Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i6.6538

# COMPARATIVE STUDY OF SKIN STAPLE, SUTURING TECHNIQUE AND SURGICAL GLUE FOR THE TREATMENT OF AURICULAR HEMATOMA IN CAPRINE

**Shahzad Ahmad[1*], Sadaf Aslam[2], Zia Ullah[3], Naveed Hussain[4], Murtaza Ali[5], Mian Syed Riaz[6], Muhammad Awais[7], Syed Muhammad Faheem Ahmad[8]**

[1*, 2, 4, 5]Department of Veterinary Surgery, University of Veterinary and Animal Sciences Lahore, 54000, Pakistan.
[3, 7, 8]Department of Small Animal Clinical Sciences, University of Veterinary & Animal Sciences, Lahore, Pakistan
[6]Department of Veterinary Medicine, Sindh Agriculture University, Tandojam, Pakistan

***Corresponding Author:** Shahzad Ahmad
*Department of Veterinary Surgery, University of Veterinary and Animal Sciences Lahore, 54000, Pakistan. Email: vet.shahzad26@gmail.com

**Abstract:**
Auricular hematomas in goats, often caused by head shaking or ear scratching, lead to blood accumulation between the skin and cartilage of the ear, resulting in swelling and discomfort. If untreated, this condition can block the ear canal and affect ear positioning. This study evaluates the most effective method for closing skin incisions in goats following surgical treatment of auricular hematoma by comparing silk sutures, skin staples, and surgical glue. The research involved 15 goats, divided into three groups of five, each treated with either silk sutures, skin staples, or surgical glue. Effectiveness was assessed based on application time, healing time, and cosmetic appearance. Analysis of Variance (ANOVA) was used for application and healing times, and Chi-Square tests were employed for cosmetic outcomes. Results indicated that surgical glue was superior, providing faster application, better cosmetic results, and shorter healing times.

**Keywords:** Suturing Technique, Skin Staple, Surgical Glue, Auricular Hematoma, Caprine, Veterinary Surgery

## 1. INTRODUCTION

The rising demand for milk and meat, both domestically and internationally, has led to significant improvements in the care and attention given to farm animals like sheep and goats. Consequently, farmers now seek advanced treatment options for various health issues that affect their animals' well-being and market value. One such concern is auricular hematoma in goats, which involves the accumulation of blood between the skin and cartilage of the ear, leading to painful, swollen areas. This condition often results from ear rubbing, head shaking, or underlying issues such as foreign bodies, otitis, ectoparasites, allergic dermatitis, and hypersensitivity, which cause blood vessels in the ear to rupture (Ahiwar et al. 2007).

Various techniques are employed to treat auricular hematomas, including skin staples, suturing methods, and surgical glue. Traditional surgical approaches involve a longitudinal incision,

drainage, and suturing (Lanz and Wood 2004; Mohsin 2010). Innovations in suture materials and closure methods, such as antibiotic-coated sutures and skin adhesives, have further enhanced treatment options (Hochberg et al. 2009). Alternatives like Penrose drain implantation also exist, offering a short anesthesia period and requiring daily cleaning (Romatowski 1994; Wilson 1983).
Skin staples, introduced in 1984, offer benefits such as reduced application time, enhanced blood flow to the incision site, lower reinfection rates, cost-effectiveness, and ease of use (Orlinsky et al. 1995; Graham et al. 2000; Selvadurai et al. 1977; Khan et al. 2002; Murphy et al. 2004). Tissue adhesives, particularly cyanoacrylate discovered in 1949, provide advantages like ease of application, rapid closure, excellent cosmetic results, no needle-stick injuries, decreased infection risk, and high tensile strength (Chen et al. 2010; Shivamurthy et al. 2010; Singer et al. 2002). These adhesives are especially useful for low tension lacerations and minor skin incisions, offering cost benefits and requiring no instruments or assistance for application (Man et al. 2009).
This study aims to compare different techniques for treating auricular hematoma in goats and identify the method that minimizes scar formation for cosmetic purposes.

## 2. MATERIALS AND METHODS

Fifteen adult goats with auricular hematoma were selected from the University of Veterinary & Animal Sciences (UVAS) Surgery Clinic at both the Main Campus and Ravi Campus. These goats, from both farm and house-kept origins, were divided into three groups (A, B, and C) of 5 goats each. Group A was treated with horizontal mattress sutures using TRUSILK, Group B with skin staples, and Group C with skin adhesive. Some goats were kept at the clinic as clinical trial patients, while others were returned to their owners with instructions for follow-up visits. Goats were identified by ear tags or owners' names if tagging was not permitted. Owners were advised to feed their goats normal fodder with specific concentrates as needed, provide clean water ad libitum, and maintain a clean environment to prevent myiasis. The study compared the effectiveness of these three treatment methods for auricular hematoma in goats at UVAS.

