A retrospective study of surgical affections of mammary glands in cattle and buffaloes and their management in the field

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ABSTRACT. The present retrospective study was conducted from 2003 to 2015 in Egypt to document common surgical affections of the udder and teat in cattle and buffaloes, and determine medical and surgical treatment options that are feasible in a field setting. We diagnosed 19 different surgical affections and classified them into 4 groups according to their location. Teat orifice affections (12.41%) included imperforate teat, contracted teat orifice, enlarged teat orifice, and black spot. Teat cistern affections (23.76%) included teat fistula, dilated teat cistern, teat polyp, and webbed teat. Teat surface affections (50.35%) included sore teat, supernumerary teat, sloughed teat, teat papilloma and fibropapilloma, teat wounds, and teat viral lesions. Udder affections (13.48%) included hypermastia, udder wounds, and suppurative and gangrenous mastitis. In cattle, the number of surgical affections located on the teat surface (20 ± 5.4) was significantly higher compared with other locations as well as compared with buffaloes (P<0.05). No treatment was indicated in 24% of recorded cases. Medical and surgical treatment was indicated in 73.75% of affected animals. Favorable results were achieved with the recommended treatments when applied in the field.

KEY WORDS: buffaloe, cattle, mammary gland, surgical affection, teat

There are numerous surgical affections of the mammary glands (udder and teats) in cattle and buffaloes, which vary in their clinical presentation. Teat affections include imperforate teat, contracted teat orifice, enlarged teat orifice, membranous obstruction of the teat canal, fused teats, conjoined teats, webbed teat, teat fistula, teat polyp, milk stones, and teat wounds and lacerations. Udder affections include wounds and lacerations, hematoma, tumors, and suppurative and gangrenous mastitis. The types of surgical affections seen and their prevalence depend primarily on the methods used for raising the animals and the surrounding environment [1–8, 15]. Treatment methods aim to salvage the integrity and function of the teats and mammary glands. Moreover, surgical intervention is necessary for recovery from several types of affections [1, 5, 11]. This study describes the common surgical affections of the udder and teat found in cattle and buffaloes in Egypt as well as to the medical and/or surgical interventions possible in field conditions.

MATERIALS AND METHODS

Animals

This study was carried out on 282 animals registered during field trips to villages of 27 provinces all over Egypt from 2003 to 2015. Animals were either female mature mixed breed cattle (n=184) or water buffaloes “Bubalus bubalis” (n=98) and their ages ranged 2–10 years.

Methods

Teat and udder affection diagnoses were primarily based on case history and clinical examinations conducted in the field. Bacteriological and radiographic examinations in addition to histopathological examination were performed elsewhere to

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Table 1. Recorded surgical affections of the mammary gland in cattle and buffaloes and number of affected animals

| Location of affections | Surgical affections                  | Cattle | Buffalo | Total |
|------------------------|--------------------------------------|--------|---------|-------|
| Teat orifice affections | Imperforate teat                     | 4      | 3       | 7     |
|                        | Contracted teat orifice               | 5      | 2       | 7     |
|                        | Enlarged teat orifice                 | 9      | 7       | 16    |
|                        | Black spot                            | 2      | 3       | 5     |
| Total                  |                                      | 20     | 15      | 35    |
| Mean ± SEM             |                                      | 5 ± 1.5| 3.8 ± 1.1|
| Teat cistern affections | Teat fistula                         | 7      | 4       | 11    |
|                        | Dilated teat cistern                  | 3      | 39      | 42    |
|                        | Teat polypi                           | 7      | 3       | 10    |
|                        | Webbed teat                           | 2      | 2       | 4     |
| Total                  |                                      | 19     | 48      | 67    |
| Mean ± SEM             |                                      | 4.8 ± 1.3| 12 ± 9 |
| Teat surface affections | Sore teat                            | 7      | 8       | 15    |
|                        | Supernumerary teat                    | 41     | 8       | 49    |
|                        | Sloughed teat                         | –      | 1       | 1     |
|                        | Teat papilloma and fibropapilloma     | 15     | 2       | 17    |
|                        | Teat wounds                           | 10     | 3       | 13    |
|                        | Teat lesions due to lumpy skin disease| 16     | –       | 16    |
|                        | Teat lesions due to foot and mouth disease| 31 | – | 31 |
| Total                  |                                      | 120    | 22      | 142   |
| Mean ± SEM             |                                      | 20 ± 5.4 | 4.4 ± 1.5|
| Udder affections       | Hypermastia                           | 1      | 3       | 4     |
|                        | Udder wounds                          | 9      | 7       | 16    |
|                        | Suppurative mastitis                  | 9      | 2       | 11    |
|                        | Gangrenous mastitis                   | 6      | 1       | 7     |
| Total                  |                                      | 25     | 13      | 38    |
| Mean ± SEM             |                                      | 6.3 ± 1.9 | 3.3 ± 1.3 |
| Total                  |                                      | 184    | 98      | 282   |

