

## Original Research Article

# Comparative study of primary closure versus non-closure of animal bite injuries in head and neck region: case study of 540 patients

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## ABSTRACT

**Background:** Rabies is a zoonotic disease caused by lyssavirus and spread through saliva of rabid animal bite. This study was taken to compare primary closure versus non-closure of animal bite wounds.

**Methods:** This is a prospective randomized study. Patients were divided into 2 groups. Group A consisted of patients with non-closure of wounds and group B with primary closure of wounds. Patients were followed up for wound healing time, infection and cosmesis.

**Results:** This study consists of 540 patients (323 males and 217 females). The common age group was paediatric and geriatric age. Most common animal bite was from dogs. The average healing time in non-infected wound in group A versus group B with Lackman's I and II grading was  $10.5 \pm 1.25$  and  $12.5 \pm 1.5$  days versus  $7 \pm 1.25$  and  $8.5 \pm 1.5$  days respectively. There were 19 cases in group A and 17 cases in group B with infection which subsided with antibiotics in 24 hrs. Cosmesis graded on VSS was better in group B (average  $4.03 \pm 1.5$ ) as compared to group A (average  $2.44 \pm 0.185$ ). Only one patient from group A with Lackman's grade II contacted rabies died 2yrs after the bite.

**Conclusions:** Animal bite wounds over head and neck were found to be more common in paediatric and geriatric population who are more vulnerable. Infection and spread of rabies virus through these wounds can be prevented by thorough debridement and cleaning whereas primary suturing helps in achieving early wound healing and better cosmesis producing a socially and functionally acceptable scar.

**Keywords:** Rabies, Wound healing, Primary suturing, Equine rabies immunoglobulin

## INTRODUCTION

Animal bites are more prevalent in developing countries. Among them, the occurrence of wound infection and incidence of rabies are highly prevalent in this part of the world due to inadequate animal vaccination protocol. The situation is especially pronounced in India, which account for 18000 to 20000 cases of rabies a year and about 36% of the world's deaths from the disease.<sup>1</sup>

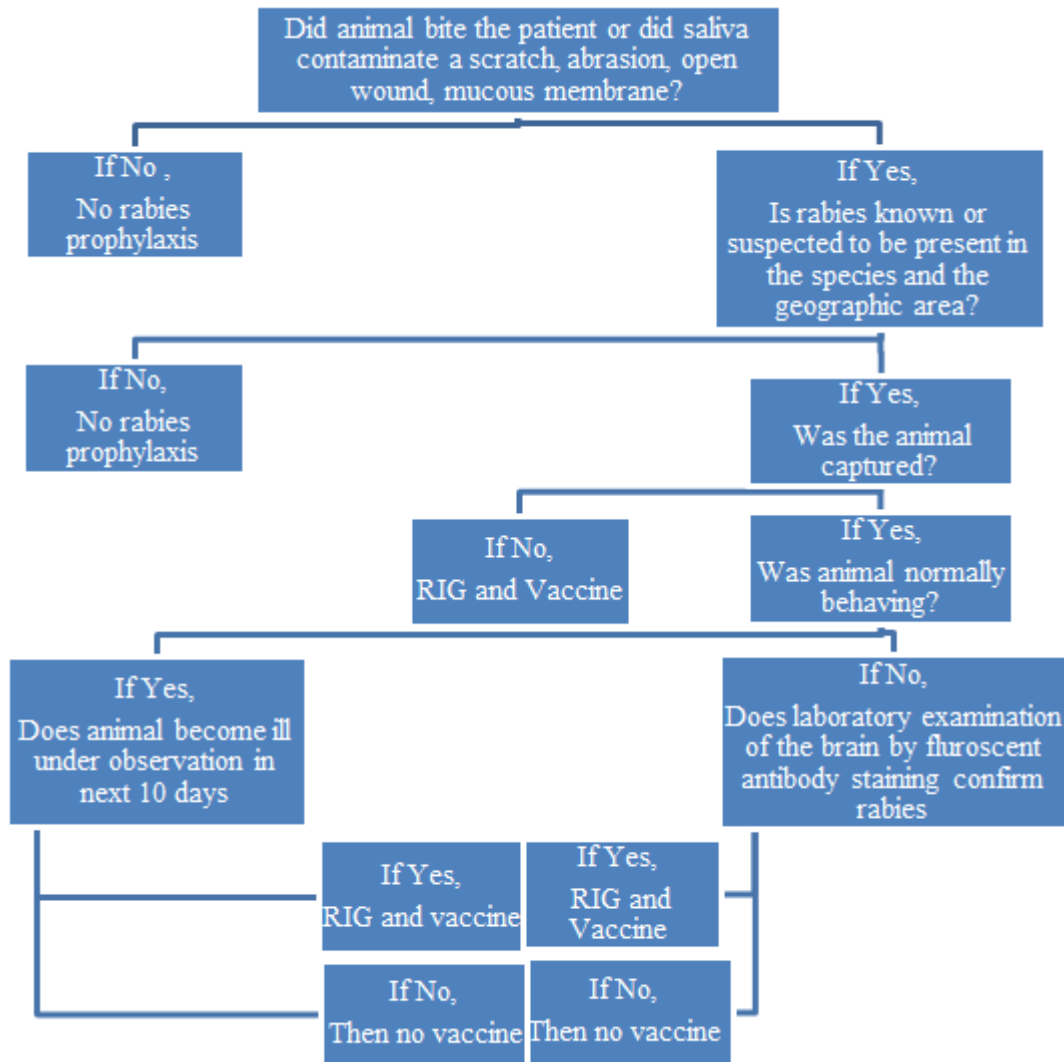
According to WHO, globally 30,000 deaths occur every year due to Rabies. Most bites were from stray dogs affecting mainly children.<sup>2</sup> Other animal bites that are

