

Surgical Management of Traumatic Teat Fistulas with Polyester Sutures in Crossbred Cows

Preamsairam, C*¹., Aruljothi, N²., Balagopalan, T.P²., Alphonse, R.M.D³. and Abiramy @ Prabavathy, A⁴.

¹M.V.Sc Student, ²Professor, ³Associate Professor, Department of Veterinary Surgery and Radiology,

⁴Associate Professor, Department of Veterinary Medicine,
Rajiv Gandhi Institute of Veterinary Education and Research, Pondicherry, India, 605009

Abstract: A total of 6 cows presented to Department of Veterinary Surgery and Radiology, Teaching Veterinary clinical complex, Rajiv Gandhi Institute of Veterinary Education and Research, Pondicherry with traumatic teat fistulas were selected for the present study. Upon preoperative evaluation, the mucosal and muscular layers were sutured separately by simple continuous suture pattern using polyglactin 910. The skin edges were apposed by using braided and polybutylate coated polyester sutures. Postoperative evaluation of the reconstructed teat was carried out by the morphological evaluation and ultrasonographical evaluation.

Keywords: Cows, Traumatic teat fistula, polyglactin 910, braided and polybutylate coated polyester sutures.

Date of Submission: 16-03-2020

Date of Acceptance: 01-04-2020

I. Introduction

Udder and teat health care is increasingly important for dairy farmers since disease condition involving them ultimately affects the productivity causing heavy economic loss¹. The bovine teat is composed of five layers viz. mucosa, sub-mucosa, highly vascularized connective tissue, muscularis and the skin¹⁶. The occurrence of teat injuries in milking cattle can be categorized as stenosis (31.5%), laceration without perforation (22.2%), skin wound (21%), rupture or splitting (20%) and perforating injury (4.9%)⁷. Teat lacerations are rarely clean, straight and incised wound, many are flap wounds with irregular shapes and depth of penetration²⁵. The teat injuries are classified into two categories viz., external or “uncovered” lesions and internal or “covered” lesions²⁸. They can also be classified as superficial and deep based on the different layers involved³⁰. External injuries include all types of lacerations involving different layers of teat wall and the internal injuries include that of the teat cistern and papillary duct³². Most of the teat injuries occurs when cattle housed (78%) than when they were kept in pasture (21%) of the cases²⁴. They were often self-inflicted when the cow stands and can occur in tie stall or free stall barns²⁹. The teat wounds are common during parturition as a result of increase in the udder size and clumsy movement of the cow and there is a higher incidence in animals aged five or six years, i.e. during the early lactation²⁵. The authors also reported that most of the teat injuries occur within one month of calving, when cows are in high production. Use of appropriate suture material on bovine teat with the appropriate suture pattern will yield better results¹¹.

The sutures made of polyester were strongest non-absorbable synthetic suture material currently available. They are superior to nylon, polypropylene and polyester and are second only to stainless steel sutures⁶. They are non-absorbable synthetic braided multifilament composed of polyethylene terephthalate having properties, such as minimal tissue reactivity, high tensile strength, good handling and everlasting. They were available as plain and coated with polybutylate, teflon or silicone¹⁹.

II. Materials and Methods

Six cows presented to the large animal surgery ward of Teaching Veterinary Clinical Campus, Rajiv Gandhi Institute of Veterinary Education and Research (RIVER) and were diagnosed to have deep lacerated wounds with exposed teat cistern (Fig. 1) were selected for the present study. The animal particulars viz; breed, age, body weight, feeding pattern- grazing/ stall feeding, stage of lactation, calving history were documented. A complete history was obtained from the farmer regarding the time of occurrence of wound and its duration and its etiology. Clinical examination of the affected teat was performed and the parameters included were udder morphology, teat which was affected, shape of the affected teat, and length of the teat (Table 1). Milkability of the affected teat was assessed on the day of presentation and after the suture removal using the following parameters viz; milk yield per quarter (kg), nature of milk flow and milk flow rate of the affected quarter (kg/min) by hand milking. The milk quality was assessed by its colour, consistency, pH, California mastitis test and somatic

cell count (1×10^5 cells/ml) on the day of presentation and suture removal. Following preoperative evaluation, food and water was withheld for 12-18 hours prior to surgery in all the animals and they were sedated with Inj. Xylazine at the dose rate of 0.1mg/kg intravenously and ring block technique was employed with 0.5% Bupivacaine hydrochloride.