### 2.1: Surgical Procedure

The surgical instruments were sterilized in autoclaves for aseptic purpose.

### 2.1.2: Group A

In Group A, auricular hematoma was treated using the incisional method. After administering atropine sulfate and general anesthesia, a longitudinal cut was made on the inner surface of the ear pinna, preserving the cartilage. Blood and fibrin clots were drained from the hematoma cavity using mosquito forceps or moistened gauze. The cavity was flushed with a sterile saline solution. Simple Interrupted sutures with absorbable TRUSILK-1 were applied, extending 0.75-1 cm through the skin and connecting the underlying cartilage to the skin as seen in figure 2.1.

### 2.1.3: Group B

Group B goats underwent incisional treatment for auricular hematoma. After administering atropine sulphate and inducing general anesthesia, a longitudinal incision was made on the internal floor of the ear pinna, preserving the cartilage. Blood drainage and removal of fibrin clots were performed using mosquito forceps or moistened gauze sponge. The cavity was flushed with sterile saline solution. Finally, skin staples (+ADVAN) were applied to close the incision site as seen in figure 2.2.

### 2.1.4: Group C

In Group C, auricular hematoma treatment involved an incisional method. After administering atropine sulfate and inducing general anesthesia, a longitudinal incision was made along the internal floor of the ear pinna, preserving cartilage. Blood drainage and removal of fibrin clots from the hematoma cavity were performed using mosquito forceps or moistened gauze sponge. The cavity

was flushed with sterile saline solution. Surgical glue was applied to the hematoma cavity using the nozzle of a skin adhesive bottle as seen in figure 2.3.

**Figure 2.1 (Simple Interrupted sutures n goats) applied on pinna of ear),**

**Figure 2.2 Skin Staples applied overm, the incision on pinna of ear**

**Figure 2.3 (Application of Surgical Skin glue)**

### 2.2: Treatment and Post-Operative Care:

Proper medication was given to goats after surgeries. Antibiotics NSAIDs were administered. Antiseptic dressing was performed to prevent the contamination of wound causing by an incision in

the case of goats of groups A and B while no dressing was done in case of Group C as tissue adhesive has bactericidal properties and offers a water-proof end (Shivamurthy *et al.* 2010)

### 2.3: Evaluation Parameters

For the evaluation, the following parameters were kept in mind to find out the best technique for the treatment of auricular hematoma in goats.

### 2.4: Closure Time

Time thus was taken in the application of skin staples, traditional suturing, and surgical glue was noted in minute form. Time was taken into account from the start of application to the point of complete closure. This was performed to see or find out the technique which requires the least time for its application.

### 2.5: Cosmetic Appearances

The restorative look become surveyed on a noticeable basic scale stretch out from 1 to five where 1 addressed the vulnerable conclusive outcomes and 5 showed the excellent outcome.

- Poor = 1
- Fair = 2
- Good = 3
- Very Good = 4
- Excellent = 5

### 2.6: Healing Time

Goats were examined on the $7^{th}$, $10^{th}$, $15^{th}$, and $20^{th}$ days of postoperative assessment for repairing outcome was considering the time when both edges of the incision were opposed completely.

### 2.7: Statistical Analysis

Statistical analysis was carried out by using the Statistical package for social sciences (SPSS) program (Window version 17, SPSS INC., Chicago *II*, USA). The data thus obtained was analyzed by using Analysis of Variance (One Way ANOVA) for the time of application, chi-square method for the cosmetic appearance, while repeated measure design ANOVA for the time of healing.

### 2.8: Parameters for Evaluation

The following parameters were kept in mind to evaluate the best technique for closure of skin incision, in case of auricular hematoma in goats.

#### 2.8.1: Application Time

Time taken in application of Skin staples, conventional suturing and skin adhesive to complete close the incision line.

