

FOOD/FARMED ANIMALS

Total mastectomy in a cow with gangrenous mastitis

Antonio Ortega-Pacheco,¹ Armando J Aguilar-Caballero,¹ Matilde Jimenez-Coello,² Rene Tzab,³ Eduardo Gutierrez-Blanco¹

¹Salud Animal y Medicina Preventiva, Autonomous University of Yucatan, Merida, Yucatan, Mexico

²CIR/Biomedicas. Lab. de Biología Celular, Autonomous University of Yucatan, Merida, Yucatan, Mexico

³Centro Centro de Desarrollo Tecnológico "Tantakin" FIRA, Tzucacab, Yucatan, Mexico

Correspondence to

Dr Antonio Ortega-Pacheco, opacheco@uady.mx

Received 7 May 2016

Revised 17 August 2016

Accepted 18 August 2016

SUMMARY

A three-year-old recently calved, dual-purpose cow (Brown Swiss/zebu) presenting with signs of inappetence was examined. The udder was hot and painful. The left hide teat appeared black in colour and was cold to the touch with a bloody discharge evident on stripping the teat. The other teats had a normal appearance and a few drops of watery milk were coming. A gangrenous mastitis was diagnosed. The histopathology showed the presence of coagulative necrosis and fibrosis. Given the cow's commercial value and udder condition, a total mastectomy was performed. Induction and maintenance of anaesthesia was provided by a constant rate infusion of ketamine-xylazine and a regional block was performed. Laboratory cultures were positive for *Pseudomonas*. Ciprofloxacin was provided for 10 days, and topical treatment with a commercial bee honey product was applied covering all the open wounds. After 45 days, the wound granulated; the cow successfully bred and a healthy calf resulted.

BACKGROUND

Gangrenous mastitis in cows is an acute and serious condition with frequently fatal consequences. Partial mastectomy is indicated when the other quarters are unaffected and still functional (Phiri and others 2010). Amputation of the complete mammary gland, although less frequent, can be a good alternative. Factors considered to carry out a total mastectomy include duration of illness, general health status at physical examination, clinical-pathological findings, genetic value of the animal and costs. Several infectious agents are involved in gangrenous mastitis. The most common and primary cause of bovine mastitis is *Staphylococcus aureus*, which has been found in gangrenous mastitis (Scott and others 2011). Other causes of gangrenous mastitis include *Proteus* (Phiri and others 2010), *Pseudomonas aeruginosa* (Crossman and Hutchinson 1995), *Clostridium perfringens* type A and *Escherichia coli* (Schoonderwoerd and others 1990). Radical mastectomy is a safe and effective procedure and is well tolerated in ruminants. However, during surgery, a swift, aseptic procedure and haemostasis are important for prompt recovery (Cable and others 2004). Postoperatively, treatment may be based on the isolation of the pathogen and testing of its antibiotic sensitivity.

This case describes the anaesthetic management, surgical approach and postsurgical therapy of a

total mastectomy in a cow due to gangrenous mastitis.

CASE PRESENTATION

A three-year-old recently calved, dual-purpose cow (Brown Swiss/zebu) presenting with signs of inappetence was examined. The appearance of the udder was normal, but it was hot and painful to touch. The left-hind quarter with a black colour (Fig 1) and a continuous bloody discharge were observed on stripping the quarter. A few drops of watery milk were drawn from the other quarters, which appeared normal. The cow's mobility was normal; fever and anorexia were present. A gangrenous mastitis was diagnosed. The calf was removed from the pen and nursed with a commercial milk replacer. Partial mastectomy was an option, but, due to the physical examination findings (developing of toxæmia), udder condition (rapid development of oedema, change of colour, damp and cold to the touch) and genetic value of the cow, a total resection of the udder (mastectomy) was performed. After surgery, histopathology showed a mammary tissue with coagulative multifocal necrosis and fibrosis surrounded with abundant collagen fibres, multifocal necrosis, fibrosis and severe neutrophilic infiltration.

INVESTIGATIONS

A blood sample was taken from the jugular vein to perform a complete blood count, and samples of milk were taken for microbiological culture and for antimicrobial sensitivity testing. Complete blood count results are shown in Table 1. A mild normocytic anaemia was present. The white blood cell values showed an increase in band neutrophils. In the milk culture, *Pseudomonas* was isolated. The antibiotic sensitivity test showed susceptibility to ciprofloxacin, oxytetracycline, norfloxacin and cephalirin.

