Surgical management of cranial meningocele in 4 cow calves

ABHISHEK VERMA[1], VANDANA SANGWAN[1]*, TARUNBIR SINGH[1], BISWADEEP JENA[1] AND ANURADHA GUPTA[2]

[1] Department of Veterinary Surgery and Radiology,
[2] Department of Veterinary Anatomy, College of Veterinary Science, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India, 141004

SUMMARY

The study reports the management of congenital cranial meningocele in 4 female cow calves (3 Holstein Friesen crossbred and one indigenous Gir breed). All the calves were presented with the complaint of a soft tissue swelling {with (2 calves) or without hairy skin (2 calves)} in the cranium bones. Radiography in one calf revealed a gap in the frontal suture. While, echocardiography revealed atrial septal defect in one calf. Out of 4, 3 were surgically operated under local infiltration and injectable general anaesthesia. The one Holstein Friesen crossbred calf with a small non-cystic soft tissue swelling and no hairy skin covering was not operated but recovered completely on follow up. Out of the other 3 calves operated, one completely recovered (HF crossbred with Atrial septal defect) while one (Sahiwal) showed circling nervous signs in post-operative period but recovered with medicines, and the third calf showed blindness and circling after 7 days of surgery and did not respond to treatment. It was concluded that cystic cranial meningocele should be surgically resected while small non-cystic cranial meningocele without skin covering can be left as such for healing.

KEY WORDS

Cow-calf, cranial meningocele, echocardiography, management.

CASE HISTORY AND PRESENTATION

Simple meningocele is a common congenital neural tube defect and involves the cystic expansion of meninges containing cerebrospinal fluid. The cranial meningocele is commonly recorded in cow calves and is characterized by the protrusion of fluid-filled meninges through a skull defect due to defective ossification in the frontal or occipital bone regions[1-3]. The aetiology of congenital meningocele is still unclear and a combination of congenital factors during fetal development, environmental influences[4,5], insufficient nutrition to cow, exposure to teratogenic viruses, or use of teratogenic drugs[6], and the high doses of Vitamin A during pregnancy[7] may contribute to its occurrence.

The report describes the management of congenital cranial meningocele in 4 female calves.

Animals were aged between 1-4 days and weighing an average of 34.69 ± 3.95 Kgs. All calves were presented a forehead soft tissue swelling. The calf 1 had a small growth on the frontal eminence without skin covering. No surgical intervention was done in calf 1. The other 3 calves were treated surgically for the resection of the meningocele.

The detail signalment, diagnosis and outcome of the calves in presented in Table 1.

Anaesthesia was performed by general (injectable) and local anaesthesia. The ear vein was cannulated for fluid therapy (Normal saline) during surgery. Intravenous administration of diazepam at a dosage of 0.2 mg/kg and ketamine at a rate of 3 mg/kg was given mixed in a single syringe. The local anaesthesia (2 ml of 2% lignocaine HCl) was infiltrated along the incision line, at the base of the meningocele. No topping of general anaesthesia was required in any calf.

Regarding surgical treatments, the calves, 2 and 4, with cystic meningocele were placed in lateral recumbency and were prepared aseptically for surgery. An elliptical incision was made, slightly above the base of the cyst. The cyst got ruptured once the subcutaneous tissue was cut. Any part of sac protruding out of skull bones was resected. Ligatures were applied for any bleeding. Subcutaneous sutures were applied using polygalactin (910, 2-0) followed by skin sutures with silk/Nylon thread.

The calf 3 was placed in sternal recumbency and was aseptically prepared for surgery.

An elliptical incision was made at the base of the growth and was resected cautiously. The subcutaneous sutures and the skin sutures were applied as described above.