#### 2.8.2: Cosmetic Appearance Evaluation Basis

**a)** Scar formation
**b)** Wound dehiscence
**c)** Wound oozing
**d)** Apposition

#### 2.8.3: Cosmetic Grading

Grading was done the 1-5 factor visual basic scale, where one donates the poor result while 5 represent the best possible outcome

**a) Poor** = 1
**b) Fair** = 2

**c) Good** = 3
**d) Very Good** = 4
**e) Excellent** = 5

### 2.8.4: Healing Time

Healing was considered as complete apposition

### 2.8.5: Evaluation

Wound was inspected on following postoperative

a) $7^{th}$
b) $10^{th}$
c) $15^{th}$
d) $17^{th}$
e) $20^{th}$

Time was noted in the form of seconds by using stopwatch for the application of skin staples, suture material and surgical skin glue. The time was noted from start of incision line to its entire closure. After applying the statistical analysis, it was analyzed that a significant difference ($p< 0.05$) was noted in case of application time. Group A, having a mean of 147.1 ± 19.9872, Group Behaving a mean of 62.200± 2.2672 while in Group C, it was changed into 48.9886 ±5.03671 (Table 2.1.). Study of this parameter showed that $3^{rd}$ technique of surgical glue was having fast test of recovery and closure time over the ear pinna while the other two techniques are not favorable in this regard.

**Table 2.1: Closure Time after surgery of auricular hematoma by different suturing strategies, noted among all the groups**

| Group Name | No. of Samples. | Mean. | Standard deviation |
|---|---|---|---|
| Group. A. | 5 | 147.100 | 19.9872 |
| Group. B. | 5 | 62.200 | 2.2672 |
| Group. C. | 5 | 48.9688 | 5.0367 |

**Data is presented as mean value and standard deviation (Sample: 15)**

**Group A.** Skin suture **Group B.** Skin Staples. **Group C.** Surgical Glue

The Cosmetic appearance was assessed on the basis of 1 to 5-point visual analogue basic scale, while 1 addressed poor, 2 as fair, three showing good, 4-indicating very good and five presenting excellent results. The statistical examination showed that all these three methods were not dependent on each other ($p< 0.05$). The group C where we applied surgical glue as adhesive material indicated the best cosmetic appearance in comparison to the other groups named A and B. only the group C could show excellent results (33.33%), while the cosmetic appearance coming in the category of very good was seen in a group A (33.3%), in case of Group B (50%) and group C (66.77%) was observed. Cosmetic appearance category was highest in the group A (66. 77%) in comparison to the group B (33. 33%) and group C (16.77%) (Table 2.2).

**Table 2.2: Visual point scale percentages seen among all groups**

| Visual point Scale | Group A | | GroupB | | Group C | |
|---|---|---|---|---|---|---|
| | Frequency | %age | Frequency | %age | Frequency | %age |
| **1** | | | | | | |
| **2** | | | | | | |
| **3** | 4 | 66.77 | 2 | 33.33 | 1 | 16.77 |
| **4** | 2 | 33.33 | 4 | 66.77 | 3 | 50.00 |
| **5** | | | | | 2 | 33.33 |

**Data is presented as % of visual points.**

**The Scale of Visual points: Poor**= 1 **Fair**= 2 **Good**= 3 **Very Good**= 4 **Excellent**= 5

The goats were assessed after clinical surgeries at the seventh, tenth, fifteenth, and twentieth days for assessment of the healing time. The assessment was carried on the basis of the mean value of the healing days. Finally, the statistical analysis showed a significant difference ($p > 0.05$) concerning to the healing time. The mean values were as 13.7 ± 1.0257, 11.03±0.6727, and 8.63±0. 8537 for Group A, Group B, and Group C respectively. This evaluation of this factor showed very clearly that Group C had the excellent healing time in comparison to the other groups A and B (Table 2.3.).

**Table. 2.3: The healing time after surgery of auricular hematoma by different suturing strategies**

| Group Name | No. of samples | Mean value | Standard deviation± |
|---|---|---|---|
| **Group A** | 5 | 13.7 | 1.0257 |
| **Group B** | 5 | 11.03 | 0.6727 |
| **Group C** | 5 | 8.63 | 0.8537 |

