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ORIGINAL ARTICLE

A comparison of the outcome of Gun Shot Wounds with and without skin closure in terms of wound healing time and wound infection.

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ABSTRACT… Objective: To compare the outcome of Gun Shot Wounds with and without skin closure in terms of wound healing time and wound infection. **Study Design:** Comparative Study. **Setting:** East Surgical Ward Mayo Hospital Lahore Pakistan. **Period:** 6 Months (from 1st January 2020 to 30th June 2020). **Material & Methods:** Sample size of 300 patients was used by consecutive convenient non probability sampling. Patients were divided into Group A and Group B with 150 patients in each group by lottery method. Group A patients underwent wound debridement and primary skin closure while group B patients underwent wound debridement and wound packing. Outcome was measured in terms of wound healing time and wound infection 24 and 48 hours post operatively. P-value less than 0.05 was taken as significant. **Results:** Two hundred and fourteen (n=214,71.33 %) patients were male and 86 (28.66 %) were female with mean age of 32 ± 7.56 years. The wound healing time in Group A patients was 6 days ± 2.18 days while in group B it was 13 days ± 3.87 days (P value 0.01). After 24 hours, Frequency of wound infection was 43 (14.3%) in Group A patients while 31(10.3%) in Group B patients (P value = 0.19). Similarly, after 48 hours wound infection rate was 17 (5.6%) in Group A while 11 (3.6%) in Group B (P value = 0.42). **Conclusion:** Applying skin stiches on Gun Shot Wounds after sufficient debridement and irrigation leads to early healing of the wound.

Key words: Debridement, Firearm, Gunshot, Infection, Skin, Wound.

INTRODUCTION

The world health assembly (WHA) labelled Firearm injuries (FAI) or gunshot Wounds (GSWs) as global public health issue because of its significant morbidity.[1] There are almost 639 million arms present all around the world which means more than one weapon to 10 people. Violent injuries are considered as eighth leading cause of death in the world.[2] Not only it causes high death toll but gunshot wounds also cause significant morbidity, long term physical and psychological disability for many individuals families and societies. Mostly gunshot injuries are common in low- and middle-income countries. United states of America (USA) have highest rate of gunshot injuries among the develop countries. It has been estimated that the homicide rate is 7 times higher in United States than that of other developing nations.[3] Gunshot wounds are also very common in Pakistan like other developing countries.[4] Wartime experiences have provided the scientific basis for the proper treatment of gunshot wounds but still many controversies exist regarding the definite treatment of gunshot wounds. Different modalities of treatment include operative exploration, extensive debridement of wounds, wound wash, treatment of open wound and intravenous administration of antibiotics.[5]

Wound is generally defined as the break in the integrity of biological tissue including skin, mucous membrane and organ tissue. The American college of clinical wound specialties (ACCWS) states that it is very difficult to find the common treatment for all the organs injured by gunshot wounds as each tissue has its own

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healing capacity and the gunshots induce different trauma effect on different tissues.[6] Gunshot wounds on skin are considered as dirty wounds and many centers believe to wash the skin wound of gunshot with copious amount of water along with generous debridement and leave the wound open for secondary or tertiary intention. This causes poor cosmetic appearance of gunshot wounds and many patients needs skin grating later.[7]

To our knowledge, till now no study has been done on national and international level which finalize the decision of primary closure of gunshot wounds versus secondary or tertiary closure of skin wounds by gunshots. In this study we are going to compare the gunshot wounds with and without skin closure after wound wash and debridement and see outcome in both groups in terms of wound infection and healing time.

MATERIAL & METHODS

It was a comparative study conducted in Mayo Hospital which is the tertiary care hospital of Punjab and teaching hospital of King Edward Medical University (KEMU) Lahore Pakistan. The duration of the study was 6 months from 1st January 2020 to 30th June 2020. The study was approved by the Institutional Review Board of King Edward Medical University (182/RC/KEMU). A total of 300 patients were selected for this study after fulfilling inclusion criteria by consecutive non probability sampling technique and divided into two groups by lottery method, each containing 150 patients each. All those patients were included in this study who presented in the emergency department of Mayo Hospital Lahore with one to two penetrating wounds which may be an entry or exit wound or both entry wounds. single entry of exit of GSW. All wounds had size of less than 3x3 cm and only muscle deep on chest, abdomen, back, upper and lower limbs for which no other major operation (exploratory laparotomy, thoracotomy, vessel exploration) was needed other than wound debridement. Patients who undergone major abdominal operation, patients with peritoneal or pleural breach, any neurovascular injury or with fractures of upper and lower limbs, immunocompromised and diabetic patients were excluded from the study.