Corresponding Author:
Vandana Sangwan (drvandanasangwan@rediffmail.com)

Table 1 - Table showing the details of the 4 cow calves managed for cranial meningocele. (HR=heart rate=beats/min, RR=respiration rate)

	Calf 1	Calf 2	Calf 3	Calf 4
Age	2 days	1 day	1 day	4 days
Breed	Holstein Friesen crossbred	Holstein Friesen crossbred	Gir	Holstein Friesen crossbred
Gender	Female	Female	Female	Female
Body weight	29 kgs	34 kgs	26 kgs	34 kgs
HR, RR and SpO_2	138, 54, 95	128, 31, 97	131, 30, 96	108, 31, 97
Site of meningocele	Frontal eminence suture	Frontal eminence suture	Frontal eminence suture	Frontal bone suture
Dam reproductive status	6th parity, conceived through Artificial insemination	1st parity, conceived through Artificial insemination	1st parity, conceived through Artificial insemination	1st parity, conceived through Artificial insemination
Primary complaint	Abnormal growth	Abnormal growth and difficulty in balancing head.	Abnormal growth	Abnormal growth and difficulty in balancing head
Type of meningocele (with or without skin)	Not covered with hairy skin, pink, soft but no cyst **(Figure 1a)**	Covered with skin and a large cyst **(Figure 1b)**	Not covered with hairy skin, pink, soft but no cyst **(Figure 1c)**	Covered with skin and a large cyst **(Figure 1d)**
Diameter/shape of the meningocele	Round 2.5cm in diameter	Cystic cavity (15cm length) with a 3.5cm base.	Round 2.5cm in diameter	Cystic cavity (20cm length) with 7cm base.
Skull radiography findings	The frontal suture was wide open. No soft tissue opacity appreciable. **(Figure 2a)**	Radiograph not done	Radiograph not done.	The frontal suture not clear. A soft tissue opacity seen on frontal bone. **(Figure 2b)**
Echocardiography findings	Normal	Atrial septal defect (ASD) seen with mild regurgitation **(Figure 3)**	Normal	Normal
Anaesthesia		Injectable general anaesthesia and local infiltration		
Surgical treatment with anaesthesia	No surgical treatment done.	Resection of the cyst	Resection of the mass	Resection of the cyst
Post-operative complications	None	None	Circling seen after 6-7 days. Recovered with treatment but slight head tilt seen	Circling and right-side blindness on 7th day. No improvement with treatment.
Outcome	Complete recovery **(Figure 4a)**	Complete recovery **(Figure 4b)**	Recovery with mild complications **(Figure 4c)**	Died **(Figure 4d)**

POST-OPERATIVE CARE, COMPLICATIONS AND OUTCOME

The calf 1 was prescribed oral administration of tablet containing vitamin B1, B6 and B12 complex for 10 days and antibiotic ointment locally. In the other calves, antibiotic (cefotaxime, 20mg/kg of BW, twice daily for five days) and analgesic (meloxicam, 0.02mg/kg of BW, once daily for three days, IM) treatments were carried out. Tablet containing vitamin B1, B6 and B12 complex was prescribed daily for 10 days. Skin suture removal was advised after 12 days.

The calf 3 developed circling after 6-7 days after surgery. A treatment of prednisolone (2mg/kg of BW) was given and was tapered after every 3 days to half the previous dose. Tab ranitidine and vitamin B1, B6 and B12 complex were continued.

The calf 4 also developed circling with left side blindness at 7th post-operative day. The prednisolone was started but the calf does not respond to it and eventually died. The calf was not able to walk properly and was falling/circling on the side with sight.

Recovery outcomes demonstrated that the calves 1 and 2 showed uneventful recoveries, with no complications, normal body growth, and complete wound healing with hair coverage. Even though calf 2 had ASD on the day of surgery with mild regurgitation, it showed normal body growth with age.

Calf 3 also recovered with normal body growth but mild head tilt (showed occasional) on follow up at 3 months. The overall outcome was 75% for cranial meningocele in cow calves. Histopathology were performed but no cellular component or neural tissue were found in the resected wall of the cyst.[8].

