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The Role of Antibiotic Therapy in Infected Wounds: Ccorrelation Between Clinical Judgment and Microbiological Assesment

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Abstract

Context: Microbiological culture and sensitivity though gold standard, takes time to convey report which can delay rational treatment for the infection of the wound that take place after surgery.

Aims: To assess the efficacy of clinical assessment of infected wounds in terms of bacteriology in comparison to culture and sensitivity

Settings and design: Hospital based observational diagnostic evaluation study was carried out at department of General Surgery, Government Medical College, Latur.

Methods: Detailed history, thorough clinical examination including systemic examination of all the patients and local examination of the wound of all the patients was carried out and the data was recorded. Swabs taken on sterile swab sticks and sent for culture within 1 hr. Where swabs cannot be taken pus, samples are taken and sent for culture. Antibiotic regimen started as per the clinical judgement from history and examination. Comparison between the swab reports and the suspected organism done and observations noted.

Statistical Analyzis: The data was analyzed using sensitivity, specificity, positive predictive value and negative predictive value

Results: The sensitivity of the clinical assessment of the infected wound for positivity was found to be 87% with same rate for Positive predictive value. But it has been observed that the clinical assessment lacked the specificity. The sensitivity of the clinical assessment of the resistant infected wound was found to be 100% with same rate for negative predictive value. Specificity was 98.9% and a Positive predictive value was found to be 83.3%. The sensitivity of the clinical assessment of the type of organism was found to be 100% with same rate for negative predictive value. Specificity was 78.3% and a Positive predictive value was found to be 84.4%.

Conclusion: Commensal flora of organisms is responsible for infections in almost 80 percent of wounds as the wounds are due to trauma causing break in the epithelial barrier. This can be identified clinically and can be treated accordingly before the microbiological report appears

Keywords: Infection; Clinical assessment; Wounds; Correlation; Therapy.

Introduction

Wound infection after surgery is a common challenge for any operating surgeon. This situation is in spite of modern developments in the surgical techniques, more focus on patient prophylaxis by giving perioperative antibiotics. But this situation remains a challenge. It has been considered as a very common complication even today. They come under the term nosocomial infections. It is a global issue. It has been estimated that the incidence of these wound infections after surgery can range between 11.32–15.45%. Naturally infection of the

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wound occurring after surgery puts unnecessary burden on the patient, his family and the care givers. Cost of the therapy also increases. Not only patient and his family but also it puts extra burden on the existing health care system. These things increase the morbidity of the patients. There can be increased deaths due to infection of the wounds after operation. Therefore based on this above mentioned background about the infection of the wound that may take place after operation, USA based the Surgical Infection Society as well as CDC have recommended that in any hospital it should be a standard practice to carry out surveillance of the infection of the wounds that take place after surgery.[1]

Risk of the infection of the wounds that take place after surgery depends upon what surgery was performed and the type of technique adopted for the operation by the operating surgeon. Classically the operations can be divided as those are very clean, operations that are clean but get contaminated, operations that are absolutely contaminated and operations that are really dirty. Operations that are clean are those where the incision was given on the non inflamed tissue the place where ultimately the wound will be closed. In this type aseptic technique is meticulously followed with not opening of the viscus and at the same time there is closed drainage system. The second type which are classified as clean but contaminated are those where there is minor problem or breach in the aseptic technique used which is generally seen in the emergency surgeries which is otherwise clean, the cut was given on the non inflamedskin, where GI tract, bladder are opened.

The third type of wound i.e. contaminated wound are those where they are usually traumatic with a duration of six hours or less and inflamed GI tract and obstructed bladder were opened and the contents spilled. These are also associated with major breaks in sterile techniques. When the pus was present along with formation of the abscess or there is any perforation of the viscera and traumatic wound with duration of more than six hours are classified as dirty wound.[2]

Treatment of these infected wounds that take place after surgery demand an understanding of the commonly infecting organisms, their resistance pattern and what antibiotics are available at that local place. Based on this suitable antibiotics can be given to prevent further complications and to prevent further morbidity and mortality. This knowledge also constitutes the hospital infection control measures. Hence it is very important to carry out the culture and sensitivity of the infection of the wounds that take place after surgery. This type of investigation is very much required to find out the resistance of the infecting organism to the class of antibiotics that are available at the local place.[3]

Anaerobic bacteriology is costly. Special facilities are required. Expert staff is required to perform it. Much hospital won't have these facilities especially in non industrialized countries. Hence this is reason that studies from these countries barely include these data on anaerobic bacteriology. As a matter of fact, anaerobic organisms play a very important role in the infection of the wound that take place after surgery.[4]

With this background, present study we attempted to first assess clinically based on certain factors what organism may be involved, their resistance pattern and then confirm them from after sending to culture and sensitivity.

Materials and Methods

Study design: Hospital based observational study

Study period: November 2017 to April 2019

Study participants: All patients with infected wounds during the study period

Sample size: 100 eligible cases willing to participate in the present study were finally included with infected wounds

Ethical aspects: Institution Ethics Committee permission was taken before the start of the study. Written informed consent was taken from all eligible cases. All cases were given proper Follow-up and treatment till the infection is resolved.

