



## A Case Study of Delayed Primary Suturing in Facial Injuries Following Animal Bites

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### Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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### ABSTRACT

**Aims:** To evaluate the role of delayed primary suturing in prevention of sepsis and achieving better cosmetic appearance in animal bite injuries over the head and neck areas.

**Study Design:** Prospective observational study.

**Place and Duration of Study:** Department of Otorhinolaryngology at Govt. Medical College, Nanded, Maharashtra, (India) from a period of Jan 2009 to Dec 2013.

**Methodology:** A prospective observational study of 70 cases of patients presented to us in the form of injury to head and neck area by animal bites. In all patients we followed the standard norm for delayed primary closure in form of:

- Thorough wound toileting
- Equine Rabies Immunoglobulin at the site of wound in all patients
- Anti-Rabies vaccination
- Daily dressing
- Delayed primary suturing after 10 days

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All patients were routinely followed up and assessed for wound sepsis, cosmesis and function.  
**Results:** Among the animal bites, dog bite injuries were found to be most common facial injuries followed by swine and cat. In our study group of 70 patients which was dominated by males from second decade onwards showed a faint line of demarcation in sex distribution in children. Cosmetic outcome on comparing our study of delayed primary closure with Paschos NK et al. study healing by secondary intention, delayed primary suturing exhibited significantly better result with the mean score of (1.50) for VSS compared to healing by secondary intention group with mean score of (3.05) for VSS was recorded ( $p= 0.000$ ) (95% CI 0.1516-0.1494).  
**Conclusion:** Delayed primary closure exhibited improved cosmetic appearance when compared with healing by secondary intention.

*Keywords: Delayed primary suturing; equine rabies immunoglobulin; anti-rabies vaccination; cosmesis.*

## 1. INTRODUCTION

Rabies also known as hydrophobia is an acute, highly fatal, viral disease of CNS, caused by type 1 lyssavirus. It is primarily a zoonotic disease transmitted to humans by bite or lick of saliva of rabid animal.

According to WHO, globally 55,000 deaths occur every year due to Rabies. The burden of rabies related deaths in India is 18000-20000/yr.

In animal bite injuries, wound closure happens in one of these three ways

- 1) Primary closure
- 2) Secondary healing
- 3) Delayed primary closure

In primary wound closure also known as healing by primary intention, sutures are taken immediately following injury and is the fastest way of closure.

Secondary closure requires granulation tissue matrix to be built to fill the wound defect and is also known as healing by secondary intention.

Delayed primary closure [1] (defined as sutures taken after 6 hrs of trauma, up to 7-10 days usually) also known as healing by tertiary intention is a combination of healing by primary and secondary intention. It helps to achieve a better cosmetic appearance, prevent wound sepsis and preserves functional ability of muscles.

Among all the animal bites, dog bite is most frequently encountered in medical practice all over the world [2-3]. As opposed to western countries, the incidence of sepsis is higher in developing countries like India where many

cases go under reported. In most parts of developed countries, people are bitten by their own pets, vaccination status of whom is known, but in India, considering low vaccination coverage against rabies in dog population and the difficulties in laboratory diagnosis of rabies, there is a thin line of demarcation between rabid and non rabid bites, any animal bite is assumed to be suspicion of Rabies and hence patients have to complete anti rabies vaccination schedule.

Among all the animal bites, wound infection is more prone to occur in dog bites followed by swine bites and then cat bites, especially in patients having immune-compromised status and diabetes mellitus who are more vulnerable to other dreaded complication like necrotizing fasciitis.

Animal bite injuries over facial region are considered to be having highest risk of transmission of rabies and hence these injuries are put into category III of wound severity.

Animal bites over facial region commonly present in the form of abrasion (80%), laceration (60%) and puncture wounds (30%). Puncture wounds carry highest risk of sepsis and Rabies if contaminated by rabid animal saliva [4].

According to Lackmann [5], Facial bite injuries are primarily classified into:-

Type I: Superficial injury without muscle involvement

Type II A: Deep injuries with muscle involvement

Type II B: Full thickness injuries of cheek and lips with oral mucosal involvement

Type III A: Deep injuries with tissue defect (complete avulsion)

Type III B: Deep avulsion injuries exposing nasal and auricular cartilages

Type IV A: Deep injuries with severed facial nerve and/or parotid duct

Type IV B: Deep injuries with concomitant bony fracture

The traditional line of medical management of animal bite injuries over facial region includes keeping the wound open after thorough wound toileting and allow it heal by secondary intention in the form of granulation formation. The newest surgical management in western world is immediate closure of wound (primary closure) where vaccination status of pet animal is known.

In developing countries like India where vaccination status of animal is usually not known Considering the high contamination rate of dog bite injuries in, late presentation of patient from rural area and most of injuries were in a form of punctures or lacerated form we had gone for delayed primary closure with aim of prevention of wound sepsis and achieving better cosmetic appearance.

The objective of this study is to show that early surgical intervention in the form of delayed primary suturing of the wound along with wound toileting, infiltrating the wound with equine rabies immunoglobulin and post exposure prophylaxis with anti-rabies vaccine helps in achieving better cosmetic results besides primary prevention of sepsis [6-8].