DISCUSSION

Meningoceles are commonly seen in the frontal regions of the calves; however, some may be present below the occipital crest[9]. The diagnosis of a cranial meningocele is clinically based on the presence of an abnormal growth with or without hairy skin or a cystic swelling[10] in the frontal skull bones[11]. The large cystic meningoceles lead to imbalance of the calf in standing and balancing the head for suckling[12]. Meningoencephalocele and meningocele and are two different conditions based on the presence or absence of brain tissue, respectively[3]. Radiography and ultrasonography may not be helpful in differentiating the two conditions[12]. Contrast computed tomography has been reported to differentiate the two conditions and the surgical protocol may be decided based on it. It has been recommended to place all the neural tissue back inside the skull and should not be resected[12], however, multiple reports suggest the removal of tissue hanging with the skull defect[13-15]; with success reported both

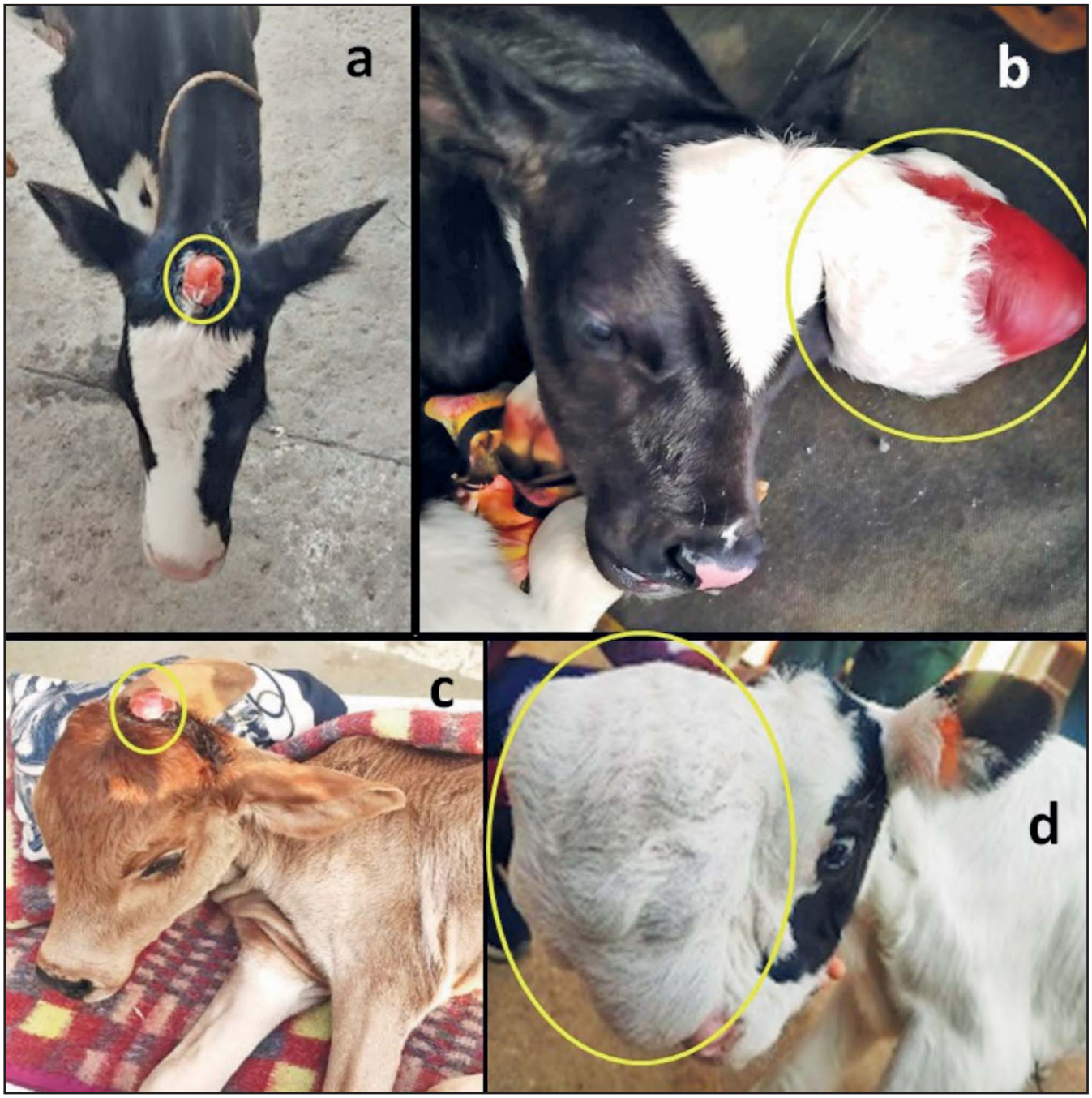

Figure 1 - Photographs of the cow calves presented with cranial meningocele. A 2-day old Holstein Friesian crossbred calf with small non-cystic meningocele not covered by hairy skin (a); One day old Holstein Friesian crossbred calf with a large cystic meningocele covered with hairy skin (b); One day old Gir breed calf with a small non-cystic meningocele not covered by hairy skin (c); Four-day old Holstein Friesian crossbred calf with a large cystic meningocele covered with hairy skin (d).

ways. In the present report also, the tissue at the skull defect was resected, but 2 calves showed complications with nervous signs.

Most of the surgical repair of meningocele is reported to be done under xylazine sedation and local infiltration[12-14] but in the present study a combination of diazepam and ketamine was used along with local infiltration to avoid any untoward movement during surgery. The anaesthesia was sufficient and safe.

Multiple single reports on the successful surgical correction of meningocele/meningoencephalocele have been reported in literature [11,12,14].

The resection of neural tissue along the skull defect[12], increased intracranial pressure or vestibular disturbances may lead to nervous signs like blindness and circling[12]. ASD is normally reported in calves at birth which closes within 7-14 days[16].

The calf 2, with ASD as well on presentation, recovered well from surgery and had normal body growth up to 4 months follow up.

CONCLUSION

The study reports 4 cases of cranial meningocele in calves. Histopathology proved inconclusive in diagnosing meningocele, because of the absence of the neural tissue. It was concluded that cystic cranial meningocele should be surgically resected while small non-cystic cranial meningocele without skin covering, may be left as such for spontaneous healing.

