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BRIEF COMMUNICATION

Management of chronic gangrenous mastitis in a 3-year-old cow using partial (quarter) mastectomy

A. M. Phiri · W. Muleya · K. E. Mwape

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Abstract Bovine gangrenous mastitis is an acute or peracute condition involving one or more quarters of the cow's udder. It occurs infrequently, but when it occurs, mortality of the affected cows is high. A partial mastectomy of one quarter using a cranial epidural analgesia with 2% lignocaine is described to manage a gangrenous mastitis affecting only one quarter caused by *Proteus mirabilis* (a gram-negative bacteria) which was not amenable to medical treatment. Partial mastectomy can be a safe and effective procedure for ruminants with udder disease in genetically or otherwise valuable cattle.

Keywords Cattle · Udder · Mastectomy · Chronic mastitis · Zambia

Introduction

Gangrenous mastitis is relatively uncommon but often fatal mastitis of sheep, goats, and cattle. Affected cows always lose the quarter of the mammary gland that is involved and sometimes the patient dies, too. Because most of the cases are caused by gram-positive organisms, procaine penicillin containing intramammary infusions are used.

A. M. Phiri (✉) · K. E. Mwape
Department of Clinical Studies, School of Veterinary Medicine,
University of Zambia,
P.O. Box 32379 Lusaka, Zambia
e-mail: andrew.phiri@unza.zm

W. Muleya
Department of Biomedical Sciences,
School of Veterinary Medicine, University of Zambia,
P.O. Box 32379 Lusaka, Zambia

Proteus spp. are less common pathogens that can cause mastitis. As opportunist organisms, they usually invade the mammary gland when defense mechanisms are compromised or when they are inadvertently delivered into the gland at the time of intramammary treatment. Such organisms are also sporadic in occurrence and usually affect only one cow or a few cows in a herd.

Cases of mastitis not amenable to medical treatment may be managed by being dried off and allowing for sloughing of affected quarters or surgically. Complete mastectomy has been recommended in exceptional circumstances following conservative therapy with the animals in good physical condition. Some authors have reported and compared different methods of mastectomies (Brewer 1963; Dehghani and Baniadam 1996; Cable et al. 2004; Allen et al. 2008). Teat amputation and physiological udder amputation (tying off blood vessels supplying the udder) have also been suggested to treat gangrenous mastitis. A partial mastectomy of one quarter using a cranial epidural analgesia with 2% lignocaine is described to manage a gangrenous mastitis affecting only one quarter caused by *Proteus mirabilis* (a gram-negative bacteria) and not amenable to medical treatment.

Case history

A 3-year-old Jersey cow weighing 350 kg was first attended to after presenting with depression, inappetence, reluctance to move, and production of watery milk. The udder was hot and painful but did not show signs of gangrene. It had calved about two and half months previously. The cow was normal systemically (temperature, respiratory rate, ruminations were normal), except for submandibular and right subiliac lymphadenopathy. There

was temporary improvement of the mastitis after treatment with intramammary oxytetracycline for 5 days but the condition recurred. The cow belonged to a small herd of 12 cattle with basic management and semicommercial milking practices on a semi-intensive farm. The nutrition status of the herd was above average with supplementation of concentrates.

Ten days after treatment, the cow was presented with a worsening condition which was accompanied with gangrenous right forequarter (Fig. 1). On physical examination, major findings were poor body condition, right subiliac lymphadenopathy, and an udder and teat that was blue-greenish, cold to touch, swollen, firm, nonpainful, and with distinct marked line differentiating affected from non-affected tissue. There was also a foul-smelling brownish-red (milk containing blood and pus) fluid expressed from the affected right forequarter.

A milk sample from the affected forequarter was collected aseptically for bacterial culture and isolation, gram staining, and antibiotic sensitivity testing. Gram stain and culture characteristics (colony, morphology, pigmentation, and hemolysis) were used as presumptive identification of isolates. Further inoculations were done to confirm identification of isolates biochemically. There was swarming motility with a foul smell on blood agar; white-colorless, nonlactose fermenting, smooth, round-edged, and elevated colonies on MacConkey agar; negative on citrate media, but evidence of hydrogen sulfide production and glucose fermentation on triple sugar iron media (SIM). Hydrogen sulfide production, motility, and urease enzyme activity were evident on urease and SIM media. It was also indole negative.