TREATMENT

The cow was initially sedated with xylazine (0.03 mg/kg intramuscularly) (Procin 2%, PISA, Mexico). After 15 minutes, the skin over both jugular veins was clipped and an intravenous catheter (Introath 16 ga Bencton & Dickinson, Mexico) was placed into each jugular vein. The skin area over the right and left transverse process of the lumbar vertebrae and the sacrococcygeal joint were also clipped, washed and aseptically prepared. A Farquharson's paravertebral regional anaesthesia technique involving the second, third and fourth lumbar vertebrae was used to desensitise



CrossMark

To cite: Ortega-Pacheco A, Aguilar-Caballero AJ, Jimenez-Coello M, et al. *Vet Rec Case Rep* Published online: [please include Day Month Year] doi:10.1136/vetreccr-2016-000333



FIG 1: Mammary gland of a cow with gangrenous mastitis. Notice the black colour and bloody discharge from the left hind teat of the udder's left side. The teat was cold and damp on palpation

both lateral aspects of the mammary gland. A total dose of 10 ml per site of 2 per cent lidocaine (Pisacaina, PISA, Mexico) was injected between the transverse processes of the second–third and third–fourth lumbar vertebra. A caudal sacrococcygeal epidural anaesthesia was also performed by using xylazine (0.05 mg/kg) (Procin 2%) in order to desensitise the caudal aspect of the mammary gland. Once the cow was in lateral recumbency on a previously padded pen's floor, the skin area over the udder was clipped, cleaned and surgically prepared. General anaesthesia was induced with pentobarbital (1 mg/kg intravenously) (Pentobarbital 6.5%, Aranda, Mexico) followed by ketamine (2 mg/kg intravenously) (Ketamina 10%, PISA, Mexico) and xylazine (0.01 mg/kg intravenously) (Procin 2%). Immediately after induction of anaesthesia, a cuffed endotracheal tube (18 mm) was inserted. The cow remained on its right lateral side on a padded floor. Oxygen was supplied at a flow rate of 15 l/minute during the entire anaesthetic procedure and recovery. Ten minutes after induction of anaesthesia, a constant rate of infusion of ketamine (4 mg/kg/hour intravenously) and xylazine (0.02 mg/kg/hour intravenously) was administered for maintenance of anaesthesia.

Initially an elliptical incision around the left half of the udder was made in order to preserve enough skin for an appropriate closure of the surgical wound. At the time of incision, lack of

blood perfusion of the skin close to the right half of the udder was noticed. The skin colour of the mammary gland had changed from red to violet.

Once the elliptical incision was finished, the subcutaneous tissue was manually dissected using gauzes, and the haemorrhage was controlled by haemostat angioplasty and ligation sutures. The initial approach began from the lateral aspect of the udder, running from the cranial to the ventral aspect of the mammary gland. When major blood vessels appeared (external pudendal artery and vein, ventral perineal artery and vein and caudal superficial epigastric vein), they were clamped and double ligated before transection. After ablation of the mammary gland and its skin attached, the right and left borders of the surgical wound were sutured to the external layer of the external abdominal obliquus muscle. Because a large amount of damaged skin was seen after udder separation, it was removed and part of the surgical wound was left open to let the wound close by second intention. Just before suturing, a thorough rinse with 0.1 per cent iodine solution was performed, then, a latex drain was placed at each side of the surgical wound. Macroscopic examination of the udder tissue revealed the whole hind mammary gland's tissue was gangrenous (Fig 2). Once the surgery was finished, the cow received atipamezole (0.02 mg/kg intramuscularly) (Antisedan 0.5%, Zoetis, Mexico). Twenty minutes later, the patient adopted a sternal position but was unable to stand until 40 minutes after atipamezole administration. Recovery was calm and uneventful. Total surgery time lasted 210 minutes, and the time from induction of general anaesthesia to standing position was 265 minutes. The antimicrobial drug therapy consisted of ciprofloxacin (2.5 mg/kg intramuscularly) (Primecin 7.5%, Lapisa, Mexico), once a day for 10 days. Inflammation and pain management consisted of a reduced dose of flunixin meglumine (1 mg/kg intramuscularly) (Napzin 5%, PISA, Mexico) once a day for three days, followed by meloxicam (0.3 mg/kg intramuscularly) (Metacam 2%, Boehringer Ingelheim, Mexico) for four days. Local wound treatment consisted of saline solution rinses once a day and topical administration of commercial bee honey for 30 days. A total of 45 days elapsed between surgery and total wound healing; no postsurgical complications were observed during this period.