Inclusion criteria

1. Patients with infected wounds that need urgent debridement under anesthesia
2. Willing to participate in the present study

Exclusion criteria

1. Severe other co morbidities
2. Bed ridden patients
3. Not able to cooperate due to any reason

Materials and Methods

Detailed history, thorough clinical examination including systemic examination of all the patients and local examination of the wound of all the patients was carried out and the data was recorded in the pre designed, pre tested, semi structured study questionnaire developed for the present study.

History pertaining to age, presence of any co morbidities, recent treatment with any antibiotics, pattern of infected wound, progression of the infected wound, Possible site of inoculation–trauma, fungal infections, History of previous cellulitis, Travel history, Risk for atypical organisms like Profound immunosuppression, Animal or human bites, Sea or freshwater exposure (to broken skin) including pools and spas, Exposure to animals, fish, or reptiles, Intravenous drug use (including skin-popping) etc was noted.

The other major clinical aspect is the evaluation of the local wound and the site of the wound. As different sites of the body harbor different commensals they also have a predisposition to infection by a specific variety of organism. The bacteria live in the superficial layers of the stratum corneum and in the upper parts of the hair follicles. Some bacteria, however, reside in the deeper areas of the hair follicles and are beyond the reach of ordinary disinfection procedures. These bacteria are a reservoir for re-colonization after the surface bacteria are removed.

Swabs taken on sterile swab sticks and sent for culture within 1 hr. Where swabs cannot be taken pus samples are taken and sent for culture. Antibiotic regimen started as per the clinical judgement from history and examination. Comparison between the swab reports and the suspected organism done and observations noted.

Statistical Analyzis

The efficacy of the clinical assessment was measured by sensitivity, specificity, positive predictive value and negative predictive value.

Results

Table 1 shows comparison clinical assessment and microbiologically positive culture reports. The sensitivity of the clinical assessment of the infected wound for positivity was found to be 87% with same rate for Positive predictive value. But it has been observed that the clinical assessment lacked the specificity.

Table 1: Comparison of positivity between clinical assessment and microbiologically positive culture reports

Clinical assessment	Microbiologically positive		Total
	Yes	No	
Positive	87	13	100
Negative	0	0	0
Total	87	13	100
Sensitivity	87%		
Specificity	0		
Positive predictive value	87%		
Negative predictive value	0		

Table 2 shows comparison of resistance between clinical assessment and microbiological reports. The sensitivity of the clinical assessment of the resistant infected wound was found to be 100% with same rate for negative predictive value. Specificity was 98.9% and a Positive predictive value was found to be 83.3%.

Table 2: Comparison of resistance between clinical assessment and microbiological reports

Clinical assessment	Microbiologically Resistant		Total
	Yes	No	
Resistant	5	1	6
Non resistant	0	94	94
Total	5	95	100
Sensitivity	100%		
Specificity	98.9%		
Positive predictive value	83.3%		
Negative predictive value	100%		

Table 3 shows clinical entity and the pathogen found. In one case of diabetic foot, pathogen found was Methicillin resistant staphylococcus aureus, in one case it was gram negative, in one case it was pseudomonas and in one case it was mixed flora. In Diabetes with multiple abscesses the pathogen found was Methicillin resistant staphylococcus aureus. In Necrotizing fasciitis pathogen found was pseudomonas. In Lower limb gas gangrene pathogen found was clostridium. In Inguinal abscess pathogen found was clostridium. In Lower limb necrotizing fasciitis pathogen found was clostridium. In Spreading perianal abscess pathogen found was gram negative. In Fournier's gangrene pathogen found was gram negative. In Diabetic necrotizing fasciitis pathogen found was gram negative.

Table 3: Clinical entity and the pathogen found

Clinical entity	Pathogen found
Diabetic foot	Methicillin resistant staphylococcus aureus
Diabetes with multiple abscesses	Methicillin resistant staphylococcus aureus
Diabetic foot	Pseudomonas
Necrotizing fasciitis	Pseudomonas
Lower limb gas gangrene	Clostridium
Inguinal abscess	Clostridium
Lower limb necrotizing fasciitis	Clostridium
Diabetic foot	Gram negative
Spreading perianal abscess	Gram negative
Fournier's gangrene	Gram negative
Diabetic necrotizing fasciitis	Gram negative
Diabetic erysipelas	Staphylococcus/Streptococcus
Fournier's gangrene	Staphylococcus/Streptococcus
Diabetic foot	Mixed flora
Crush injury	Mixed flora

Table 4 shows comparison on type of organism between clinical assessment and microbiological reports. The sensitivity of the clinical assessment of the type of organism was found to be 100% with same rate for negative predictive value. Specificity was 78.3% and a Positive predictive value was found to be 84.4%.

