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EVALUATION OF NEW SCORING SYSTEM COMPARED TO A GOLD STONE METHOD FOR PREDICTING THE OCCURRENCE OF DEEP INFECTION IN OPEN FRACTURES PATIENTS

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ABSTRACT

Background: The management of open fractures had been improved by early adequate surgical debridement and various types of fracture fixation. The Gustilo classification is commonly used for treatment decisions and comparison. Although it had a good prediction power for deep infection but the variability among the inter observer was a problem. Yokoyama et al., 2009 he had advised a new scoring system based on three items of HFS-98 to predicting significant deep infections in open upper and lower extremity fractures. **Methods:** Patients with open fractures of long bones were included in study. The patients were classified according to the criteria proposed by Gustilo classification & Yokoyama's new scoring system. The relationship between the new score three items were investigated by categorical regression multivariate analysis.

Results: In this study, we had 183 Patients with open fractures of long bones. Road traffic accidents were the mechanism of injury in (56.70%). Deep infection was positive in 70/233 patients with Gustilo GI. The cut-off point of application of Yokoyama's new scoring system was 30, Sensitivity; 63.3%, Specificity; 89%, significant P-value <0.001.

Conclusions: The cut-off point of the new Yokoyama's new scoring application in this study very little different from the reported applicable values before. This revised scoring system was thought to be useful for predicting deep. Further prospective trial is needed for advising new scoring system.

KEYWORDS : Deep infection, New score system, HFS-98, Open fractures of long bones

INTRODUCTION

High energy trauma is most common cause of open fractures.[1] Open fractures are characterized by an external communication of hematoma which makes it more prone to infection and other complications.[2] The management of open fracture has improved with advancement in prophylactic usage of antibiotics and early surgical debridement and cleaning of wound with antiseptics, and fixation either internally or externally.[3] The principles of open fractures management have not changed since world war one by doing a primary asepsis technique, then adequate debridement with early fixation & immobilization, and later protection of wounds against infection or reinfection.[4] The decisions about treatments are made are made by using system of Gustilo and Anderson classification and is also useful in comparing of published treatment results.[5] Although it had a good predictor power in predication of deep infection and used frequently but the variability among the inter observer results is also very high.[6]

The Hannover fracture scale'98 (HFS-98) was created to emphasize upon the predictive indices of the limb salvage or the limb amputation.[7] It composed of eight items: bone loss, skin injury, muscle injury, wound contamination of infected organisms, deperiostation or not , local circulation & perfusion, systemic circulation & neurology using ATLS protocol for initial assessment.[8] It's considered that the HFS-98 could be useful for predicting the occurrence of deep infection in open tibial fractures, and as a utility for predicting the occurrence of deep infection in a newly developed scoring system based on the HFS-98 in previous studies.[5]

Based on Yokoyama et al, he had significance tests and univariate analyses on the eight items of HFS-98, with categorical regression analysis on the significant items to identify significant factors predicting deep infections in open upper and lower extremity fractures.[5] Resulting in the new scoring system items which are: muscle injury: 0– 20 points, wound contamination: 0–20 points, local circulation: 0–20 points, and clarified that the cut-off point for occurrence of deep infection in open extremity fractures was 35 by ROC analysis.[5]

In this study we tried to evaluate (Yokoyama new scoring system) devised by Yokoyama et al in 2009 as new scoring system of open upper and lower extremity fractures based on the basis of the Hannover Fracture Scale'98 (HFS-98).[5] Aiming to evaluate the new scoring system in predicting the occurrence of deep infection on open fracture patients.

METHODS

This is a prospective study was conducted at Department of Orthopedics, L. N. Medical College and research centre, Bhopal on 183 Patients with open fractures of long bones from January 2017 till December 2018. All adult patients, more than 18 years of age, presenting with long bones open fracture, were eligible. Exclusion criteria were patients undergoing immediate or delayed amputations that is due to deficient limb circulation, brain dead patients or patients who are known to be immunocompromised due to one cause or other eg. diabetic, sepsis, corticosteroids usage, auto immune disease and malignancy.