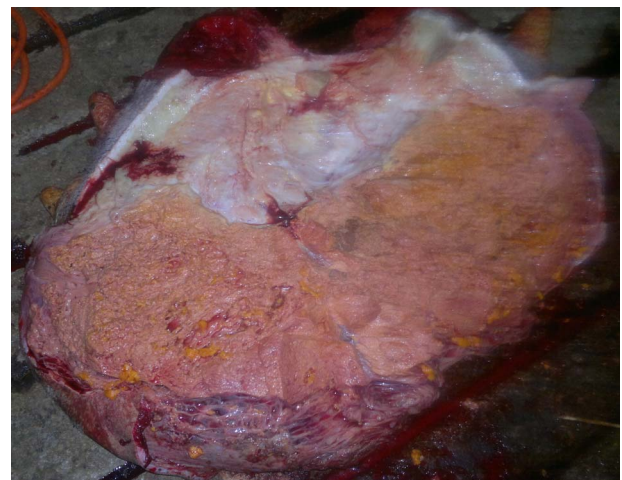


FIG 2: Open ablated mammary gland showing gangrenous parenchyma in the entire left gland; oedema and moderate diffuse subcutaneous emphysema that extend to the mammary parenchyma is evident. A process of liquefaction is present delimited by extensive haemorrhages in necrotic areas

TABLE 1: Complete blood count in a cow with gangrenous mastitis

		Reference interval
Red blood cells ($\times 10^6/\mu\text{l}$)	5.30	5–10
Haemoglobin (g/dl)	6.99	8–15
Packed cell volume (%)	26	24–46
Mean cell volume (fl)	49	40–60
Mean cell haemoglobin concentration (%)	27	26–34
Platelets ($\times 10^3 \text{ mm}^3$)	450,000	100–800
White blood cells (mm^3)	9300	4–12
Band neutrophils (mm^3)	465	0–240
Mature neutrophils (mm^3)	2883	600–4000
Lymphocytes (mm^3)	4278	1800–9000
Monocytes (mm^3)	465	80–840
Eosinophils (mm^3)	1209	80–2400
Basophils (mm^3)	0	0–240



FIG 3: Ventral view of the surgical area 30 days after mastectomy and treatment with bee honey. A complete coverage with healthy granulation tissue can be seen surrounded by healthy skin

OUTCOME AND FOLLOW-UP

Thirty days post surgery, a good granulation tissue bed was observed and skin covered most of the surgical wound (Fig 3). The cow became pregnant three months after the surgery and successfully calved a healthy male calf nine months later.

DISCUSSION

Gangrenous mastitis in cows is an acute and serious condition with frequently fatal consequences. In the present case, *Pseudomonas* infection was associated with the mammary gland gangrene. During its replication and tissue damage, *Pseudomonas* may release endotoxins, provoking tissue coagulative multifocal necrosis and fibrosis of the mammary tissue. Clinical signs including agalactia seen in the cow were as a consequence of the release of endotoxins and the inflammatory process. However, septicaemia was rapidly resolved by the anti-inflammatory, antimicrobial and fluid therapy. Partial mastectomy is indicated when the other quarters are unaffected and still functional (Phiri and others 2010). Amputation of the complete mammary gland, although less frequent, can be a good alternative depending on factors such as health status, genetic value of the animal and costs. Radical mastectomy when properly performed is a safe procedure used in ruminants with a good success rate; during surgery, a rapid, aseptic procedure and haemostasis are important for prompt recovery (Cable and others 2004). Physiological mastectomy has been described to reduce the blood supply to the mammary gland, leading to eventual tissue atrophy in cows. This method, as the total mastectomy, is considered as a salvage procedure (Allen and others 2008). However, due to the lack of experience in such procedures, a radical mastectomy was performed.

Anaesthesia and trans-surgical pain management are fundamental for a good surgery; in this case, regional blocks provided good pain relief and the induction and maintenance protocols used were simple, effective and inexpensive mainly based on xylazine and ketamine, which are widely used in ruminants (Thurmon and Benson 1993, Valverde and Doherty 2008, Lin 2015). During surgery, some skin areas adjacent to the mammary gland were cold and friable with evidence of necrosis; consequently, the tissue was removed, leaving a wide open wound. Recovery of anaesthesia was quick due to the use of atipamezole, a specific $\alpha 2$ adrenergic receptor antagonist (Valverde

and Doherty 2008). The pain and inflammatory response were managed with flunixin meglumine and meloxicam. NSAIDs proved to be useful by promoting comfort during recovery and the immediate postoperative period. The use of bee honey as a wound dressing was chosen because of its properties, capable of moisturising injured tissue, arresting microbial infections, soothing inflammation and preventing gauze sticking to wounds (Molan 2006); it is also capable of promoting granulation, angiogenesis and epithelisation (Molan 2001). In the present case and due to the extended open wound, bee honey was the treatment of choice. Bee honey was very effective, promoting granulation and healing without further infections. However, since antimicrobial and anti-inflammatory drugs were also administered, the granulation and healing process cannot be solely attributed to the honey treatment and results should be taken with reservation.