a) Significant at $P<0.05$.

corroborate the diagnosis and for differential diagnosis in relevant cases. Teat and udder viral lesion cases were documented during the Lumpy Skin Disease (LSD) outbreak from 13 to 26 June, 2006, as notified by the official authorities of the El-Behera province and during the Foot and Mouth Disease (FMD) outbreak in Bani-sewief province from 6 to 16 April, 2012.

Treatment

If indicated, the recorded cases were managed either medically or surgically, using routine maneuvers reported in medical literature and textbooks [4–9]. All surgical procedures were performed using xylazine hydrochloride (0.17 mg/kg) (Xylaject, ADWIA Pharma, Egypt) as a tranquilizer, and 2% lidocaine hydrochloride (Depocaine 2%, DEPIKY PHARMA, Egypt) as a local analgesic. The treatment outcomes for different affections were recorded and further recommendations were suggested. Owners or veterinarians were contacted via telephone to collect follow-up information.

Statistical analysis

All data were expressed as mean± SEM. All data were analyzed by one-way ANOVA to determine the main differences among groups. When main effect of group was observed, the difference of group means at specific point were analyzed by the Student’s $t$-test using JMP statistical software (version 5.1; SAS Institute, Cary, NC, U.S.A.). The different means were considered significant at $P<0.05$.

RESULTS

Nineteen surgical affections of the teats and udder were recorded in 184 cattle and 98 buffaloes. These affections were categorized into 4 groups, according to their location on the teat and udder: teat orifice affections, teat cistern affections, teat surface affections, and udder affections. In cattle, the mean number of surgical affections found on the teat surface was significantly higher than the number of affections at other locations (20 ± 5.4; $P<0.05$). Whereas in buffaloes, the mean number of teat cistern affections was higher than number of affections at other locations. However, this difference was not significant (Table 1, Fig. 1A and 1B).

In comparison between cattle and buffaloes, the teat surface affections in cattle were significantly greater in number than in buffaloes (20 ± 5.4 vs. 4.4 ± 1.5, $P<0.05$; Fig. 1C).
Group 1: Teat orifice affections

Imperforate teat was diagnosed at the time of first lactation in 7 animals (4 cows and 3 buffaloes; Fig. 2). The teat cistern was filled with milk, but milk could not be passed when pressure was applied over the teat. Under the effect of a local infiltration analgesic (1 ml of 2% lidocaine solution), a 14-gauge hypodermic needle was introduced at the seat of the teat orifice. A milk tube was attached and left for 10 consecutive days until healing occurred. All cases recovered without any postoperative complications. Contracted teat orifice was diagnosed in 7 animals (5 cows and 2 buffaloes; Fig. 3) and the condition was characterized by decreased milk flow and increased milking time. Treatment using a teat dilator was unsuccessful, following which surgical intervention was done using a hug knife to widen the teat orifice and then attaching a milk tube. The animals recovered without complications within a few days.