Patients were divided into two groups. Group A included those patients in which muscle and subcutaneous tissue was closed with vicryl 2/0 and skin was closed with prolene 2/0 vertical mattress suture after wound debridement and wound wash with normal saline. Group B patients were those in whom only debridement and wound wash was done and wound was left open for secondary or tertiary intention after packing wound with povidone-iodine and polymyxin and bacitracin-soaked gauze. 3rd generation antibiotics (Inj ceftriaxone 1gm) was given before debridement and then 12 hourly for 3 days. Written and Informed written consent was taken by all selected patients before starting any procedure. All debridements were done under local anesthesia (Percutaneous: 1-60 mL of 0.5-1% lignocaine solution (5-300 mg total dose). Debridement of gunshot wounds was done in elliptical shape rather than circular shape in order to approximate the margins easily. Wound healing time was defined as presence of scab in group A patients and presence of granulation tissue in group B patients. Wound infection was defined as the presence of amount of exudate (none, small, moderate and large), type of exudate (serous, sanguineous, serosanguinous, purulent) and redness of margins of the wound in both groups along with classical signs of wound infection like heat, pain, redness and swelling.[8] Wound infection was assessed at 24 and 48 hours after debridement.

Data was analyzed using SPSS version 26.0. Qualitative variables were determined as frequency and percentages. Quantitative correlations among variables will be determined by application of independent sample t test. P Value less than 0.05 was considered significant.

RESULTS

Out of 300 selected patients who fulfilled the inclusion criteria, 217 (72.33 %) were male and 83 (27.66 %) were female. Male to female ratio was 2.4:1. The mean age of the patients was 32 ± 7.56 years. Wound healing time in group A patients was 6 ± 2.18 days and 13 ± 3.87

days in group B patients (P Value= 0.01). Table-I shows wound healing time in both groups after 24 and 48 hours. Table-II showed location of Gun Shot Wounds on different parts of body. Figure-1 shows the number of GSWs to different parts of human body in male and female patients.

	Group A (n=150)	Group B (n=150)	P-Value *
Wound healing time	6 days ± 2.18 days	13 days ± 3.87 days	0.01
Wound infection after 24 hours	43 (14.3%)	31(10.3%)	0.19
Wound infection after 48 hours	17 (5.6%)	11 (3.6%)	0.42

Table-I. Comparison between Group A and Group B (* calculated by independent sample t test)

Location of GSWs	Number (N) (%)
Head & Neck	54 (18 %)
Chest	12 (4 %)
Abdomen & Pelvis	28 (9.33 %)
Upper Limbs	127 (42.33 %)
Lower Limbs	79 (26.33 %)
Total	300 (100 %)

Table-II. Location of gun shot wounds on different parts of body.

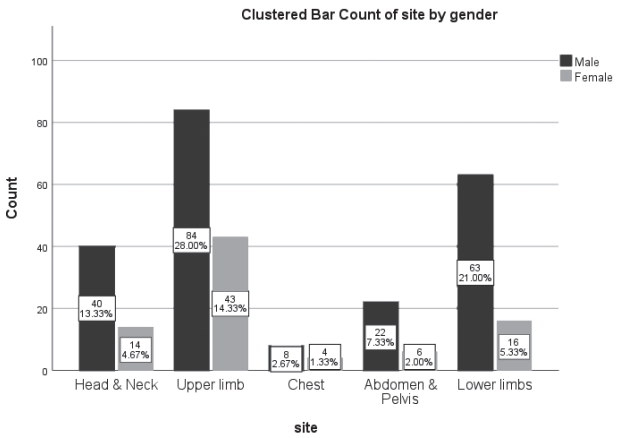

Figure-1. Count and percentages of GSWs to different parts of human body in male and female patients.