## 2. MATERIALS AND METHODS

A prospective study of 70 patients was conducted by Department of Otorhinolaryngology at Govt. Medical College, Nanded, Maharashtra, (India) from a period of Jan 2009 to Dec 2013.

### 2.1 Study Site

Tertiary care Centre.

### 2.2 Inclusion and Exclusion Criteria

#### 2.2.1 Inclusion criteria

1. Patients having animal bite injuries on Head & Neck region.

2. Animal bite injuries were restricted to dogs, cats and swine.

#### 2.2.2 Exclusion criteria

##### 2.2.2.1 Patients having diabetes mellitus and compromised immune status

We have followed the standard norm for delayed primary closure in form of:

- Through wound toileting
- Injecting Equine Rabies Immunoglobulin at the wound site in all patients
- Daily dressing
- Anti-Rabies vaccination
- Delayed primary suturing after 10 days

Written valid informed consent was taken from all the patients who underwent the study. All the patients were given tetanus vaccine [9] and post exposure rabies prophylaxis as per WHO guidelines for post exposure prophylaxis [10] and which were followed in the hospital where the study was conducted. The post-exposure vaccination schedule consisted of injecting intramuscularly 0.5 ml into the deltoid muscle (or anterolateral thigh in children aged <2 years) of patients on each of days 0, 3, 7, 14 and 28

Also patients were injected with the Equine Rabies Immunoglobulin at the site of the wound as much as possible and rest in a large muscle like gluteus or deltoid.

The swab for microbiological culture was sent in all patients [11]. Wounds were thoroughly cleaned and toileting with antiseptics solution was done. All patients were admitted in isolation ward. All patients were put in category III of wound severity for post exposure rabies prophylaxis and facial wounds were classified according to Lackmann's classification on basis of wound depth. Suturing of all patients was done under general anesthesia under all aseptic precaution. The wound was thoroughly cleaned with H<sub>2</sub>O<sub>2</sub> and betadine. While doing delayed primary suturing, refreshing of wound margins was done. Suture material used for Head & Neck wound were 3-0 chromic catgut.

### 2.3 Delayed Primary Suturing Photographs

For mucosal injuries and 2-0 mersilk for skin suturing. For injuries involving commissure of mouth, patients were advised to take liquid foods only with straw to avoid excessive mouth opening. Post-operative dressing was given by

Hydrogel dressing. Dressing was changed every 12 hours in operation theatre under all aseptic precaution.

Secondary suturing was done in complicated cases of wound gaping or wound sepsis where the patient was referred to plastic surgeon for further management.

All patients, especially women and children underwent psychiatric counseling to boost their morale as there have been incidents reported of post-traumatic stress disorders and children especially for nocturnal enuresis [12].

### 2.4 Post-suturing Care and Follow Up

Patients were kept on IV antibiotics and analgesics during ward stay for 7 days [11]. Sutures were removed after 7 days and patients were discharged on oral broad spectrum antibiotics and analgesics. All patients completed anti rabies vaccine post exposure prophylaxis schedule and were ask to follow-up on 7<sup>th</sup>, 15<sup>th</sup> and 1 month postoperatively an then regularly thereafter. On each follow-up the wound was assessed and dressing was given.

The Post-suturing success was measured on the parameters of:

1. Prevention of sepsis
2. Cosmetic appearance

The post suturing infections were considered to be treatment failure on the basis of:

1. Wound gapping
2. Wound sepsis

These were later managed by secondary suturing under the broad spectrum antibiotic coverage.

### 2.5 Recording Cosmetic Appearance

VanCouver Scar Scale (VSS) was used to assess the cosmetic appearance of the patients at the end of 4<sup>th</sup> week of initial injury.

### 2.6 Statistical Analysis

Statistical analysis was performed using SPSS 20.0(USA). Mann Whitney U test and unpaired t test was used for comparing the success rate and cosmetic appearance in the two studies. The

significance level and Power of the study was set at 5% and 80 respectively.

## 3. RESULTS AND DISCUSSION

The overall infection rate was 15.71% in our study as compared to 8.3% in study conducted by Paschos et al. [13]. Statistically no significant difference (p=0.529) found between success rate by delayed primary closure and Paschos NK et al. study (healing by secondary intention) [13-16].

Cosmetic outcome on comparing our study of delayed primary closure with Paschos NK et al. study healing by secondary intention, delayed primary suturing exhibited significantly better result with the mean score of (1.50) for VSS compared to healing by secondary intention group with mean score of (3.05) for VSS was recorded (p= 0.000) (95% CI 0.1516-0.1494).