The wound was irrigated with 0.5% Povidone Iodine solution and the margins were thoroughly debrided using No.11 scalpel blade. The suturing of first layer of teat included inner mucosal layer in simple continuous pattern, muscular and connective tissue in simple continuous pattern were done with polyglactin 910 No. 3/0 in all the animals. Braided polybutylate coated polyester sutures of size 2/0 (Ethibond Excel – Ethicon, Johnson and Johnson private limited, India) was applied in simple interrupted pattern for apposing the skin wound edges (Fig. 2).

A sterile modified polyvinyl tube (Infant feeding tube No. 10, Romsons Scientific and Surgicals India) was placed in the teat to maintain the patency and fixed with stay sutures. A sterile disposable 2ml syringe was connected to the modified polyvinyl tube and closed. Postoperatively Inj. Meloxicam @ 0.5mg/kg and Inj. Streptomycin – Procaine penicillin (Dicrysticin- S- ZyduS AHL) @ 10mg / kg body weight were administered intramuscularly for 7 days. The surgically corrected teat was evaluated on 7th and 10th day post-operative by taking the parameters viz; intactness of sutures, no. of sutures present, nature of suture line (dry/ moist), nature of the suture site (soiled/ contaminated), presence of discharge, wound dehiscence if any.

III. Results and Discussion

Out of six animals five animals were cross bred Jersey and one was Holstein Friesian cross with an age group of 3 to 7 years, similar findings were also reported^{13,14,20,30}. Among all the animals four cows were on grazing and two were fed install. Stall fed animals were kept in closed enclosure and more hence more prone for teat injuries due to stamping. Similar findings were also reported^{22,24,27,29,30}.

The calving history ranged from 6 to 25 days as they were all in their first stage of lactation. The present findings were in agreement with other studies⁹ as most teat injuries occurred within one month of calving, when cows were in high production. The teat wounds were common around parturition as a result of udder size and movements of the cow²⁵.

The duration of wound was in between 2-20 days and the etiological factors of the wound were due to thorn in three animals, treading in two and barbed wire in one case. Due to overcrowding in tie stall or free stall barns of recently calved animals with enlarged udder puts the teats at risk of self-inflicted injury or by the other animals^{26,29}. The poor udder conformation, with low hanging teats predisposes the teat to being kicked by the cow causing injuries³².

Udder morphology of the animal studied on the day of presentation which revealed three animals had bowl, pendulous in two and globular shaped udder in one. These findings were deferred³³ as the teat laceration was mostly observed in those animals that have long teats and pendulous udder.

The affected teats were right hind teat in three animals and one had in right fore teat, left hind teat and left fore teat. However, the hind teats are more frequently affected than the fore teats and vice versa²⁵. The incidence of injury to the right and left side is approximately equal⁹. The shape of the affected teats were cylindrical shaped in five cows and funnel shaped teat in one cow. The length of the affected teats ranged between 6-9cm, which indicates longer teats were prone for injuries¹⁵.

Milkability detection on the day of presentation was found to be difficult as the milk was dribbling from the affected teat and was difficult to assess. Whereas on the 10th postoperative day the milk yield per quarter (kg), nature of milk flow and milk flow rate of the affected quarter (kg/min) by hand milking observed as the Mean \pm S.E. was 0.07 ± 0.01 . In all the cases deep laceration from skin to mucosa communicating the cistern, caused dribbling of milk from the injured site. So, it was difficult to assess the milkability on the day of presentation. Similar statement was reported by^{26,27}.