commonly encountered in hospital are cat-bites, swine-bites. Unlike adults, in whom only 10% of bites involve the head and neck, most bites in children affect the head and neck region, with 76% affecting lips, nose, and cheek.<sup>3</sup>

Rabies is a zoonotic disease caused by a lyssavirus transmitted to humans through the saliva of a rabid animal.<sup>4,5</sup> It has 3 clinical phases: prodromal phase, acute neurologic phase, coma and death.<sup>5</sup> Certain diagnostic tests like reverse transcription polymerase chain reaction test, serum neutralizing antibodies are available however they are positive only in late stage when the disease is

irreversible. It makes the treatment of post exposure prophylaxis very crucial in preventing from spread of virus from site of wound to central nervous system (CNS) for which there is a standard algorithm.<sup>5</sup>

Management of animal bite wounds is also important apart from post exposure prophylaxis and rabies immunoglobulin (RIG) (Figure 1) as these are associated with higher risk of local wound infection along with high susceptibility of contracting rabies.



**Figure 1: Assessment of patients for providing with post exposure prophylaxis and immunoglobulin for rabies prevention.**

Thus wounds especially over head and neck which has the characteristics of rich blood supply, least infective potential and excellent wound healing needs early intervention to bring the best outcome in terms of reducing infection and aesthetic component especially in younger population.<sup>6,7</sup> But animal bite over the face has highest risk of transmission of rabies (Category III) and the line of treatment was to keep the wound open after thorough wound toileting and allow it to heal by secondary intention to prevent the spread of infection to CNS. But there are no recent studies confirming that non closure of wound has prevented the spread of infection. Thus study was conducted to compare the outcome of primary wound closure with non-closure of facial wound.

**METHODS**

This is a prospective and retrospective study done at J. J. group of hospitals, Mumbai from January 2016 to January 2019. It included 540 patients who were divided into 2 groups: Group A consists of patient with animal bite who was treated with antibiotics and wound was allowed to heal by secondary intention. Group B consists of patient who had undergone primary surgical closure of the facial wound at the time of presentation.

**Inclusion criteria**

Patients of all ages and gender attending for Rabies Prophylaxis with facial bite from dogs, cats, swines

presenting within 8 hours were enrolled in the prospective, randomized trial.

### **Exclusion criteria**

All other patients presenting more than 8 hours, wounds with skin loss requiring plastic surgery, or patients with immune deficiency, using immunosuppressive agent, autoimmune disorder and diabetes were excluded.

### **Procedure**

Patients with only facial bite were attended by ENT surgeon and wound was cleaned, assessed and categorized into Lackman's classification.

### **Disinfection and debridement**

The area of wound along with 2-3 cms surrounding was cleaned with 100 ml of 10% soap water. Local anaesthetic was administered before cleaning the wound to avoid pain. Subsequently, the wounds were alternating doused with physiological saline, 3% hydrogen peroxide for a period of 10 mins. Then it was washed with 100 ml of standard betadine solution. All dead tissue and clots were removed. Once completely debridement and cleaning was confirmed, equine RIG was given calculated according to the weight of the patient as all bites were considered as a potential etiology for transmission of rabies, until otherwise proved in India. Patient was also given antibiotics and tetanus vaccine.

Then patient wound were classified into Lackman's classification and randomly divided into group A and group B.

Lackman's classification:

- Type 1- Superficial lesion without muscle involvement.
- Type 2- Deep lesion with muscle involvement.
- Type 3- Deep lesion with muscle involvement and tissue defect.
- Type 4A- Type 3 combined with vascular damage or nerve lesion.
- Type 4B- Type 3 combined with bone damage or organ involvement.