Enlarged teat orifice was seen in 16 animals (9 cows and 7 buffaloes; Fig. 4). This condition was characterized by milk flow spraying from the four quarters even when milking was not induced. Treatment by subcutaneous injection of less than 1 ml of Lugol’s solution around the teat orifice provided satisfactory results and stopped milk leakage within 12 hr. A second injection was administered after 24 hr in the 3 teats that continued to discharge milk after the first injection. Black spot was recorded in 5 animals (2 cows and 3 buffaloes; Fig. 5). These were corrected medically by using antiseptic solutions followed by antibiotic ointment application twice daily for 3–5 days; the recoveries in these cases were without complications.

Group 2: Teat cistern affections

Teat fistula was documented in 11 animals (7 cows and 4 buffaloes; Fig. 6). Majority of these appeared to be congenital fistulae and were seen at first lactation. Using local infiltration analgesia, an elliptical skin incision was made around the fistula orifice. The incision continued downward to the mucous membrane creating a fresh teat wound. A vertical mattress suture was applied in a single row to the fibrous layer to coaptate the mucous edges, whereas the skin wound was sutured with simple interrupted stitches. An elastic adhesive bandage was applied for 5–7 days and a milk tube was used for milking; recovery was uneventful and without complications. Dilated teat cistern was diagnosed in 42 animals (3 cows, 7.14% and 39 buffaloes, 92.86%; Figs. 7 and 8). In this condition, the teat cistern increased in size and volume while the teat wall thickness did not change. No treatment was suggested for such cases.

Teat polypi was recorded in 10 animals (7 cows and 3 buffaloes; Fig. 9). A pea-like structure was palpated inside the teat cistern close to the base in 5 animals (4 cows and 1 buffalo) and at the middle of the teat cistern in the rest. Open teat surgery was suggested as treatment, using a ring block analgesic at the base of the teat. All cases successfully recovered except one cow in which a teat fistula recurred two weeks after surgery. In this case, the operation was repeated after one month with favorable results. Webbed teats were seen in 4 animals (2 cows and 2 buffaloes; Figs. 10, 11 and 12A) and are characterized by a short additional teat with small glandular tissue (small quarter) adhered to a normal well-developed teat covered by the same skin sheath, but with two separate teat cisterns. It is similar to hypermastia, which is characterized by a complete teat cistern with well-developed udder tissue (complete additional quarter; Fig. 12B). Surgical treatment of a webbed teat involves the creation of a shunt between the two adjacent teat cisterns, but the operation is tedious in a field setting. Surgery was not performed in the recorded cases, in accordance with the owners’ requests.

Group 3: Teat surface affections

Sore teat was recorded in 15 animals (7 cows and 8 buffaloes; Fig. 13). Affected teats were enlarged and appeared to be...
covered by a thick brown layer of keratinized skin with superficial cracks. Teats appeared to be extremely sensitive to touch and manipulation. Under sedation, the condition was corrected medically by application of mild antiseptic solutions for cleaning and softening of the skin, followed by application of zinc oxide ointment or cod liver oil and glycerin for 7–10 days consecutively until recovery.

Supernumerary teats were classified into 5 types and diagnosed in 49 animals (41 cows and 8 buffaloes; Table 2, Fig. 14). The type I condition presented as a unilateral in 6 cows (3 left & 3 right) and bilateral in 1 cow and 1 buffalo (Fig. 15). Additional functioning teats were mostly located between the front and rear quarters. The type II condition presented as unilateral at the left side in 2 cows and the right side in 1 buffalo and bilateral in 2 cows (Fig. 16). Teats were functional, and no treatments were suggested for both type I and II conditions. The type III condition presented as unilateral (2 left & 1 right) in 3 cows and 1 buffalo (left side). The extra teat was located close to the base of the original teat and secreted milk (Fig. 17). Amputation of the extra teats was performed as they usually interfere with the milking process. Surgery was performed under sedation and using local infiltration analgesia around the base of the extra teat. An elliptical skin incision was made through the tissue of the original teat, passing through the fibrous layers and mucous membrane to enclose the extra teat. After excision of the extra teat, the fibrous layers were sutured for the coaptation of the mucous membrane edges by simple continuous suture with absorbable suture material (vicryle 3/0) and an eyeless needle. The skin was sutured using non-absorbable silk sutures in a simple interrupted pattern. All cases recovered without any postoperative complications. The type IV condition was recorded in 16 animals (12 cows and 4 buffaloes; Fig. 18). Introduction of a metal probe through the teat orifice of the extra teat revealed no connection with the udder or teat cistern. Treatment was not recommended for such cases unless the condition interfered with milking. The type V condition was recorded in 16 animals (15 cows and 1 buffalo) and appeared as a localized elevation on the skin of the udder in 12 cases and on the teat skin in 4 cases. No treatment was suggested for such cases (Fig. 19).