**Data is presented as mean value and standard deviation (Sample: 15)**

**Group A.** Skin suture **Group B.** Skin Staples. **Group C.** Surgical Glue

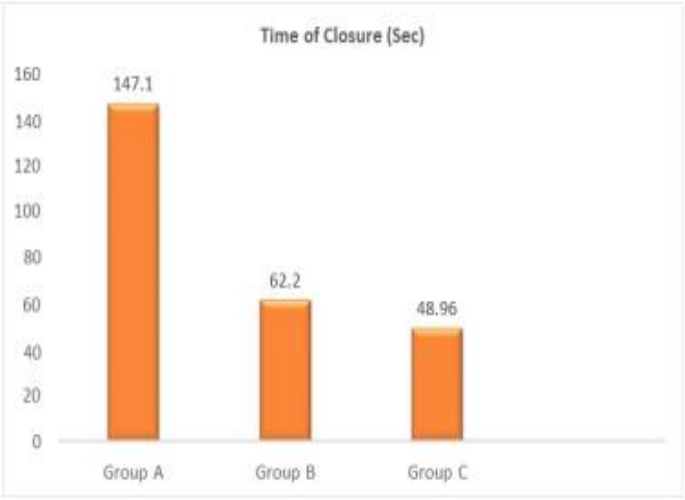


**Figure. 2.3.1: Closure time (Sec) in all groups. (Sample:15)**

**Group A.** Skin suture **Group B.** Skin Staples. **Group C.** Surgical Glue


**Figure 2.3.2: Healing time (Days) in all groups. (Sample:15)**

**Group A.** Skin suture **Group B.** Skin Staples. **Group C.** Surgical Glue

## 3. RESULTS

The regular evaluations were conducted to compare application time, healing time, complication rates, infection recurrence, scar formation, and cosmetic appearance. The health status of the goats

was closely monitored, and necessary treatments were provided. Results indicated that surgical glue was superior, providing faster application, better cosmetic results, and shorter healing times.

## 4. DISCUSSION

Auricular hematoma, although more common in canines, particularly in pendulous-eared breeds, is a rare occurrence in ruminants (Tyagi and Singh, 2010). Typically, it manifests on the concave surface of the ear due to various factors such as fighting, injury, scratching, or head shaking (Henderson and Houses, 2002). Over the years, several techniques have been employed to treat auricular hematoma, including disposable teat-tube drainage (Wilson, 1984), Penrose tube usage (Joyce, 1994), glucocorticoid instillation and drainage (Kuwahara, 1986), and closed suction drainage (Swaim et al., 1996). This study aimed to compare the efficacy of conventional suturing, surgical glue, and skin staples for skin incision closure in goats with auricular hematoma. The evaluation criteria included application time, healing time, and cosmetic appearance. Application time was measured in seconds, healing time in days, and cosmetic outcome assessed using a visual analogue scale ranging from 1 to 5. Fifteen adult goats with auricular hematoma were divided into three groups (A, B, and C) with five goats each. Group A underwent horizontal mattress suturing using TRUESILK, Group B received skin staples, and Group C was treated with skin adhesive. The study was conducted at the surgery clinic of UVAS, Lahore, and Ravi campuses. Surgical glue demonstrated the shortest skin incision closure time (mean value 62.200 ± 2.2672 seconds) compared to suturing and staples (147.1 ± 19.9872 and 48.9886 ± 5.03671 seconds, respectively). These findings are consistent with previous studies (Safwan et al., 2018; Nagpal et al., 2004). Additionally, surgical glue yielded excellent cosmetic outcomes and resulted in lower pain levels during recovery. Fibrin glue also showed effectiveness in managing auricular hematoma (Weerda, 1986). Although skin staples were less effective than surgical glue, they performed better than suturing, with faster closure times but similar cosmetic outcomes. However, concerns regarding the possibility of permanent cartilage damage with staples remain (Shally et al., 2011). Analysis of healing time revealed that surgical glue led to the shortest healing period (8.63 ± 0.8537 days) compared to suturing (13.7 ± 1.0257 days) and skin staples (11.03 ± 0.6727 days). These results are in line with another study (Lilius, 2009). In contrast to some findings, our study observed a significant difference ($p < 0.05$) in cosmetic appearance improvement with surgical glue, despite similar wound healing outcomes. However, the study found no significant relationship between the techniques and cosmetic appearance ($p > 0.05$) (Safwan et al., 2018).

## 5. CONCLUSION

The comparative study concludes that surgical skin glue is the most effective and suitable technique for treating auricular hematoma in caprines compared to silk sutures and skin staples. Healing time is notably better with surgical skin glue due to its waterproof closure and bactericidal properties, resulting in superior cosmetic outcomes with minimal scarring. However, the technique's high cost and limited availability in Pakistan pose challenges. Despite these limitations, the improved results justify the expense, particularly in cases where other options are impractical, such as in severely burned patients.

## References

1. Ahiwar V, Chandrapuria VP, Bhargava MK, Swami M, Shahi A, Jawre S.2007. A comparative study on the surgical management of canine aural haematoma. Indian J Vet Surg. 28:98–100.
2. Bowen ML, Selinger M. 2002. Episiotomy closure comparing enbucrilate tissue adhesive with Brow C. 2010. Surgical management of canine aural hematoma. Lab Anim. p. 14-105.
3. Lanz OI, Wood BC. 2004. Surgery of the ear and pinna. Vet Clinic North Am Small Anim Pract. p.567–599.
4. Mohsin AJF.2010. Surgical treatment of ear haematoma in dogs. Bas J Vet Res. 9:65–70.
5. Hochberg J, Mayer KM, Marion MD.2009.Suture choice and other methods of proficiency.