The milk was apparently normal without any change in colour, consistency and pH on the day of presentation and 10th postoperative day (Table 2). California mastitis test was negative and somatic cell count (1×10^5 cells/ml) on the day of presentation was 278015 ± 12631.91 (Mean \pm S.E.) and on the 10th postoperative day it was of 363568.5 ± 19654.31 , which were found to be within normal range, since all the animals were treated with antibiotics and the wound was protected with Dynafix without any contamination. Similar findings were recorded by^{3,18,34}.

Administration of Inj. Xylazine to induce sedation and ring block with 0.5% Bupivacaine were found to be effective to carry out the surgical procedure as suggested by^{17,21,28}.

Irrigating with 0.5% Povidone iodine solution and thorough debriding the wound margins were found to be very effective to freshen the surgical site^{3,26,27}. The mucosal and the muscular layers were sutured in simple continuous pattern separately with polyglactin 910 No. 3/0. Three layer suture pattern was adopted in the present study and was found to be very effective in complete closure of the teat cistern^{3,5,13,28}.

Braided and polybutylate coated polyester sutures were used to close the skin and the number of sutures applied ranged from 5 to 12 numbers which depended on the length, direction and size of the wound as they are synthetic braided sutures that lasts indefinitely in tissues. They are primarily used in humans for tendon lacerations in which the sutures remain within the tissues for longer periods³¹. The suture pattern employed was simple interrupted pattern²⁹. Morphological evaluation was done on 7th postoperative day (Table 3) and the all sutures were intact in (33%) of animals whereas not intact in four animals (67%) (Fig. 3). The average number of sutures present were only 5.3 and this could be due to its multifilament nature, poor knot security, causing more tissue reaction and increasing the inflammatory response. The application of polyester sutures might have caused persistent local infection and exaggerated tissue reaction⁸. The nature of suture line was dry only in 33% of the animals whereas moist in 67% which could be due to the inflammatory response at the suture line and multifilament nature of the suture material favouring infection. Similar findings were reported^{8,12}. The multifilament nature favoured the retrograde infection causing postoperative wound infection²³. The moist nature of the suture line could be due to the presence of discharge at the suture site in 67% animals which resulted in contaminated suture site. Discharge was noticed at the suture site in four animals (67%) and which was absent in only 33%, which indicated the persistence of local infection at the suture site and exaggerated tissue reaction to the polyester suture favoured the postoperative wound infection and resulted in discharge from the suture site^{6,8}. The braided nature of the polyester sutures potentiated suture site contamination and further leading to infection². There was no evidence of wound dehiscence in 33% of cases but 67% of the animals had dehiscence due to the contaminated suture site which resulted in increased inflammatory response due to the shredding of the outer coated layer⁸.

The skin sutures were removed on the 10th postoperative day in all the animals²⁹ in which wound dehiscence, fistula formation and gaping of edges were observed. The moist nature of suture line, contaminated suture site with discharge, postoperative surgical complications like tissue flap necrosis, wound dehiscence and fistula formation with the gaping of wounds exposing the inner lying structures might have caused wound dehiscence and complete wound healing was not achieved in four animals^{4,26}. Polyester sutures were not intact in 67% of animals, caused more tissue reaction and increased inflammatory response, contamination of the suture site, persistent local infection and exaggerated tissue reaction as explained^{8,10}, whereas 33% of the cases showed uncomplicated wound healing without any dehiscence (Fig. 4).

The in-situ fixing of sterile prosthetic tube made up of modified polyvinyl chloride number 10 was very useful to retain the teat patency and to remove the milk from the affected quarter. Application of adhesive bandage (Dynafix) was found to be effective for protecting the surgical site. Attachment of 2ml syringe to the tube was useful to complete the circuit.