The cultured organisms were gram-negative bacillus species (*P. mirabilis*) which were facultative anaerobic in nature. *P. mirabilis* was isolated after aerobic and anaerobic culture.

The isolates were subjected to in vitro drugs susceptibility test using disk diffusion method (Bauer et al., 1966). Only antibiotics against gram-negative bacteria were tested, i.e., Gentamicin, Nitrofurantoin, Co-trimoxazole, and Doxycycline. Gentamicin was the most potent of them all, while Doxycycline was of intermediate potency. To the other two, the organisms were resistant.

Even though the prognosis for the right forequarter was poor, the prognosis for the return of the cow to lactation in the other quarters was good. Therefore, a partial mastectomy was undertaken to preserve life of the cow and the remaining udder quarters without compromising future milk yield (Fig. 2a). If the cow was left to dry off, the affected quarter would have broken down and sloughed off, subsequently having an animal with depressed appetite and reduced weight gain resulting from the absorption of toxic material from the sloughing tissue. It can take 2 to 4 months for the affected tissue to slough and enough healing to occur to be sure the cow will pass slaughter inspection (Dehghani and Baniadam 1996).

A cranial epidural block with 2% lignocaine was undertaken using 120 ml of lignocaine in the epidural space to achieve a cranial epidural block. An additional 60 ml was infiltrated around the site of the incision. The cow was cast in lateral recumbency with the affected side uppermost. The udder was draped off and the right hind limb safely secured from the surgical area. The area was aseptically prepared and an elliptical incision was then made on the lateral udder. The small blood vessels were clamped, ligated, and then transected. The incision was then deepened through the subcutaneous tissue to expose the lateral fascia covering the mammary gland tissue. Blunt dissection was carried out laterally, medially, cranially, and caudally. The tissue was necrotic and easy to separate. The mammary artery was double-ligated using chromic catgut and transected dorsally in the inguinal area. The associated

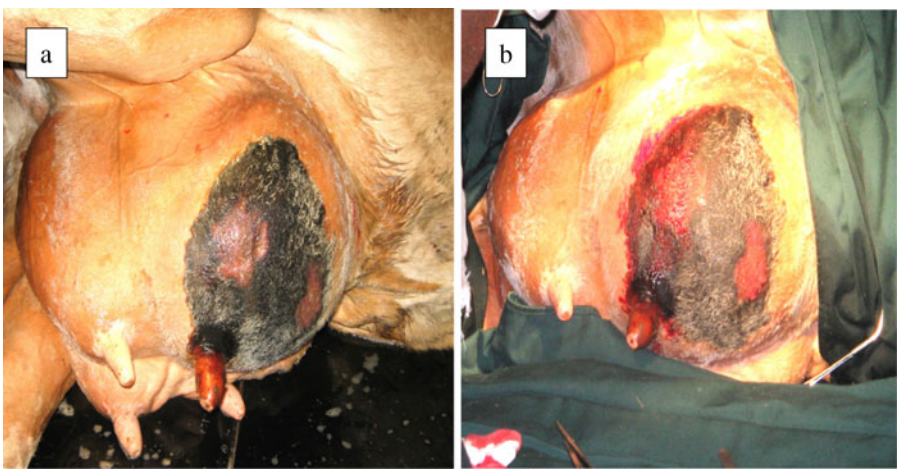

Fig. 1 **a** Gangrene affecting the right forequarter and **b** surgical draping for mastectomy mastitis cases in genetically or otherwise valuable cattle