Table 4: Comparison on type of organism between clinical assessment and microbiological reports

Clinical assessment	Microbiologically Report		Total
	Commensal	Other	
Commensal	54	10	64
Other	0	36	36
Total	54	46	100
Sensitivity	100%		
Specificity	78.3%		
Positive predictive value	84.4%		
Negative predictive value	100%		

Discussion

The sensitivity of the clinical assessment of the infected wound for positivity was found to be 87% with same rate for Positive predictive value. But it has been observed that the clinical assessment lacked the specificity. The sensitivity of the clinical assessment of the resistant infected wound was found to be 100% with same rate for negative predictive value. Specificity was 98.9% and a Positive predictive value was found to be 83.3%. The sensitivity of the clinical assessment of the type of organism was found to be 100% with same rate for negative predictive value. Specificity was 78.3% and a Positive predictive value was found to be 84.4%.

Akinkunmi EO et al.[5] found that all specimens showed the presence of the bacterial pathogens.

Candida was seen in 12.4% of the cases. Most common organism seen was Staphylococcus aureus in 18.3% of the cases which constituted 126 in numbers of all the cases. Pseudomonas aeruginosa and Bacillus sp were found in 11.1% of the cases each. E. coli was found in 10.3% of the cases. Coagulase negative staphylococci were seen in 8.7% of the cases. On sensitivity pattern the authors found that β-lactam antibiotics were found to be resistant in 98% of the cases. It was also observed that more than 70% of the organisms isolated in the study were found to be resistant to erythromycin. Thus the authors concluded that multiple organisms were found in the culture results and multidrug resistance was widespread. They recommended the use of drugs like ofloxacin, ciprofloxacin and quinolones as leading drugs while treating the patients who developed infection of the wound that took place after surgery. The authors did not study the efficacy of the clinical assessment of the organisms in relation to microbiological culture reports which we studied.

Melaku S et al.[6] found from their study that the incidence of infection of the wound that took place after surgery was 17.1% of the 961 cases who underwent surgery in the surgery department, 21% of the 333 cases who underwent surgery in the in the obstetrics department and 13.5% of the 89 cases who underwent surgery in the gynecology department. Total incidence rate was 17.8%. The incidence of urinary tract infection was 48%. The incidence of surgical site infections was 45.6%. 52.6% of the cases it was found that the infection was due to gram negative bacteria and 47.4% of the cases it was found that the infection was due to gram positive bacteria. 19.5% of the cases were due to E. coli. The authors concluded that the incidence of SSI was very high in the study settings and antibiotic resistance is common.

Tesfahunegn Z et al.[7] found the incidence of nosocomial infection rate as 27.6%. 53% of the cases it was found that the infection was due to gram negative bacteria. More than 80% of the cases were resistant to first line antibiotics like ampicillin, gentamicin, amoxicillin, trimethoprim-sulphamethoxazole etc. the authors concluded that prevalence of hospital acquired infections is very high and resistance is widespread. They felt that there is need to have a good infection control system and surveillance.

Ako-Nai AK et al.[8] isolated 190 bacteria from patients and 120 bacteria from the environment of the ward. In their study males were 39 and females were 21. The authors reported that the distribution of the bacteria obtained from patients and those obtained from the environment of the wards was totally different and on statistical Analyzis, was significantly different. Similarly they also reported that resistance pattern of the bacteria obtained from patients and those obtained from the environment of the wards was totally different and on statistical Analyzis, was significantly different

Fierheller M et al.[9] observed that skin temperature was a good indicator of infection of the wound that take place after surgery. The r value was found to be 0.939 which was statistically highly significant. Temperature of the skin around the wound and the probability of the infection of the wound that take place after surgery were highly correlated with a large *F*-value of 44.238. They reported that characteristics of the patients and the characteristics of the wound were not found to be correlated with the infection of the wound that take place after surgery. But we found that sensitivity, specificity are good for clinical assessment and matched well with the microbiological reports.

Blokhuis-Arker MH et al.[10] reported that diagnosis of infection of the wound that take place after surgery is usually based on the infection signs. Swabs are generally taken whenever the infection of the wound that take place after surgery is suspected. The author condemned both these methods i.e. clinical assessment as it is subject to errors and microbiological reports as it takes several days to start the rational treatment. Hence author emphasizes that an easy diagnostic tool should be developed which will be simple, cost effective, and giving results quickly. The authors attempt to study the role of enzymes in this case. They included 81 cases with acute as well as chronic wound. They used three enzymes. They reported that all three models of the enzyme were found to be statistically significant. The authors also commented that clinical judgment did not correlate with swab reports of wound. But in the present study we found that sensitivity and the specificity of the clinical assessment was good. The authors concluded that enzyme Analyzis should be used for fast results instead of wound swabs.

Conclusion

Commensal flora of organisms is responsible for infections in almost 80 percent of wounds as they are due to trauma causing break in the epithelial barrier. The history clinical examination and the inciting mode of infection form a very vital aspect in treatment of the patient. Resistant strains can also

be suspected from comorbid condition of patients and the presentation.

Key messages: As per the present study results, clinical assessment can be used to determine which organisms are involved as well as their resistance pattern can be assumed while awaiting the culture and sensitivity reports so that patient is benefitted.

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