Group A patients were closed with sterile antibiotic dressing and allowed to heal by secondary healing after daily dressing

In Group B patient's wounds, primary closure was done with 4-0 ethilon over skin and 3-0 vicryl if deeper tissue and mucosal area needs to be closed. For suturing done at the angle of mouth liquid food was allowed only with straw. In case of children and non-co-operative patients suturing was done under general anesthesia.

All patients, especially women and children underwent psychiatric counselling to boost their morale as there have been reported incidences of post-traumatic stress disorders and children especially for nocturnal enuresis.

After this, dressing was done in both groups every day until wound healing in group A and suture removal in group B. All patients were kept on intravenous antibiotics and analgesics during ward stay of 7 days. At discharge the patients were prescribed with oral antibiotics and analgesics and followed up. The patients in both groups were compared for 3 parameters: wound healing time, infection, and cosmesis.

Wound healing time was calculated from the time of bite till complete closure of wound.

The wound is said to be infected based on the following parameters: (a) Major criteria (one required for diagnosis) such as fever (>38 degree Celsius), local abscess and lymphangitis, (b) minor criteria (four required for diagnosis) such as local erythema that extended from >2 cms from the edges of the wound, tenderness at the wound, edema at the site, purulent discharge and white blood cells per cubic millimeter >12000.

### **Infection time**

The interval from time of bite to point of infection indication (time calculated in hours).

### **Recovery time**

The interval from time of bite to the point of healing of wound (time calculated in days). In case of wound infection the culture and sensitivity of wound swab was done and the patients were discharged only after infection subsided.

Cosmesis was evaluated based on Vancouver scar scale (VSS) at the end of 6 weeks.

- Pigmentation (0-2): normal-0, hypopigmentation-1, hyperpigmentation-2
- Vascularity (0-3): normal-0, pink-1, red-2, purple-3
- Pliability (0-5): normal-0, supple-1, yielding-2, firm-3, ropes-4, contracture-5
- Height (0-3): flat- 0, <2 mm- 1, 2-5 mm- 2, >5 mm- 3

### **Statistical analysis**

It was performed using SPSS 20.0 (USA). The chi square test and t-test was applied. Statistical significance was set at  $\alpha=0.05$ .

## **RESULTS**

Total of 540 patients were included in the study that consist of 323 males and 217 females. They were divided

into group A and group B equally of 270 patients each (Table 1). In this most common age group was paediatric and geriatric age (Table 2 and 3). Considering the animal bites, most frequent animal bite encountered were dogs (75.37%), followed by cats (21.67%), and least was swine (2.96%) (Table 4).

The average healing time in non-infected wound in group A with Lackman's 1 and 2 was  $10.5 \pm 1.25$  and  $12.5 \pm 1.5$  days respectively which differed from group B which had  $7 \pm 1.25$  and  $8.5 \pm 1.5$  respectively. There were 17 cases

each in group A and B with infection which subsided with antibiotics in 24 hrs. This delayed the wound healing process in both groups accordingly as shown in table. The healing time was significantly less in group B as compared to Group A (Table 5 and 6).

Based on grading of VSS (Table 5 and 6) group B (average of  $4.03 \pm 1.5$ ) was found to be better as compared to group A (average of  $2.44 \pm 0.185$ ). In our study one patient died of rabies that had contacted with rabies and was labelled in group A with Lackman's grade II.

**Table 1: Distribution of patients into Lackman's classification in each group.**

Particulars	Lackman's type 1 wounds	Lackman's type 2 wounds
Group A (270 patients)	196	74
Group B (270 patients)	178	92

**Table 2: Age distribution of animal bite in group A and B.**

Age group (years)	Group A		Group B	
	Male	Female	Male	Female
0-15	43	39	41	45
15-30	26	27	24	29
30-45	29	19	25	25
45-70	33	9	30	12
>70	38	7	34	5

**Table 3: Gender distribution.**

Gender	N
Males	323
Females	217

**Table 4: Distribution of wounds according to animal bites.**

Animal	Number of cases	Percentage (%)
Dog	407	75.37
Cat	117	21.67
Swine	16	2.96

**Table 5: Parameters used to asses wound in Group A.**

Parameters	Lackman's type 1 wounds	Lackman's type 2 wounds
Infection	9	10
VSS grading for cosmesis	$3.85 \pm 0.06$	$4.21 \pm 0.15$
Wound healing time (infected)	$13.5 \pm 1.25$	$16 \pm 1.75$
Wound healing time (non-infected)	$10.5 \pm 1.25$	$12.5 \pm 1.5$