IV. Conclusion

The quality of milk and milkability reflected the effectiveness of the technique in regaining the functional capacity of the teat postoperatively. The surgical technique employed for the management of teat wounds with fistula was found to be less effective due to the encountered complications which could be due to the management practices, postoperative care and the suture material.

Acknowledgements

The authors are thankful to the Dean, Rajiv Gandhi Institute of Veterinary Education and Research, Pondicherry for the facilities provided to conduct the study.

References

- [1]. Abd-El-Hady. 2015. Clinical observations on some surgical udder and teat affections in cattle and buffaloes. *Sch. J. Agric. Vet. Sci.*,2(4A): 270-281.
- [2]. Al-Mubarak, L. and Al-Haddab, M. 2013. Cutaneous Wound Closure Materials: An Overview and Update. *J. Cutan. Aesthet. Surg.*,6(4): 178-188.
- [3]. Aruljothi, N., Balagopalan, T.P., Rameshkumar, B. and Alphonse, R.M.D. 2012. Teat fistula and its surgical management in bovines. *Intas Polivet*, 13 (1):40-41.
- [4]. Azizi, S., Rezaei, F.S., Saifzadeh, S. and Naghadeh, B.D. 2007. Associations between teat injuries and fistula formation in lactating dairy cows treated with surgery. *JAVMA*,231(11): 1704-1708.
- [5]. Balagopalan, T.P and Aruljothi, N. 2016. Surgical management of webbed teat in a cow. *JAVS*, 9 (7): 84-86.
- [6]. Banks, A.S., Downey, M.S., Martin, D.E. and Miller, S.J. 2001. Chapter 5 Sutures and Anchoring Devices. McGlamamry's comprehensive textbook of foot and ankle surgery. 3rd edn, volume 1. Lippincott Williams and Wilkins, Philadelphia, USA. Pp 148.
- [7]. Beuch, W., Wollrab, J. and Reuschel, G. 1987. Current aspect of udder and teat surgery. *Monatshefte-fnr Veterinariarmedizi*, 42: 126-129.
- [8]. Boothe, H.W. 2003. Chapter 18. Suture materials, tissue adhesives, staplers and ligating clips. *Textbook of small animal surgery*. 3rd edn. Saunders publisher Elseviers. Pp.238.
- [9]. Bristol, D.G. 1989. Teat and udder surgery in dairy cattle. Part 1. *Compend. Cont. Educ. Vet.*, 11: 868-873.
- [10]. Chellamani, K.P., Veerasubramanian, D. and Balaji, V.R.S. 2013. Surgical Sutures: An overview. *JAIR*,12: 2278-5213.
- [11]. Couture, Y. and Mulon, P.Y. 2005. Procedures and surgeries of the teat. *Vet. Clin. North Am. Food Anim. Pract.*, 21: 173-204.