Surgical affections of mammary glands are a common problem in dairy animals. The primary symptoms include pain, inflammation, swelling, and discharge. Treatment options include conservative management, surgical excision, or ablation. The surgical approach depends on the type and extent of the lesion. Early intervention is crucial to prevent complications such as infection and tissue necrosis.

**Fig. 2.** Imperforate teat in a buffalo.
**Fig. 3.** Contracted teat orifice in a buffalo. (A) Before application and (B) after application of teat dilator.
**Fig. 4.** Enlarged teat orifice in a cow. (A) Dilated teat orifice. (B, C) Spraying of milk flow.
**Fig. 5.** Black spot at the orifice of a teat in buffalo.
**Fig. 6.** Teat fistula in a cow (A) and cutaneous overgrowth around the teat orifice in a cow (B).
**Fig. 7.** Different forms of dilated teat cistern in buffaloes.
**Fig. 8.** Dilated teat cistern in a buffalo (A) before and (B) after milk evacuation.
**Fig. 9.** Teat polypi during open teat surgery in cows.
**Fig. 10.** Webbed teat in a buffalo at first lactation.
**Fig. 11.** Two forms of webbed teats (A) in a buffalo and (B) in a cow.
artery forceps at the tumor base, and then removal by sharp scissors was the treatment recommended in such cases. Follow up of these cases for several months showed that there was a recurrence of other warts elsewhere on the teat and/or udder in 8 cows.

Teat wounds were recorded in 13 animals (10 cows and 3 buffaloes; Figs. 24 and 25): superficial wounds were documented in 10 cases and deep wounds in 3 cases, one of which was longitudinal and perforated the teat cistern. Wound management was performed as usual without suturing for superficial lacerations. Deep and penetrating wounds were sutured and they healed drastically within a few days without postoperative complications.

Teat lesions due to LSD were recorded in cattle only during an outbreak of the disease (Fig. 26). A large rounded necrotic zone was seen on the teat surface in these cases and sloughing occurred spontaneously. Wound management was done by second intention healing until complete recovery. Teat lesions due to the FMD outbreak were diagnosed in 31 cattle and were not recorded in buffaloes (Fig. 27). These lesions mostly appeared in the form of cutaneous small ulcers. These ulcers were treated with topical antibiotic preparations for several days and healing took a considerable time, resulting in fibrous tissue formation.

**Group 4: Udder affections**

Hypermastia was diagnosed in 4 animals (1 cow and 3 buffaloes): 2 buffaloes presented with 6 full mature quarters and the cow with 5 quarters (Figs. 12B and 28). The additional quarters that were smaller in size than normal ones, were considered as type I supernumerary teats. No treatment was recommended for this condition.
Udder wounds and lacerations were recorded in 16 animals (9 cows and 7 buffaloes). These were due to trauma from barbed wire fences or gag instruments. Wounds were superficial in 11 cases (5 cows and 6 buffaloes), deep in 5 cases (3 cows and 2 buffaloes), and penetrating in one cow. Usual wound management was performed, and healing occurred within 10 days after wound debridement and suturing without any postoperative complications.