Several infectious agents are involved in gangrenous mastitis. The most common and primary reservoir of bovine mastitis is *S aureus* (Scott and others 2011), but other agents such as *Proteus* (Phiri and others 2010), *P aeruginosa* (Crossman and Hutchinson 1995), *C perfringens* type A and *E coli* (Schoonderwoerd and others 1990) have also been found in gangrenous mastitis. *P aeruginosa* is commonly present in dairy cattle with high levels of contamination in milking parlour wash water and associated with atypical *P aeruginosa* mastitis (Mushin and Ziv 1973). Clinical mastitis in dual-purpose cow has been associated with the absence of calf suckling after milking, where *P aeruginosa* have been detected (González-Sedano and others 2010). In the present case, the origin of *P aeruginosa* gangrenous mastitis was not determined but contamination of the milking parlour is suspected; no other case of mastitis was detected in the herd. Increased hygiene and disinfection procedures were subsequently employed, particularly in the milking facilities.

Contributors All authors were involved in the clinical case and writing the manuscript. The authors have all revised the manuscript for intellectual content and give their approval for the submission.

Competing interests None declared.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- Allen A. J., Barrington G. M., Parish S. M. (2008) Physiologic mastectomy via flank laparotomy. *Veterinary Clinics of North America: Food Animal* 24, 511–516
- Cable C. S., Peery K., Fubini S. L. (2004) Radical mastectomy in 20 ruminants. *Veterinary Surgery* 33, 263–266
- Crossman P. J., Hutchinson I. (1995) Gangrenous mastitis associated with *Pseudomonas aeruginosa*. *Veterinary Record* 136, 548
- González-Sedano M., Marín-Mejina B., Maranto M. I., Leme De Magalhães-Labarthe A. C., Alonzo-Díaz M. A. (2010) Effect of residual calf suckling on clinical and sub-clinical infections of mastitis in dual-purpose cows: epidemiological measurements. *Research in Veterinary Science* 89, 362–366
- Lin H. (2015) Comparative anesthesia and analgesia of ruminants and swine. In: *Veterinary Anesthesia and Analgesia*. 5th edn. Eds K. A. Grimm, L. A. Lamont, W. J. Tranquilli, S. A. Greene, S. A. Robertson, India: Wiley Blackwell. pp 743
- Molan P. C. (2001) Potential of honey in the treatment of wounds and burns. *American Journal of Clinical Dermatology* 2, 13–19
- Molan P. C. (2006) The evidence supporting the use of honey as a wound dressing. *The International Journal of Lower Extremity Wounds* 5, 40–54
- Mushin R., Ziv G. (1973) An epidemiological study of *Pseudomonas aeruginosa* in cattle and other animals by pyocine typing. *Journal of Hygiene* 71, 113–122
- Phiri A. M., Muleya W., Mwape K. E. (2010) Management of chronic gangrenous mastitis in a 3-year-old cow using partial (quarter) mastectomy. *Tropical Animal Health and Production* 42, 1057–1061
- Schoonderwoerd M., Lewis I. M., Scholten J. A. (1990) Acute gangrenous mastitis due to *Clostridium perfringens* type A and *Escherichia coli* in a cow. *Canadian Veterinary Journal* 31, 523–524
- Scott P. R., Penny C. D., Macrae A. I. (2011) Cattle medicine. In *Mastitis and Teat Disease*. London, UK: Manson Publishing/The Veterinary Press. pp 218–219; Chapter 11

Thurmon J. C., Benson G. J. (1993) Anesthesia in ruminants and swine. In *Current Veterinary Therapy, Food Animal Practice*. 3rd edn. Ed J. C. Howard. Philadelphia: W.B. Saunders. pp 58–76

Valverde A., Doherty T. (2008) Anesthesia and analgesia of ruminants. In *Anesthesia and Analgesia in Laboratory Animals*. 2nd edn. R. Fish, P. J. Danneman, M. Brown, Others. USA: Academic Press. pp 385–411

Copyright 2016 British Veterinary Association. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.

Veterinary Record Case Reports subscribers may re-use this article for personal use and teaching without any further permission.

Become a Veterinary Record Case Reports subscriber today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional subscriptions contact consortia@bmj.com

Visit vetrecordcasereports.bvpublications.com for more articles like this and to become a subscriber