0.15, 0.25, 0.5, 0.75, 1, 1.5, 2.5)mg\ml .

RESULTS

Table (1) - The percentage of the bacterial isolates resistant to different antibiotics.

Proteus mirabilis	*Strept.pyogenes*	*Staph.aureus*	*Antibiotics*
50%	71.4%	50%	Cephalexin
25%	42.9%	37.5%	Cefotaxime
50%	71.4%	70.8%	Methicillin
75%	78.6%	62.5%	Erythromycin
25%	42.9%	33.3%	Gentamycin
0	35.7%	41.7%	Piperacillin
0	35.7%	33.3%	ciprofloxacin

Table (2)- The effect of different concentration of vinegar solution on growth of different bacterial species in (mm).

Bacteria Species	Concentration of vinegar solution in mg /ml .					Mean
	2	4	8	16	32	
Staphylococcus aureus	38.3	42.27	45.23	46.33	47.3	43.80
Streptococcus pyogenes	29.1	31.2	33.3	35.3	38.4	33.46
Proteus mirabillis	15.1	18.23	21.2	24.3	264	21.04
Mean	27.51	30.56	33.24	35.31	37.37	
L.S.D	Concentration		Bacteria		Concentration x Bacteria	
0.05	1.300		1.679		Non Significant	
0.01	1.892		2.366		Non Significant	

Table (3)- MIC and MBC of vinegar solution on different bacterial growth measured in (mg/ml)

Bacteria	MIC	MBC
Staphylococcus aureus	0.15	0.25
Streptococcus pyogenes	0.5	0.75
Proteus mirabilis	0.5	1

DISCUSSION

Table No (1) describe the sensitivity of bacterial isolates from impetigo patient. Forty-two bacterial isolates (24 isolates of *Staphylococcus aureus*, 14 isolate of *Streptococcus pyogens* and 4 of *Proteus mirabilis*) were tested against 7 antibiotics, by measuring the inhibition zone in mm (15). This table explain that the majority of bacterial isolates show resistant to more than one antibiotics. *Staphylococcus aureus* show resistant to (cephalexin, methicillin, erythromycin),the (50%, 70.8%, 62.5%),while *Streptococcus pyogenes* show resistance by (71.4%, 71.4%, 78.6%) and *Proteus mirabilis* by (50%, 50%, 75%) . On the other hand, the cefotaxime and gentamycin antibiotics show good activity toward *Proteus mirabilis* when the percentage of bacterial isolates resistant reach (25%, 25%) respectively and the percentage of resistant to cefotaxime antibiotic for *Staphylococcus aureus* and *Streptococcus pyogenes* found to be (37.5%, 42.9%) respectively while the percentage of resistant to gentamycin antibiotic reach (33.3%, 42,9%) respectively. The ciprofloxacin, piperacillin antibiotics show good activity toward the bacterial isolates mentioned above when the resistant of *Staphylococcus aures* to these antibiotics reach (33.3%, 41.7%) respectively and reach (35.7%, 35,7%) respectively for *Streptococcus pyogenes*, while the *Proteus mirabilis* show no resistant to both antibiotics. The cause of high bacterial resistant to the used antibiotics was the widely used of these antibiotics (14) , in addition , the development of the bacterial resistant due to change in the site of antibiotic activity and bacterial membrane permeability or may be enzymatic resistant (19,20). Three bacterial isolates were taken from each bacteria which show high resistant to antibiotics for testing their sensitivity to vinegar solution. All concentration of vinegar solution show effect on bacteria in comparison with distal water in different percentage, while the statistic analysis show no significant differences between the concentration of vinegar solution in their effect on growth of bacteria and in probability of 0.05 and 0.01.

Table (2) show that *Staphylococcus aureus* was the highly sensitive to vinegar solution from other types of bacteria when the means of inhibition zones reach (38.3, 42.27, 45.23, 46.33, 47.3)mm for the concentrations (2,4,8,16,32) mg\ml respectively and the cause of this may be due to the vinegar solution contain high concentration of acetic acid (10), while the ratio of

inhibition zones for *Streptococcus pyogenes* was (29.1, 31,2, 33.3, 35.3, 38.4) mm respectively for the same concentration , on the other hand, the *Proteus mirabilis* was the highly resistant to vinegar solution when the means of inhibition zones reach (15.1, 18.23, 21.2, 24.3, 26.4) mm respectively for the same concentration .

However, many of studies refer that the antimicrobial effect of vinegar solution may be due to prop ionic acid, acetic acid, pectin (fibers), and important minerals (such as potassium, calcium, magnesium, sulphur, chlorine, phosphorus, iron, silicon and other trace minerals), vitamins which are bioflavonoid {vitamin p},beta carotenes {precursors to vitamin A }, vitamin {C, E, B1, B2, and B6}(12).

The MIC and MBC of vinegar solution described in table (3) refer to the activity of vinegar solution on different bacteria, the MIC of *Staphylococcus aureus* reach 0.15 mg/ml while that of *Streptococcus pyogenes* and *Proteus mirabilis* reach o.5mg/ml and the MBC of *Staphylococcus aureus* reach 0.25 mg/ml while that of *Streptococcus pyogenes* and *Proteus mirabilis* reach (o.75,1) mg/ml respectively, and so, the decrease in MIC and MBC of vinegar solution on different bacterial types refer to the activity of vinegar on bacteria that cause impetigo. This effect may be due to the contents of vinegar(organic acids and oxidizing compounds) that lead to denaturizing of outer cell wall of the bacteria that lead to death (21) .

CONCLUSIONS

1. The *Staphylococcus aures* Bacteria is the main bacteria that cause impetigo.
2. The ciprofloxacin and piperacillin have the highest activity (from other antibiotics) on different bacteria that cause impetigo.
3. The *Staphylococcus aures* Bacteria was the most sensitive to the action of vinegar solution while the *Proteus mirabilis* was the lest sensitive to it.

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