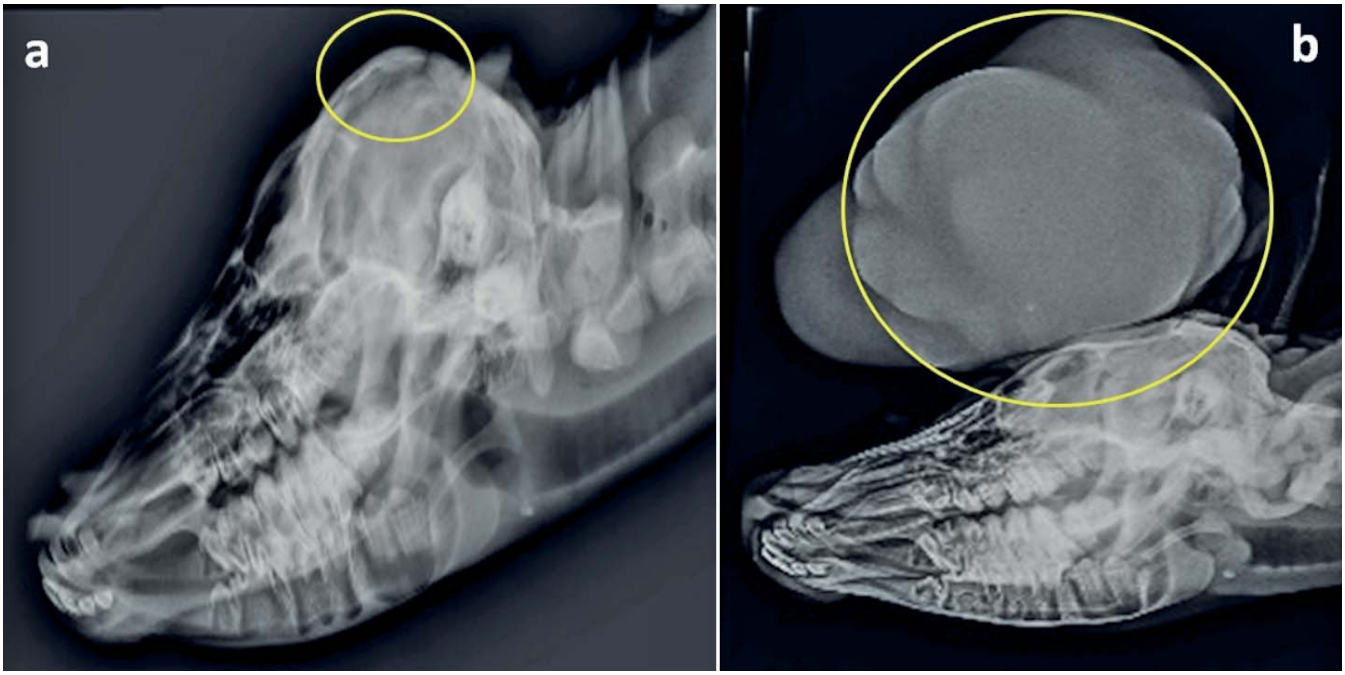

Figure 2 - Lateral skull radiograph of calf 1, showing the frontal suture to be wide open and no soft tissue opacity appreciable in the region of meningocele (a), radiograph of calf 4 showing the frontal suture not clear but a