DISCUSSION

Gunshot wounds (GSWs) is a major contributor of trauma patients around the globe. Pakistan is among the top ten importers of firearm weapons and it has been estimated that approximately 100 million dollars imports of weapons were carried out in 2015.[9] On comparison young males are more susceptible to gunshot injuries as compared to females. Our study shows that males are more affected by gunshot wounds as compared to females and the ratio is 2.4: 1. The more ratio of males affected by the gunshot wounds is also due to the fact that males are more aggressive, adventurous and exposed to external environment as compared to females. In a study done by Khatri JP et al showed that the incidence of GSWs in females are very less (2.3%) as compared to men.[10] In another study done in Pakistan by Rizwan M et al, ,GSWs are more common in illiterate societies with poor socioeconomic status with wounds in the neck were most common.[11]

Gunshot wounds to the extremities are rarely life threatening but is the major cause of morbidity in young patients.[12] In our study, venous and nerve injuries due to gunshot wounds were not included and only those wounds were included where only wound debridement was needed.

Center for disease control and prevention (CDC) classified the wounds in four classes. Class 1 are clean wounds, class 2 are clean contaminated wounds, class 3 are contaminated wounds and class 4 are dirty wounds.[13] It has been considered generally that class 1 and 2 should be closed primarily while class 3 and 4 should be left open and allowed to heal by secondary or tertiary intention.[14] While surgical wounds can be divided into above mentioned CDC wound classes, gunshot wounds are still in controversy regarding their CDC wound group. Many authors consider gunshot wounds to be dirty wound and advise their management as wound wash and leaving the wound open to get healed by secondary or tertiary intention.[15]

A study done by Fowler et al, showed that the surgical wounds can be closed after debridement while the GSW should be left open to be washed daily with sterile solution.[16] While another study done by Bukhari et al, showed that GSWs can be approximated with minimal tension which helps in early healing and comparatively good scar mark as compared to the wound which are left to heal with secondary intention.[17] Though no literature

available worldwide that gunshot wounds should be considered as class 4 or dirty wound.

The problem with leaving the gunshot wound open is that healing by granulation tissue takes more time to heal and incidence of infection is also more in these open wounds. In a study done by Qasim Ap et al, the debridement of GSWs should be kept minimum and only the irregular and black margin of entry and exit should be trimmed in order to easy the primary or secondary closure.[18] Secondly the cost of daily dressing twice a thrice a day is a burden on patient. Thirdly if gunshot wound is larger in size, then there are chances that healing of wound cannot cover the wound completely and skin grafting may be needed. All these complications of leaving the gunshot open can be overcome by closing the gunshot wound after wound wash and debridement.[19] Also, gunshot wounds are generally considered dirty wounds so it is also not advised to close the wound primarily keeping in mind the high risk of infection. But no such recommendation is found in the literature and all these guidelines are based on personal experiences.[20]

The main problem encountered in wound classification system is that it has low inter-rater ratability among healthcare providers. Also, in neonatal gunshot wounds and surgical wounds this wound classification is not shown effective.[21] Despite many advances in the infection control American Burn Association (ABA) states that there are many problems and difficulties in application of most appropriate treatment of the wounds. Also keeping the biological factors aside, patient's own immunological status and psychological behavior also plays a very important role. In a study done by Lee et al, presence of uncontrolled diabetes directly affects the healing of wound by interfering with the collagen deposition in the wound.[22]

There are certain limitations to this study. First the sample size of this study is relatively small. Secondly this is a singly center study. More multicenter studies with large sample size are required to evaluate the more definite role of primary closure of gunshot wounds. Also, the GSWs selected in this study was small sized. More researches are needed to establish the treatment of larger and multiple GSWs.

CONCLUSION

Closure of gunshot wounds primarily by suture after wound wash and debridement will lead to less healing time of the wound as compared to leaving the gunshot wound open for secondary or tertiary closure. The infection rate is similar and not dependent on whether we close the gunshot wound or leave it open.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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1	Ahmed Siddique Ammar	Substantial contribution to the design of the work, revising it critically for important intellectual content, final approval of the version to be published and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any park of the work are appropriately investigated and resolved.	
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