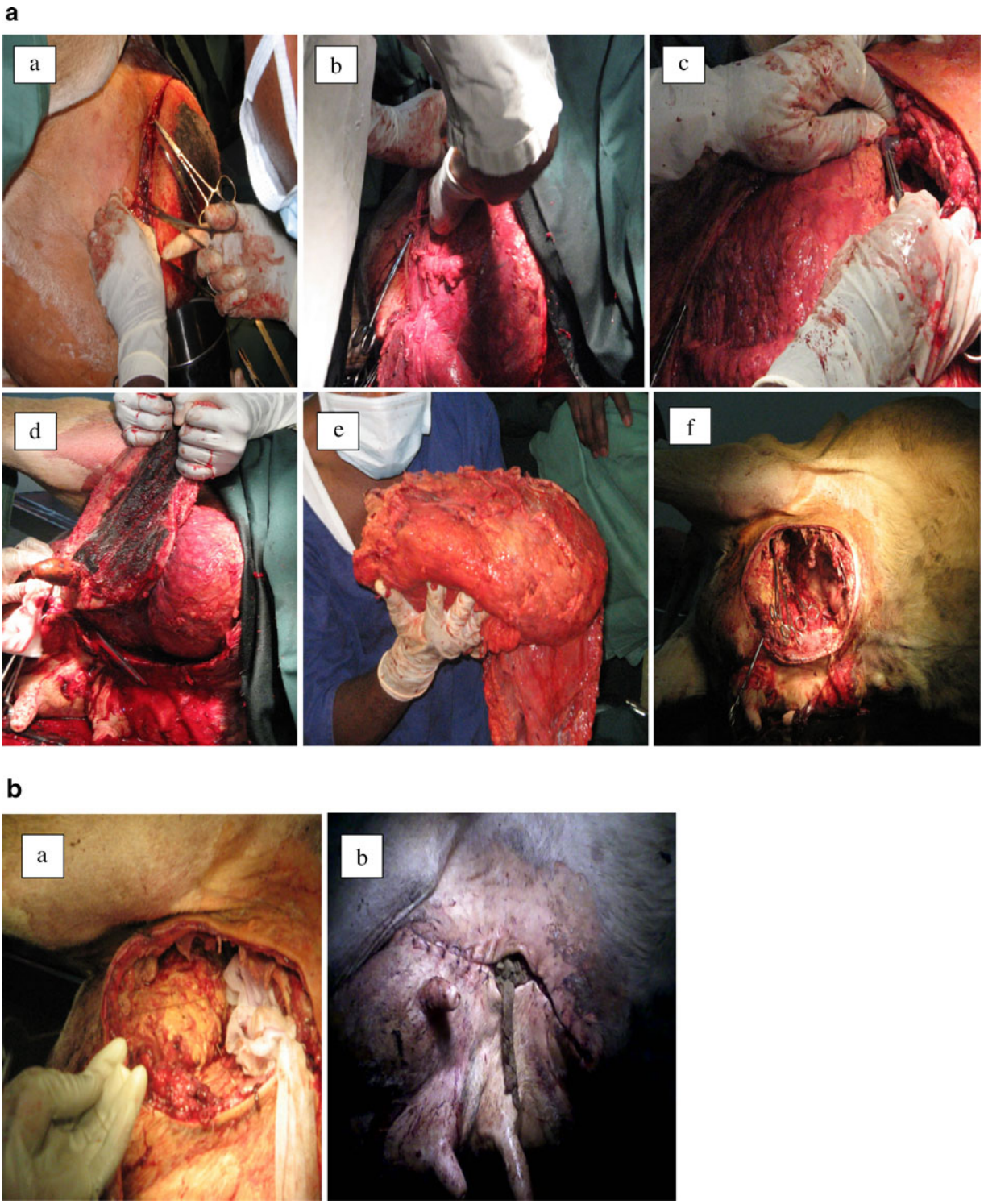

Fig. 2 **a** Partial mastectomy procedure: *a* elliptical incision, *b* bluntly dissecting necrotic mammary tissue, *c* double ligation of mammary artery, *d* removal of affected quarter, *e* a 4-kg quarter removed en bloc, and *f* resulting open defect. **b** Closure of mastectomy, *a* packing of the defect with gauge soaked in acriflavin and closure of dead space; *b* skin sutures and placement of drains