large soft tissue opacity seen on frontal bone (b).

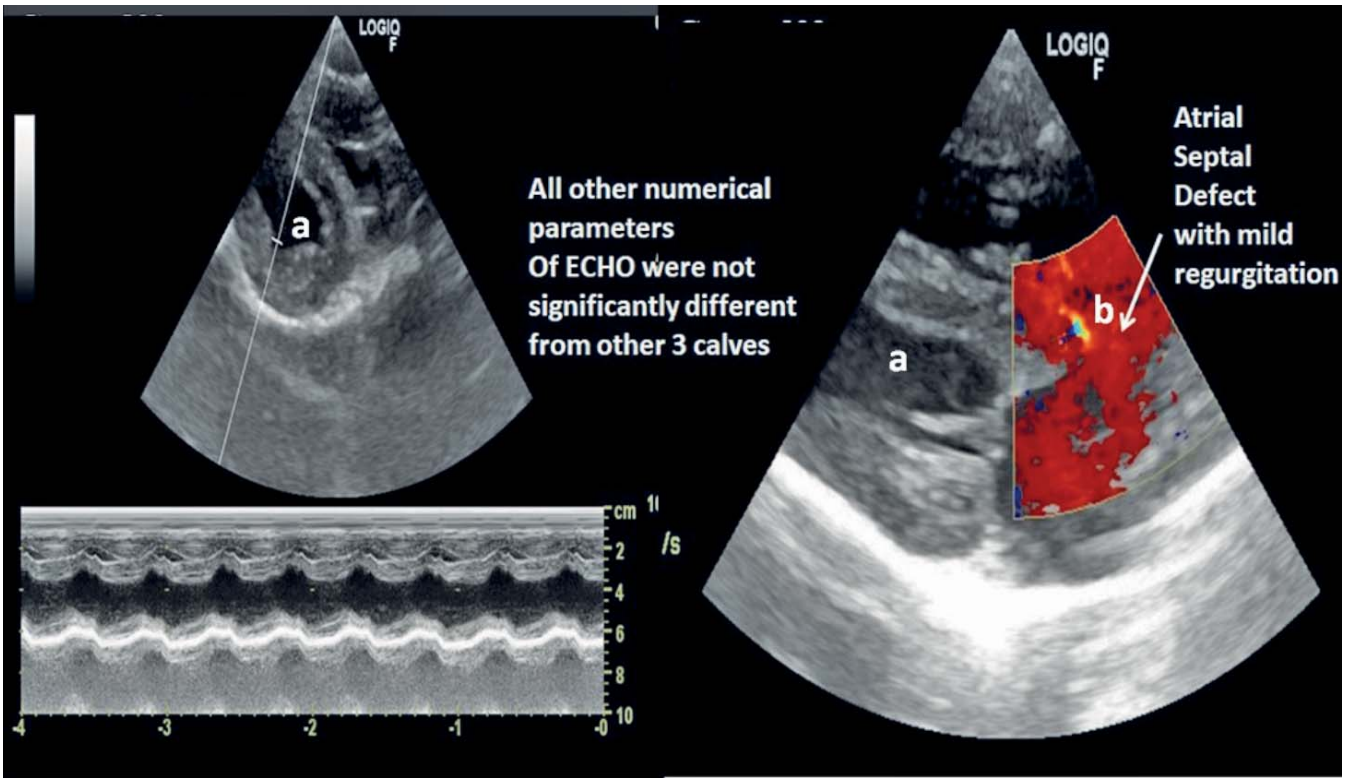

Figure 3 - Echocardiogram of calf 2 with large cystic meningocele showing normal left ventricle (a) but mild regurgitation between atriums suggesting atrial septal defect (b).