Demographic and clinical data were collected via specific data sheets filled by the researcher and from the medical records of patients in the Department of Emergency medicine at Suez Canal university hospital. The patients with open long bones fractures was classified according to the criteria proposed by Gustilo classification.[9] The relationship between the three items of Yokoyama's new scoring system as given in Table 1 based on Hannover Fracture Scale'98 (HFS-98) and Gustilo's grade in the open extremity fractures were investigated by categorical regression multivariate analysis.[5,6]

Broad spectrum antibiotics or in combination with an aminoglycoside was given for all types of fractures. prophylaxis against tetanus was administered to all patients. after patient's initial assessment according to abcde approach of Advanced Trauma Life Support (ATLS), the open wound was irrigated and debrided. Coverage methods for soft tissue for Gustilo (type I) was primary skin closure. Coverage soft-tissue methods for Gustilo (type II) could be delayed primary sutures or secondary skin grafting, or local flaps. The coverage methods for Gustilo (type III) could be delayed local muscle flaps or fasciocutaneous flaps and or free tissue transfers. The Coverage's was performed within 1 week. Diagnosis of deep infection was defined as clear counts of some bacterial organisms from bone or tissue below the muscular fascia according to Dellinger et al.[10] Statistical analysis The data were entered, cleaned and analyzed using SPSS software version 18.0. Descriptive statistics like frequency distribution and percentage calculation was made for most of the variables. Chi-Square and ROC cures were used to examine the relationship regression multivariate analysis between variables. A P <0.05 was considered statistically significant.

RESULTS

In this study, we had 183 Patients with open fractures of long bones, the age of the studied patients ranged from (18-78) years old with mean age 32±11.2 years. This study showed that the majority of the studied patients were males (85.1%).

Table 1: Yokoyama new scoring system.

Category	Score
Muscle injury	
No	0
<1/4 circumference	5
1/4-1/2circumference	10
½-3/4 circumference	15
>3/4 circumference	20
Wound contamination	
No	0
Partly	10
Massive	20
Local Circulation	
Normal pulse	0
Capillary pulse	5
Ischemia≤4 hours	10
Ischemia 4-8 hours	15
Ischemia>8 hours	20

Road traffic accidents was the most common mechanism of injury in (56.70%) of the studied patients. Isolated fracture was 41.5%, while 11% of the patients had combined injuries due to multiple trauma. This study showed that 50.9% of the culture and sensitivity of the studied patients at arrival showed no growth, while 45.9% of the culture and sensitivity of the studied patients inward showed no growth with different organisms as shown in Figure 1.

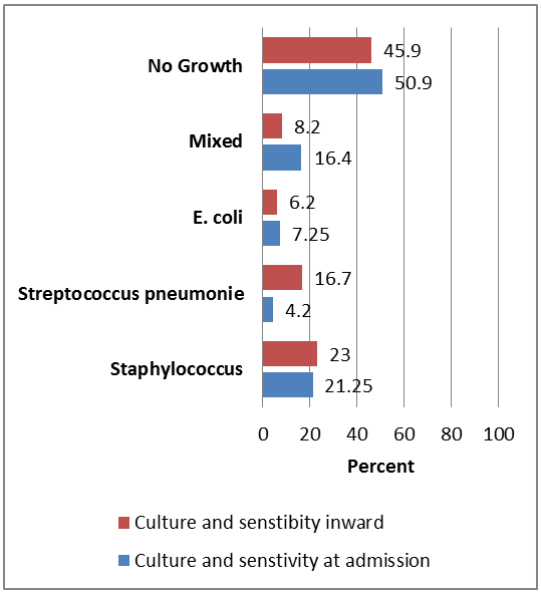

Figure 1: Distribution of studied patients according to culture and sensitivity at arrival and inward.

Deep infection was positive in 10.3% of the studied patients with ISS score <18 and 16.1% with score (18-30) and 66.7% with score >30.