- [12]. Fossum, T.W., Dewey, C.W., Horn, C.V., Johnson, A.L., MacPhail, C.M., Radlinsky, M.G., Schulz, K.S. and Willard, M.D. 2013. Chapter 8. Biomaterials, suturing, and hemostasis. Small animal surgery 4th edn. Elsevier inc. Pp.68.
- [13]. Ghamsari, S.M., Taguchi, K., Abe, N., Acorda, J.A., Sato, M. and Yamada, H. 1995. Effect of different suture patterns on wound healing of the teat in dairy cattle. *J. Vet. Med. Sci.*,57: 819–824.
- [14]. Ghamsari, S.M., Taguchi, K., Abe, N., Acorda, J.A. and Yamada H. 1996. Histopathological effect of low level laser therapy on sutured wounds of the teat in dairy cattle. *Vet. Quart.*, 18: 17-21.
- [15]. Grommers, F.J., Van de Braak, A.E. and Antonisse, H.W. 1971. Direct trauma of the mammary glands in dairy cattle. I. Variations in incidence due to animal variables. *Br.Vet. J.* 127: 271–282.
- [16]. Hendrickson, D.E. 2007. Repair of teat lacerations (Ed). “Techniques in Large Animal surgery” 3rd Edition. Blackwell Publishing, Iowa, USA. Pp 286-288.
- [17]. Ismail, Z.B. 2016. Epidural analgesia in cattle, buffalo, and camels. *Veterinary World*, 9(12):1450-1455.
- [18]. Khan, M. Z. and Khan, A. 2006. Basic facts of mastitis in dairy animals: a review. *Pakistan Vet. J.*,26(4): 204-208.
- [19]. Kudur, M.H., Pai, S.B., Sripathi, H., and Prabhu, S. 2009. Sutures and suturing techniques in skin closure. *Indian J Dermatol Venereol Leprol.*,75(4): 424-434.
- [20]. Mahdy, A.E.E. 1998. Teat surgery in dairy animals .Ph.D. of Vet.Med.(surgery), Zagazig University.
- [21]. Marongiu, M.L. 2012. Local Anesthesia for Husbandry Procedures and Experimental Purposes in Farm Animals In “A Bird’s-Eye View of Veterinary Medicine”, Dr. Carlos C.Perez-Marin(Ed.)
- [22]. Matzke, P., Holzer, A. and Denke, J. 1992. A contribution to the influence of environmental factors on the incidence of udder diseases .*Tierarztl. prax.*, 1992: 20-32.
- [23]. Modi, M. 2009. Critical Evaluation of Suture Materials and in Implant Dentistry. *International Journal of clinical implant Dentistry*, 1(2)31-40
- [24]. Molaei, M.M., Oloumi, M.M., Maleki, M. and Abshenas, J. 2002. Experimental reconstruction of teat mucosa by vestibular mucosal graft in cows. A histopathologic and radiographic study. *J. Vet. Med. A.*,49: 379-384.
- [25]. Molaei, M.M. and Ebrahimi, S. 2013.Experimental reconstruction of teat cutaneous wound by ear skin graft in dairy cattle. *Iran. J. Vet. Med.*, 7(4):271-276.
- [26]. Mulon, P.Y. 2016. Surgical management of the teat and the udder. *Vet. Clin. Food Anim.*, 32: 813–832.
- [27]. Nichols, S. 2008. Teat laceration repair in cattle. *Vet. Clin. North Am. Food Anim. Pract.*,24(2): 295-305.
- [28]. Nichols, S. 2009. Diagnosis and management of teat injury. *Food Animal Practice*. 5th Edition Chapter 82 Pp.398-406.
- [29]. Nichols, S., Babkine, M., Fecteau, G., Francoz, D., Mulon, P.Y., Doré, E. and Desrochers, A. 2016. Long-term mechanical milking status of lacerated teat repaired surgically in cattle: 67 cases (2003–2013). *CVJ.*, 57: 853-859.
- [30]. Nouh., S.R., Korittum, A.S., Elkammar, M.H. and Barakat, W.M. 2014. Retrospective Study of the Surgical Affections of the Teat in Dairy Cows of Army Farms and their Successful Treatment. *Alexandria J. Vet. Sci.*, 40 (1): 65-76.
- [31]. Singer, A.J. 2011. *Skin and Soft Tissue Injuries and Infections: A Practical Evidence Based Guide*. People’s medical publishing house – USA. Chapter 13 Pp: 91.
- [32]. Sreenu, M., Kumar, P., Sravanthi, B.P. and Sudhakar, G. K. 2014. Repair of teat laceration in a cow. *Veterinary Clinical Science*,2(3): 52-54.
- [33]. Tiwary, R., Hoque, M., Kumar, B. and Kumar, P. 2005. Surgical condition of udder and teats in cows. *The Indian Cow*, 2005: 25-27.
- [34]. Tiwary, R., Hoque, M., Maiti, S.K., Singh, G.R. and Kumar, N. 2006. Comparative Evaluation of Suture Materials and Suture Techniques for the Management of Traumatic Teat Lesions in Buffaloes. *J. Appl. Anim. Res.*,29: 33-36.