vein was treated similarly. The pubic artery and vein, lying cranial to the affected fore quarter (a branch of the subcutaneous artery and vein, respectively), were double-ligated and then transected. The udder was then removed as one mass and weighed 4 kg. In the process of its removal, about 500 ml of brownish-red foul-smelling fluid was also collected. The resulting defect was cleaned with dilute chlorhexidine, and then open weave bandages were packed

in it and some left hanging as drains. The subcutaneous tissue was sutured using a walking suture pattern in order to reduce the open space resulting from the defect. The skin incision was apposed with nylon (Fig. 2b).

Postoperative management involved administering combined procaine penicillin G and benzathine penicillin G at 1 ml/10 kg im every 48 h on two occasions. Gentamicin at 1 ml/10 kg im was instituted on day 5 for 5 days after results from the sensitivity tests were known. The incision site was inspected daily and the drains removed over a period of 4 days.

The wound was flushed with dilute chlorhexidine daily. The wound contracted and the defect greatly reduced by second intention over a 2-week period. The cow's condition improved and was returned to owners. The cow made an uneventful recovery, and even after 20 months, it remained highly productive.

Discussion

This case was caused by *P. mirabilis* which was not amenable to treatment. *Staphylococcous aureus*, *Clostridium perfringens*, and *Escherichia coli* have predominated in causing gangrenous mastitis in ruminants (Green and Bradley 2004; Atyabi et al. 2006). Decisions for gangrenous mastitis treatment can be done at various levels of management and at each level economic costs and benefits must be considered. Options to consider include surgery or culling. Although surgery is rarely indicated because it is expensive and secondary healing will take quite a while, there are some instances when it is economically feasible and should be performed. Some practitioners have performed teat amputation in early stages of the disease, incising the gland cistern to provide free drainage. Even with early treatment, the quarter is invariably lost and the gangrenous areas slough off.

Cranial or high epidural analgesia was used for udder amputation but it needed a greater volume of analgesic to provide 2 h of analgesia (Turner et al. 1989). Our approach was to make an elliptical incision on the upper lateral aspect of the right fore quarter and preserve the adjacent right hindquarter. To the best of our knowledge, this procedure has not been reported on dairy cows before. However, an incision made between the hemiquarters of the udder and then extended ventrally and cranially toward the pubic area and then dorsally on the cranial aspect has been described (Frank 2002). Removal of both quarters on one side of the udder has been recommended, but in our case, we opted to remove only the affected part. The associated hindquarter was still healthy and unaffected and able to produce milk. From a standpoint of food hygiene, these cows need to be strictly separated from the herd until full recovery and milk cannot be sold for consumption.

Physiologic mastectomy can be also used as a salvage procedure in cases of chronic suppurative mastitis, gangrenous mastitis, or chronic severe mastitis associated with organisms liberating endotoxin or exotoxin (Allen et al. 2008). It is also considered as an effective alternative to radical mastectomy for unresponsive mastitis cases in genetically or otherwise valuable cattle.

Mastectomies are expensive procedures and as such, medical management facilitated by culture, isolation, and sensitivity testing should be encouraged. Removal of only the affected quarter may bring benefits as compared to removal of both quarters. The partial mastectomy operation cost 203.51 USD excluding costs of farm visit, drugs, diagnostics, and hospitalization which amounted to about 87 USD. The cost of a replacement heifer ranges from 800 to 1,200 USD. Costs were converted from the local Zambian currency.

Ruminants with severe but localized diseases of the udder do well after radical mastectomy (Cable et al. 2004). Large surgical defects after mastectomy are common, but they heal by second intention. Seroma formation is the most common complication after mastectomy and continues to be an important problem during the early postoperative period (Tekin et al. 2001). Mastectomy is a procedure of choice in gangrenous mastitis in ruminants (Frank 2002; Ribeiro et al. 2007).

Partial mastectomy can be a safe and effective procedure for ruminants with udder disease. It can avoid severe complications associated with radical mastectomies and retain milking and reproductive potential.

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