Suppurative mastitis was recorded in 12 animals (9 cows and 3 buffaloes; Figs. 29–31). Interestingly, in all cases the skin of the affected quarters appeared normal, and when stabbed, a large amount of pus and necrotic tissues were extruded. All contents of the affected quarter were extracted, following which the cavity was washed with antiseptic solution for at least 10 days with systemic administration of antibiotics until complete recovery. All cases recovered, but there was complete collapse and fibrosis of the affected quarters. Gangrenous mastitis was recorded in 7 cases (6 cows and 1 buffalo) and was easily diagnosed by the presence of the line of demarcation between the healthy and gangrenous tissues (Fig. 32), and a putrefactive odor. Mastectomy was performed in two cows: one survived, whereas the other died immediately after operation. The other five cases were culled and sent to the slaughterhouse.

DISCUSSION

It is important to attend to surgical affections of the udder and teat in cattle and buffaloes as these may affect milk production and lead to mastitis as well as undermine the general health of the animal. In our study, we diagnosed 19 different affections and classified them according to their location on the teat and udder. The number of teat affections found was several times more than that of udder affections [6–8, 15]. In cattle, there was a significant difference between the number of surgical affections located on the teat surface and affections on any other location on the teat or udder ($P<0.05$). These results are attributable to teat viral lesions (47 cattle, 25.5%) and supernumerary teats (41 cattle, 22%). Supernumerary teats may promote mastitis, interfere with efficient placement of the milking machine, and decrease the market value of the animals [3].

Moreover, there was a significant difference between the number of teat surface lesions in cattle and buffaloes ($P<0.05$). This may be due to the teat viral lesions from the LSD and FMD outbreaks that were recorded during the study. Contrariwise, in buffaloes that resist both viral diseases, the teat surface affections were low in number. Fortunately, both teat viral lesions and supernumerary teats can be corrected successfully by either medical or surgical treatment.

Teat cistern affections in buffaloes were highest in number compared with those present on other locations. This could be due dilation of the teat cistern, which is more commonly seen in buffaloes (3 cattle, 1.6%; 39 buffaloes, 39.8%). Teat cisterns in these
animals were found to be engorged with stagnant milk, which may lead to the development of mastitis [1, 2, 12, 13]. We did not recommend surgical intervention for such cases. Further studies are required to investigate why buffaloes are more susceptible to the development of a dilated teat cistern than cattle.

In field settings, tranquilizers and local infiltration analgesics in the form of ring block, inverted–v block, and teat cistern infusion can be used to perform surgical interventions for most surgical affections of the teat and udder [10].

In rural areas, the diagnosis and differential diagnosis of teat and udder affections do not necessitate sophisticated instrumentation and procedures. Case history and clinical examination was sufficient to determine final diagnosis in many cases included in our study. However, supernumerary teats, webbed teats, and teat fistula may require radiographic examination for confirmation of diagnosis, and teat papilloma and fibropapilloma require histopathological examination to confirm the diagnosis [11]. Ultrasonography may help in identifying udder parenchymal diseases, especially the early changes in the obstructive disorders of the teat, and in visualizing the healing process after removal of the obstructions [14].

Treatment of teat affection aims to restore milk flow, lower the risk of mastitis, and avoid culling of affected animals. In the present study, around 24% of diagnosed affections did not require any intervention. These affections were either congenital or acquired and did not interfere with milking or affect the general health of the animal (Table 3). Sixteen affections, which represent 73.75% of animals in the study, were treated either medically or surgically with favorable results. This high percentage indicates that surgery can be performed in the field to alleviate such conditions [4, 8, 9]. Mastectomy, when indicated in cases of gangrenous mastitis, was the only operation with poor prognosis and may require an operating room and a well-trained surgeon [5, 7, 15]. The results of this study demonstrate that treatment of most teat and udder affections is feasible in field settings and veterinarians can expect satisfactory results after interventions.
COMPETING INTERESTS. The authors declare that there are no competing interests.

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