Acad Emerg Med.5:1012-17.
6. Romatowski J.1994. Nonsurgical treatment of aural hematomas. J Am Vet Med Assoc. p.1318.
7. Wilson JW. 1983. Treatment of auricular hematoma, using a teat tube. J Am Vet Med Assoc. p. a.1081–1083.
8. Ong J, Ho KS, Chew MH, Eu KW.2010. Prospective randomized study to evaluate the use of Orlinsky M, Goldberg RM, Chan L, Puertos A, Slajer HL. 1995. Cost analysis of stapling versus suturing for skin closure. Am J Emerg Med. 13(1):77-81.
9. Graham DA, Jeffery JA, Bain D, Davis P, Bentley G. 2000. Staples versus subcutaneous TRUESILK Henderson RA,Horne R. 2002. Pinna. In Textbook of small animal surgery 3rd edition. Eds., Slatter Douglas: Saunders W.B. Publishers. p. 1737-1740
10. Selvadurai D, Wildin C, Treharne G, Choksy SA, Heywood MM, Nicholson ML. 1977. Randomized trial of subcuticular suture versus metal clips for wound closure after Thyroid and parathyroid surgery. Ann R Coll Surg Engl. 79(4): 303-306.
11. Khan AN, Dayan PS, Miller S, Rosen M, Rubin DH. 2002. Cosmetic outcome of scalp wound closure with staples in pediatric emergency department: a postoperative randomized trial
12. Blondeel P, Murphy JW, Debrosse D, Nix JC 3rd, Puls LE, Theodore N, Coulthard P. 2004.Closure of long surgical incisions with a new formulation of 2-octylcyanoacrylateTissue adhesive versus commercially available methods. Am J Surg. 188(3):307-313
13. Chen K, Klapper AS, Voige H, Priore GD. 2010. A randomized, controlled study comparing two Chugtai T, Chen LQ, Salasidis G, Nguyen D, Tchervenkov C, Morin JF. 2002. Clips versusSutures technique: is there difference? Can J Cardiol. 16:1403-7.Co. p. 419-420.
14. Shivamurthy DM, Singh S, Reddy S. 2010. Comparison of octyl-2-cyanoacrylate and conventional sutures in facial skin closure. Natl J Maxillofacial Surg. 1(1): 15-19.
15. Singer AJ, Quinn JV, Hollander JE, Clark RE. 2002. Closure of laceration and incisions with octylcyanoacrylate: a multicenter randomizes control trial. Surgery.131:270-276.
16. Man SY, Wong EM, Ng YC, Lau PF, Chan MS, Lopez V, Mak PS, Graham CA, Rainer TH.2009.Cost consequences analysis comparing 2 Octyl-cyanoacrylate tissue adhesive and suture for closure of simple laceration: a randomized controlled trial. Am Emerg Med.53:189-197.
17. Tyagi RPS, Singh J.2010. Ruminant surgery, CBS Publishers & Distributors, New Delhi. p. 409.
18. Dubielzig RR, Wilson JW, Seireg A.1984. Pathogenesis of canine aural hematomas. J Am Vet Med Assoc. p.873–875.
19. Joyce JA. 1994. Treatment of canine aural haematoma using an indwelling drain and corticosteroids. Journal of Small Animal Practice.p. 341-344.
20. Kuwahara J.1986.Canine and feline aural hematoma: clinical, experimental, and clinic pathologic observations. Am J Vet Res. p. 2300–2308.
21. Swaim SF, Bradley DM. 1996. Evaluation of closed-suction drainage for treating auricular hematomas. J. Am Anim Hosp Assoc. p.36–43.
22. H.Safwan A.Chudhary, 2018, International Journal of Animal Husbandry and Veterinary Science Volume 3, Issue 3, ISSN (Online): 2455-8567 p.2–5.
23. Nagpal BBM, VSM, Kumar MG, Nagi MG, Singh WCP. 2004. Suture less closure of operative skin wounds. MJAFI.60:131-133.
24. Weerda H. 1986. The use of fibrin glue in auricular surgery. In *Fibrin Sealant in Operative Medicine* (pp. 133-139). Springer, Berlin, Heidelberg.
25. Shally M, Mohindroo J, Sangwan V. 2011. Modified use of surgical skin staples for treatment of ear hematoma in dogs. Onlin J Vet Res. 14(1): 28-38.
26. Lilius P. 2009. Fibrin adhesive: its use in selected skin grafting. Scand J Plast Reconstruct Surg. 21(3): 245-248.