**Total patients: 70**

**Table 1. Animals wise distribution of cases**

Animal	No.
Dog bite	51 (73%)
Cat bite	3 (4%)
Swine bite	16 (23%)
Total	70

**Table 2. Age wise classification of injuries**

Age group	Male	Female	Total
2-12	14	10	24
12-22	12	7	19
22-32	9	3	12
32-42	3	1	4
42-52	-	-	-
52-62	-	-	-
62-72	7	4	11
Total	45	25	70

**Table 3. Animal wise sex distribution of injuries**

Sex	Dog bite	Cat bite	Swine bite	Total
Male	31	2	12	45
Female	20	1	4	25
Total	51	3	16	70

The cosmetic outcome in primary delayed suturing was found significantly better than healing by secondary intention as in healing by

secondary intention the wound experience inflammation, hyperplasia of granulation tissue formation and later on scar formation which would lead to increase in healing time and functional ability of muscle would not be recovered completely due to scar hyperplasia or contracture as seen with the study conducted by C J et al. [17-19].

**Table 4. Animal wise classification of injuries**

Age group	Dog bite	Cat bite	Swine bite	Total
2-12	23	1	-	24
12-22	15	2	2	19
22-32	4	-	8	12
32-42	1	-	3	4
42-52	-	-	-	-
52-62	-	-	-	-
62-72	8	-	3	11
Total	51	3	16	70

**Table 5. Lackmann's classification**

Category	Dog bite	Cat bite	Swine bite	Total
I	18	2	2	22
II A	10	1	1	12
II B	15	-	3	18
III A	6	-	8	14
III B	2	-	2	4
IV A	-	-	-	-
IV B	-	-	-	-
Total	51	3	16	70

**Table 6. Infection rate**

Methods	Infection rates
Paschos Nk et al. (healing by secondary intention)	8.3%
Delayed primary closure	15.71%

**Table 7. Success rate**

Study	Success rate	P
Paschos Nk et al (healing by secondary intention)	91.7%	0.529*
Delayed primary closure	84.29%	

\*Not significant, (p>0.05)

In all 70 patients, delayed primary closure was done (Figs. 1, 2, 3, 4, 5 dog bite patient) and (Figs. 6, 7, 8, 9 swine bite patient). Among these 70 patients, 45 were male and 25 were female

patients. Age group of the patients was between 2 yrs. and 72 yrs. Among the animal bites, 51 bites were dog bites, 3 were cat bites and 16 were of swine bites.

**Table 8. Cosmetic appearance**

Study	VanCouver scar scale mean score	P
Paschos NK et al. (healing by secondary intention)	3.05	0.000*
Delayed primary closure	1.50	

\*Highly significant (p<0.01, CI upper limit- 0.1516, Lower limit – 0.1494)

Our study showed a male preponderance in all age groups for animal bites which correlates with the study conducted by Allan Abuabara [20].

Animal bites also showed relation with age group with dog bite injuries being more common in children which correlate with the study done by Shaikh ZS, Worrall S F and Ndon JA et al. [21-23] and swine injuries were seen almost entirely in adults with adults also having dog bites.

Our study showed that most common animal bite injury was dog bite which correlates with study of Perkins Garth A et al. and Callaham M [22].

In our study taking consideration of Lackmann's classification [8], swine bite injuries showed more depth of injuries compared to other animal bites (Table 6).

On basis of microbiological culture report, *Staphylococcus aureus* was found to be the most common microorganism which was sensitive to beta lactam antibiotics and cephalosporins this correlates well with a study conducted by Allan Abuabra et al. [20] which also suggested *Staphylococcus aureus* as most common organism found in contaminated animal bite injury.

All the patients of our study group received the psychiatric counseling to boost their morale, especially the women and children to prevent post-traumatic stress disorder.

In our study, 11(15.71%) patients showed complication in the form of wound gaping and

wound sepsis. Wound gaping was more commonly seen in injuries where sutures were taken at the angle of mouth, this correlate with the study done by Stephanopoulos PK tarantzopoulou AD [24] where he mentioned sutures taken over the angle of mouth were more prone for wound gaping in head neck areas.

Our study focuses the new emerging trend of taking delayed primary suture of facial wounds in animal bites in order to prevent wound sepsis and achieving better cosmetic results where traditionally keeping the wound open to heal on its own was a main line of treatment in rural parts of developing countries like India.



**Fig. 1. Preoperative photograph day 1 (Dog bite patient)**



**Fig. 2. Postoperative photograph day 11**



**Fig. 3. Postoperative photograph day 16**



**Fig. 4. Postoperative photograph day 17**



**Fig. 5. Postoperative photograph day 24**



**Fig. 6. Preoperative photograph day 1 (Swine bite patient)**



**Fig. 7. Postoperative photograph day 11**



**Fig. 8. Postoperative photograph day 17**



**Fig. 9. Postoperative photograph day 24**

#### **4. CONCLUSION**

1. Our study showed that, most common animal bite injury was dog bite.
2. Most common victims of animal bite were children.
3. Our study showed male preponderance in all age groups.
4. Swine bite injuries were more common in farmers and in rural areas compared to sub-urban areas.
5. In our study swine bite injury showed more depth of injury.
6. The cosmetic outcome was found significantly better in delayed primary closure compared with healing by secondary intention.

So delayed primary suturing can be considered as a good alternative to the traditional way of allowing the wounds to heal by secondary intention.

#### **ETHICAL APPROVAL**

It is not applicable.

#### **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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