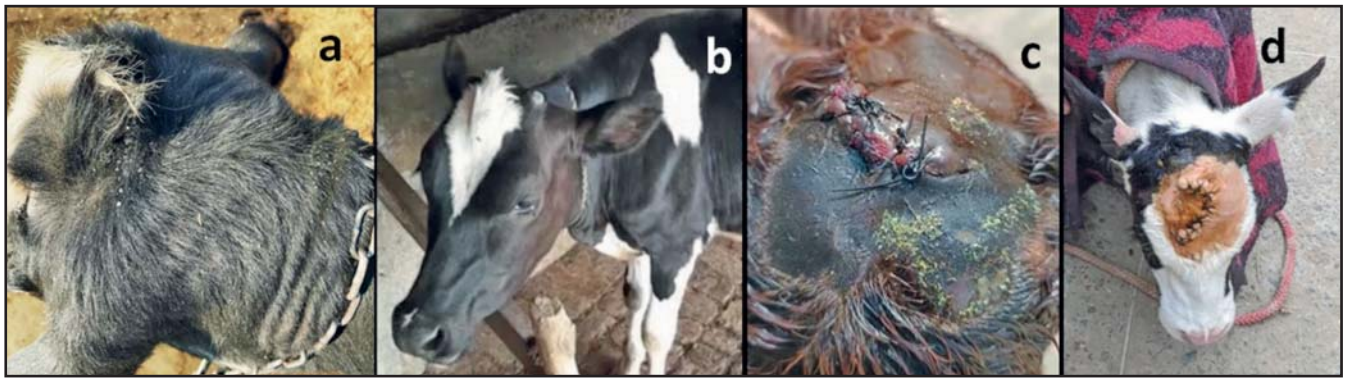

Figure 4 - Photographs showing follow up outcome of the calves; Calf 1 which was not treated surgically, showing completely healed meningocele with hair growth and normal body growth at 4 months (a); Calf 2, with large cystic meningocele and ASD and was operated showing excellent recovery and body growth at 4 months follow up (b); Calf 3, with a small non-cystic, non-hairy skin covering and was operated showing wound healing on day 14 (c); Calf 4, with large cystic meningocele and operated showing good wound healing on day 7 but blindness and circling on one side (d).

Conflicts of interest

The authors have no conflicts of interests with anyone.

Authors contribution

Author 1 was the ultra-sonologist and the work was part of his PhD research. Author 2 wrote the manuscript and guided the surgery, Author 3 and 4 were part of the surgical team, Author 5 did histopathology.

Acknowledgements

The authors acknowledge the Indian Council of Agricultural Research, New Delhi, India and Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, India for providing necessary facilities to treat the Calf.