Infection in deep tissues was positive in 70/233 patients with Gustilo classification, (G) I: 13.1% (18/137), G II: 33.3% (8/24), G IIIA: 50% (20/40), G IIIB: 60% (12/20), and G IIIC: 100% (12/12).

Deep infection was seen in 70 patients (G I: 13.1% (18/137), G II: 33.3% (8/24), G IIIa: 50% (20/40), G IIIb: 60% (12/20), GIIIc: 100% (12/12) with significant relation to grade of Gustilo classification when processed in multivariate.

The cut-off point of the Yokoyama's new scoring system was 30, Sensitivity; 63.3%, Specificity; 89%, PPV; 45%, NPV; 93.8, significant P-value <0.001*. And the area under curve will be 74%.

The cut-off point of the Gustilo was GII, when area under curve was be 77%, sensitivity will be 74.3%, specificity

97.2%, with P significant value positive =0.001. The ISS score cut-off point of was 18 when area under curve was be 78%, sensitivity will be 90%, specificity 62.6%, with P significant value positive =0.001.

DISCUSSION

In this study, the age of the studied patients ranged from (18-78) years old with mean age 32±11.2. These results going with the results of another studies in which the age of the studied patients varied from (20-56) years with the mean age was 38 years.[5,6,11] Road traffic accidents was the higher rate of mechanism of trauma, isolated fracture was the dominant followed by the combined injuries and those results agrees with the results of other study in which the mechanism of injury was motorcycle accident in (57%) of the patients followed by motor car accidents in (20%), and 11% of the patients had combination of injuries with other fractures.[12,13] Regarding ISS score, this study showed that 29.2% of the studied patients had score <18 while 39.9% of them had score (18-30) and 30.9% of them had score >30. These results don't agree with the results of a study conducted by Yokoyama K et al, in which 69.3% had ISS score <18, (22.1%) of them had score (18-30) and (8%) of them had score >30 this variation could be due to the nature of accident direct or high velocity traumas.[5,12,13] Regarding Gustilo classification, this study showed that 58.8% of the patients had GI. Unlike the results of the study performed by Yokoyama K et al, in his two researches which 15%, 17% of patients had GI respectively.5,6 Also these results not going with the results of a study conducted by Agel et al, in which 14.6% of the patients had GI.14 This culture and sensitivity studies of 55.3% of the patients showed that no growth at arrival, while 48% of the culture and sensitivity of the studied patients inward showed no growth as shown in Figure 1 with different organisms that we can't rely on the culture in diagnosis of deep infection separately without suggested clinical picture. These results agree with the results of a study performed by Hannigan GD et al. The collected swabs from patients with open fractures upon presentation to ED only 24% of surveillance cultures showed growth. 77% of the infected wounds showed negative cultures.15 This study showed that deep infection were seen in 70 patients (G I: 13.1% (18/137), G II: 33.3% (8/24), G IIIA: 50% (20/40), G IIIB: 60% (12/20), GIIIC: 100% (12/12) with significant relation to grade of Gustilo classification when processed in multivariate. These results don't match the results of a study performed by Yokoyama K et al, deep infections were seen in only 32 patients G I: 0% (0/65) , G II: 2.2% (3/133), G IIIa: 5.9% (4/68), G IIIb: 27.1% (19/70), and G IIIc: 37.5% (6/16).15 The increased rate of infection in the study group could be due to bad manipulation & delayed transfer and suturing of the fracture wound , G II: 2.2% (3/133), G IIIa: 5.9% (4/68), G IIIb: 27.1% (19/70), and G IIIc: 37.5% (6/16). The cut-off point of the Yokoyama's new scoring system in our study was 30, showing sensitivity; 63.3%, specificity; 89%, PPV; 45%, NPV; 93.8, significant Pvalue <0.001*. Those results were slit different from Yokoyama K et al, results demonstrating a cut point of 35 and the sensitivity, specificity, positive predictive value, and negative predictive value in this cut-off point were 0.67, 0.92, 0.66, and 0.98, respectively.[5]

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