Table 1: Animal Particulars, Anamnesis and Clinical examination (n = 6)

Animal No	Breed	Age (Years)	Body weight (KGs)	Feeding Pattern	Stage of Lactation	Calving History (days)	Duration (Days)	Etiology	Treatment adapted	Udder morphology	Affected Teat	Shape of the affected teat	Length (cm)
II A	CBJ	7	280	Grazing	1	25	3	Thorn	Yes	Bowl	LFT	Cylindrical	9
II B	HFX	7	320	Grazing	1	18	20	Barbed Wire	Yes	Globular	RHT	Cylindrical	6
II C	CBJ	5	287	Stall Fed	1	20	2	Treaded	Yes	Bowl	RHT	Funnel	6
II D	CBJ	6	290	Grazing	1	15	10	Thorn	Yes	Pendulous	LHT	Cylindrical	8
II E	CBJ	6	310	Stall fed	1	18	5	Treaded	Yes	Pendulous	RHT	Cylindrical	7
11F	CBJ	4	318	Grazing	1	6	2	Thorn	Yes	Bowl	RFT	Cylindrical	8

CBJ – Cross Bred Jersey, **HFX** – Cross Bred Holstein Friesian; **LFT**- Left Fore Teat; **RFT** – Right Fore Teat; **RHT** – Right Hind Teat; **LHT** – Left Hind Teat

Table 2: Qualitative examination of milk on the day of presentation and on 10th Postoperative day (n=6)

Animal No	Milkability		Colour of milk		Consistency of milk		pH		California mastitis test		Somatic cell count (1,00,000 cells/ml)	
	Day of presentation	10 th Postoperative day	Day of presentation	10 th Postoperative day	Day of presentation	10 th Postoperative day	Day of presentation	10 th Postoperative day	Day of presentation	10 th Postoperative day	Day of presentation	10 th Postoperative day
II A	0	0.125	White	White	Normal	Normal	6	6.5	Negative	Negative	234698	288347
II B	0	0.102	White	White	Normal	Normal	7	7.5	Negative	Negative	318965	397841
II C	0	0.070	White	White	Normal	Normal	7	7.5	Negative	Negative	306689	389547
II D	0	0.025	White	White	Normal	Normal	6.5	7.5	Negative	Negative	279283	398376
II E	0	0.080	White	White	Normal	Normal	6.5	7	Negative	Negative	268081	317094
II F	0	0.050	White	White	Normal	Normal	6.5	7.5	Negative	Negative	260374	390206
Mean ± S.E.		0.075 ± 0.015					6.58 ± 0.153	7.25 ± 0.170			278015 ± 12631.91	363568.5 ± 19654.31

Table 3. Morphological evaluation of teats in animals of group II (n=6)

Animal no.	Intactness of sutures	No. of sutures present		Nature of suture line	Nature of the suture site	Discharge	Wound dehiscence
		7 th day	0 th day				
II A	Intact	7	7	Dry	Not Soiled	No	No
II B	Not Intact	8	4	Moist	Contaminated	Yes	Yes
II C	Intact	6	6	Moist	Not Soiled	No	No
II D	Not Intact	15	5	Moist	Contaminated	Yes	Yes
II E	Not Intact	10	6	Dry	Contaminated	Yes	Yes
II F	Not Intact	12	7	Moist	Contaminated	Yes	Yes
Mean ± S.E.		9.6 ± 1.4	5.8 ± 0.5				

Figures



A) Fig. 1 Showing deep lacerated wounds with exposed teat cistern



B) Fig. 2 Showing Braided polybutylate coated polyester sutures of size 2/0 which was applied in simple interrupted pattern on skin



C) Fig. 3 Showing wound dehiscence, fistula formation and gaping of wound edges on day 7 postoperatively



D) Fig. 4 Showing uncomplicated wound healing without any dehiscence on day 10 after removal of sutures