**Table 6: Parameters used to asses wound in Group B.**

Parameters	Lackman's type 1 wounds	Lackman's type 2 wounds
Infection	9	8
VSS grading for cosmesis	$1.12 \pm 0.25$	$1.32 \pm 0.12$
Wound healing time (infected)	$10.5 \pm 1.75$	$11.75 \pm 1.5$
Wound healing time (non-infected)	$7 \pm 1.25$	$8.5 \pm 1.5$





**Figure 2: Pre-operative photograph.**



**Figure 6: Post-operative photograph day 14.**



**Figure 3: Post-operative photograph day 1.**



**Figure 7: Pre-operative photograph.**



**Figure 4: Post-operative photograph day 6.**



**Figure 8: Post-operative photograph after 6 weeks showing VSS of scale 5 (hyperpigmentation-2, pink-1, supple-1, <2 mm- 1).**



**Figure 5: Post-operative photograph day 7.**

## DISCUSSION

Animal bite wounds should be treated as special surgical wound. The main component of wound care and prevention of spread of disease is debridement. As our study was done in animal bite injuries belonging to Lackman's grade I, II, it aims to assess wound healing, cosmesis and functional benefits of an early primary suturing which should be weighed against risk of contracting rabies.

Similar to previous studies, Chavan et al, the incidence of dog bite was highest among the injuries encountered, comprising 79% which is due to increased stray dog population in the developing countries.<sup>8</sup> The low incidence of swine bites may be due to location of our hospital in the city.

The age group to be affected is also the younger population (0-15 yrs) and most common gender to be affected is male which was comparable with other studies.<sup>5,9,10</sup> In children there was faint line of demarcation among both genders but it was significant as the age progressed from 3<sup>rd</sup> decade onwards. The increased incidence of males may be due to the male dominant society in developing countries where they are more vulnerable for such injuries outdoor. Probable reasons for old age having an increased incidence were lack of self-defence capacity and use of supporting stick which may be seen as a threat by the animal causing bite.

In our study the average healing time in group A was 14.75±1.5 (Lackman's I and II) days and in group B was 11.12±1.62 days (Lackman's I and II). It was comparably same as the study of Rui-feng et al where healing time was 9.12±1.30 days and 6.57±0.49 days in wound healing without and with suturing respectively.<sup>11</sup> The wound healing in group A was more delayed because it would heal by second intention where the healing goes by formation of a large granulation tissue and later epithelium overgrows the granulation and such healing is called to be healing by second intention.

Infection is one factor that determines the healing process of a wound. Animal bite wounds are commonly infected by commensals of animal saliva.<sup>3</sup> The various aerobes (pasturella, streptococcus, staphylococcus, etc.) and anaerobes (*Fusobacterium*, *Prevotella*, *Prionibacterium*, etc.) identified in the bite wounds were similar to the commensals found in the animal saliva.<sup>12,13</sup> They tend to delay the wound healing by forming abscess, slough and purulent discharge from wounds and result in delayed cosmetically bad scar. Infection tends to increase even if wound is kept open for prolonged period that are found in surroundings. This can be prevented by thorough debridement and cleaning with standard solution for adequate contact period wound reduce the infection rate significantly.<sup>14,15</sup> In our study we followed a standard protocol of thorough debridement and disinfection which reduced the infection rate as well as the spread of rabies virus from wound to CNS.<sup>16-18</sup> Further antibiotics and tetanus vaccine reduce the probability of wound being infected.<sup>19</sup> In our study wound infection was seen in 19 patients in group A and 17 patients in group B which delayed the healing process in both group A and B which were comparable with similar results in other studies. In our study also we documented only one death because of rabies after two years of bite which was from group A which was contrary to the past outlook of not suturing the wound to prevent rabies spread.

### **Cosmesis**

The end result of healing is scar. Suturing was primarily done to reduce infection rate and next was for minimal scarring as the face was region of aesthetic importance. In our study scar was determined and scaled based on VSS which was 4.03±0.105 in group A as compared to

1.22±0.185 in group B. thus primary suturing was significantly better as compared to leaving the wound open that lead to infection as well as cosmetically inferior outcome. It was comparable to other studies of Chavan et al, Rui-feng et al, Jain et al, which were of same opinion about better cosmetic result after suturing.<sup>8,11,16</sup>

### **CONCLUSION**

Animal bites wounds over head and neck is common in paediatric population and geriatric population who cannot defend while being bitten. Rabies infection depends on site of wound bite, type of wound and time of presentation. It can be prevented when proper care of wound is taken. Infection and spread of rabies virus through these wounds can be prevented by thorough debridement and cleaning whereas primary suturing helps in achieving early wound healing and better cosmesis producing acceptable scar. This study can be extended further into deeper wounds like Lackman's grade 3, 4, and 5 for knowing cosmetic and functional outcome in such wounds.

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