Relation of Enterococcus Faecalis with Wound Infection Post Abdominoplasty and Role of CRP in Infection

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Abstract
Enterococcus faecalis is the third most common pathogen to be isolated from surgical site infections and is one of the most common pathogens to be isolated from all types of wounds. In this regard, very little is known about the prevalence of E. faecalis that is isolated from surgical wound infections, as well as their antimicrobial susceptibility and immune status of those patients. This cross-sectional study conducted in Kirkuk city from the period from 1/1/2017 to 1/2/2021. A total of 170 wound swabs were collected from patients of wound infection post abdominoplasty, as well as 30 samples for uninfected persons as control group. Five ml of venous blood was collected from each subject for determination of IL-1 and C-RP level. The study showed that 35.88% of patients with wound post abdominoplasty have pure positive culture and 21.18% mixed culture. all E. faecalis isolates were sensitive to toward carbenicillin and imipenem (100%), 95.2% sensitive to ampicillin, 092.9% sensitive to nitrofurantoin, while all E. faecalis isolates were resistant to nalidixic acid and Clindamycin. The study demonstrated that the highest mean of CRP level was found patients with wound infected by E. faecalis (22.23 mg/dl) comparing with the control group (4.53 mg/dl). The study demonstrated t that the highest mean of IL-beta level was found among wound infected with E. faecalis (33.76 pg/ml) comparing with the control group (8.28 33.76 pg/ml) with highly significant difference.
Keywords: wound; abdominoplasty: CRP; Enterococcus.

1. Introduction

Enterococci, which were once thought to be harmless flora of the gastrointestinal tract, have emerged in the last two decades as a major cause of hospital-acquired infections (HAIs), which include surgical site infections, urinary tract infections, and bacteremia. These infections can occur anywhere in the body, from the surgical site to the urinary tract to the bloodstream [1]. In the past, the primary source of infection by enterococci was thought to be endogenous [2,3]. Subsequently, it was discovered that enterococci could be transmitted between hospitalized patients. Enterococcus faecalis is the third most common pathogen to be isolated from surgical site infections and is one of the most common pathogens to be isolated from all types of wounds. Additionally, they are considered to be a significant factor in the development of bacteremia all over the world [4,5,6]. Due to the ability of E. faecalis to survive on inanimate surfaces as well as on the hands of hospital staff for an extended period of time, colonization of the hands of health care workers by E. faecalis can be a source of infection by contact with surfaces, or medical equipment [7]. This is the case because E. faecalis can survive on surfaces for an extended period of time. E. faecalis infections are notoriously difficult to treat because the bacteria have both innate and acquired resistance to a wide variety of antimicrobial drugs [8]. They have innate resistance to a number of antimicrobials, such as aminoglycosides and beta-lactams, as a result of carrying several resistance genes [9]. In addition, they have acquired resistance to a number of antibiotics, such as macrolides, vancomycin, cephalosporin, tetracycline, and fluoroquinolones, as a result of either mutations in their DNA or the acquisition of new genes through gene transfer. 15 The vast majority of hospital strains are resistant to a wide variety of antibiotics, such as macrolide and vancomycin,15-17 and have also been identified as producers of beta-lactamases, which causes resistance to penicillins and cephalosporins. 18 There have been very few studies that have concentrated on E faecalis that was isolated from bacteremia or surgical wound infections. In this regard, very little is known about the prevalence of E. faecalis that is isolated from surgical wound infections, as well as their antimicrobial susceptibility and immune status of those patienst

2. Materials and Methods

This cross-sectional study conducted in Kirkuk city from the period from 1/1/2017 to 1/2/2021. A total of 170 wound swabs were collected from patients of wound infection post abdominoplasty, as well as 30 samples for uninfected persons as control group. All prepared culture media and other solutions used in this study were sterilized with an Autoclave at 120°C at a pressure of 15 pounds/inches for a period of 15 minutes. The solutions affected by high temperature were sterilized using Milipore filters with a diameter of 0.22 µm, while the glassware was sterilized in the oven. Electricity at 180 ° C for two hours. The bacteria growing on the media were diagnosed on the basis of color, shape, size, edge and height of the growing colonies, and the colonies were

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regrown more than once to obtain single pure cultures. Five ml of venous blood was collected from each subject by using sterile disposable syringe and transferred into sterile gell tubes, left to clot at room temperature for 20 minutes, then centrifuged at 3000 rpm for 15 minutes, sera were then removed and added in Eppendorf tubes and stored at -20°C for determination of IL-1 beta and IL-23 and by ELISA C-RP level by immunofluorescence technique (i-chroma II).

3. Results

The study showed that 35.88% of patients wound post abdominoplasty have pure culture and 21.18% mixed culture, Table 1

Table 1: Distribution of the result of wound culture		
Wound culture	No.	%
No culture	73	42.94
Pure Culture	61	35.88
Mixed culture	36	21.18
Total	170	100

The study demonstrated that *E. faecalis* represented the most isolated bacteria from by culture of wound post abdominoplasty (n:42), Table 2

Table 2: Isolated bacteria from wound samples.	
Bacterial isolates	No.
E. faecalis	42
P. aeruginosa	33
S. aureus	27
E. coli	16
K. pneumonia	10

Figure 2 shows that all E. faecalis isolates were sensitive to toward carbenicillin and imipenem (100%), 95.2% sensitive to ampicillin, 092.9% sensitive to nitrofurantoin, while all E. faecalis isolates were resistant to nalidixic acid and Clindamycin

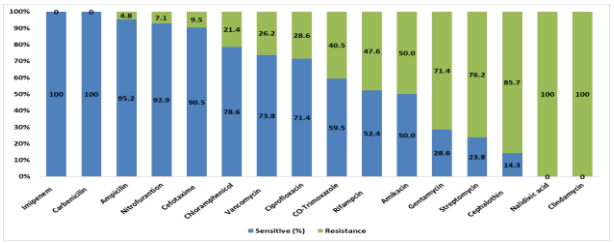

Figure 2: Distribution of antibiotics sensitivity toward E. faecalis isolates

The study demonstrated that the highest mean of CRP level was found patients with wound infected by E. faecalis (22.23 mg/dl) comparing with the control group (4.53 mg/dl) with highly significant difference, Figure 3

Table 3: Relation of C-reactive protein with E. faecalis infection			
CRP level (mg/dl)	Wound infection	Control group	P-value
Mean	22.23	4.53	0.0001
SD	5.35	1.45	

The study demonstrated t that the highest mean of IL-beta level was found among wound infected with E. faecalis (33.76 pg./ml) comparing with the control group (8.28 33.76 pg/ml) with highly significant difference, Figure 4

Table 4: Relation of IL-1 beta protein with E. faecalis infection			
IL-1 beta Pg/ml	Wound infection	Control group	P-value
Mean	33.76	8.28	0.0001
SD	4.28	1.23	

4. Discussion

For an effective mucosal homeostasis, immune responses are tightly regulated to ensure protective immunity to the host, and it is of utmost importance that the adaptive and innate immune systems are able to recognize pathogenic organisms while ignoring the commensal flora [1]. IL-23 activates the adoptive and innate immune systems to produce IL-17A, IL-17F, IL-22, and TNF, all of which help to stimulate epithelial cells to produce antimicrobial factors. These properties are important in host defense against a number of infections as mentioned earlier, such as Klebsiella pneumonia, Candida albicans and Toxoplasma gondii [10,11,12]. Estimation of serum C-reactive protein has been proposed as a useful tool to characterize systemic inflammation, infection, and sepsis [12]. Others found that the concentrations of serum CRP in patients with bacterial infection was higher than those with non-bacterial infection and in the G+ve bacterial infection group, a higher concentration of CRP was observed compared with fungus infection group [8,13]. Findings from several randomized controlled trials indicated that the use of a CRP-guided antibiotic treatment algorithm is likely to reduce antibiotic exposure in septic patients, without an adverse effect on health outcomes [11]. In agreement with the current findings, another study demonstrated significant elevation of CRP levels in patients with bloodstream infections caused by E. coli, K. pneumoniae, S. epidermidis/S. aureus and E. faecalis [14].

Increasingly, clinical studies are measuring soluble immune biomarkers to screen for product-induced mucosal toxicity/irritation in pre-clinical and clinical trials [15]. The most common soluble proteins evaluated in trials have been interleukin (IL)-1α, IL-1β, IL-1-receptor antagonist, IL-6, IL-8, tumour necrosis factor (TNF)-α and secretory leukocyte peptidase inhibitor (SLPI) [16]. In agreement with our finding, ran et al., (2021) in recent study found that E. faecalis infection induce IL-1β secretion and referred to inflammatory response mechanism induced by E. faecalisIn another study, lipoteichoic acids isolated from strains of E. faecalis have been reported to stimulate leukocytes to release several mediators like IL-1 beta which are known to play a role in various phases of the inflammatory response [17]. A recent study indicates that streptococcal LTA upregulates the expression of vascular endothelial growth factor (VEGF), a potent inducer of angiogenesis, vascular permeability, and edema, in macrophages and pulp cells. While an increase in vascular permeability is related to acute inflammation, angiogenesis is related more to chronic inflammation [1]. Enterococci are

believed to be difficult to treat because of their intrinsic resistance to antibiotics including beta – lactams and aminoglycosides which are frequently used to treat infections due to Gram-positive cocci [19]. Resistance to trimethoprim, gentamycin and vancomycin have also been reported (Muratani and Matsumoto, 2004; Cheng et al., 2014).

In agreement with many other works (Huys et al., 2004; Hummel et al., 2007; Fernández-Fuentes et al., 2014; Kürekci et al., 2016; Chajêcka-Wierzchowska et al., 2019), most E. faecalis isolates were susceptible to β-lactams (ampicillin), and imipenem. Enterococci are thought to be susceptible to vancomycin, and are considered intrinsically resistant to clindamycin, quinupristin-dalfopristin, cephalosporins and aminoglycosides [20]. In agreement with our results, the present enterococci strains proved to be quite resistant to gentamycin.Treatment of enterococcal infections is becoming increasingly problematic due to their augmented ability to acquire mobile genetic elements, resulting in increased resistance to antibiotics, including last-line-of-defense antibiotics such as vancomycin. Recently, there has been an increase in the emergence of vancomycin-resistant enterococci, putting immunocompromised individuals at risk for developing severe chronic enterococcal infections [1,4].

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