References

1. Ayhan A., Duygu Y. and Ahmet, C.D. (2013). Congenital giant occipital meningoencephalocele in a Holstein calf fetus. Kafkas Univ Vet Fak Derg, 19: 1065-1069. DOI:10.9775/kvfd.2013.9378
2. Leipold H.W. and Davis S.M. (1993). Congenital defects in cattle and sheep. In: Current Veterinary Therapy, Vol 3, Food Animal Practice. Howard JL (Edn.), Philadelphia, WB Saunders; p 89.
3. Oliver J.E., Hoerlein B.F. and Mayhew I.G. (1987). Veterinary Neurology. WB Saunders, Philedelphia.
4. Köm M. E., Han C. M. and Çeriba A. O. (2009). Surgical treatment of patients with congenital meningocele. Kafkas Univ Vet Fak Derg, 15: 979-82. DOI:10.9775/kvfd.2009.157
5. Kaya M., Okumu Z., Doan E., Çetin E. M. and Yanmaz L.E. (2011). Congenital anomalies in calves – Incidence and Survival rates. FÜ Sa Bil Vet Derg, 25: 83-93.
6. Lopez M. J. and Wilson D. G. (2000). Crania bifida with meningocoele in a Holstein calf. Large Anim Pract, 21: 16-19.
7. Packer R. A. (2022). Congenital and Inherited Cerebral Disorders in Animals. In MSD Manual 2022. Merck & Co., Inc., Rahway, NJ, USA. https://www.msdvetmanual.com/nervous-system/congenital-and-inherited-anomalies-of-the-nervous-system/congenital-and-inherited-cerebral-disorders-in-animals?query=meningocele.
8. Talwalker V.C. and Dastur D.K. (1970). 'Meningoceles' and 'Meningomyeloceles' (ectopic spinal cord) Clinicopathological basis of a new classification. J Neurol Neurosurg Psychiat. 33: 251-262.
9. Jaiswal S., Ahmad P., Gupta R.K. and Singh N.K. (2023). Surgical Correction of Congenital Cranial Meningocele in Buffalo Calf. Internat J Theoretical Applied Sci. 15(1): 01-04.
10. Soundararajan C., Chockalingam P., Nagarajan K., Raja R.A. and Arulprakash M. (2018). Cranial Meningocoele in a Crossbred Calf. Dairy Vet Sci J. 6(3), 555-687. DOI:10.19080/JDVS.2018.06.555687
11. Krishna N.V.V.H. and Palli R.K. (2016). Surgical management of congenital meningo encephalocele in a new born jersey calf: A case report. J Adv Vet Anim Res, 3(2): 192-194. http://doi.org/10.5455/javar.2016.c143
12. Ohba Y., Iguchi T., Hirose O., Takasu M., Nishii N., Maeda S. and Kitagawa H. (2008). Computer Tomography Diagnosis of Meningoencephalocele in a Calf. J. Vet. Med. Sci. 70(8): 829–831
13. Kohli R.N. and Naddaf H. (1998). Surgical treatment of cranial meningocele in Iranian calves. Vet Rec. 142, 145.
14. Nisha A., Jisha K.J., Ranjith M. and Sidhique S.A. (2020). A clinical study on the surgical management of cranial meningocele in a crossbred jersey calf. J Entomol Zool Stud. 8(4): 2424-2426.
15. Sooryadas S., Varghese T. and Cherian V. (2009). Surgical Correction of Cranial Meningocoele in a Crossbred Calf. Intas Polivet. 10(2):282-283
16. Kaiser L., Ames N. K., Patterson J. and Bell T. G. (2005). Atrial septal defect: is it a genetic problem in cattle? Bovine Pract. 39(1): 54–63. https://doi.org/10.21423/bovine-vol39no1p54-63.

LAR
Large Animal Review

GUIDELINES FOR AUTHORS

Official scientific journal of SIVAR

Large Animal Review is a bimonthly magazine published by SIVAR (Italian Society of Farm Animals Veterinary Practitioners) for scientific updating of veterinarians who deal with animals in livestock production and the supply chain control in the production of food industry. The topics of main interest for the journal are those of internal medicine, surgery, obstetrics, animal nutrition, zootechnics, infectious and parasitic diseases, food safety and security, animal welfare, prevention and management.

MANUSCRIPTS

Large Animal Review publishes manuscripts in the form of reviews, original articles and case reports; manuscripts must comply with the guidelines below.

Review - This is a complete coverage of a specific topic accompanied by a detailed and updated bibliography. Authors interested in writing a review should contact the editor of Large Animal Review. The text should not have more than 48.000 characters (including spaces) and not be accompanied by more than 15 figures or tables.

Original Article - The papers published in Large Animal Review are short or full-length research articles related to the topic of the journal. The full text article should not exceed 32.000 characters (including spaces) and should not be accompanied by more than 10 figures or tables. Manuscripts in the form of short articles should not exceed 16.000 characters and no more than 4 figures or tables.

Case Report - Single clinical or herd case report should be presented in Large Animal Review. The manuscript must not exceed 10.000 characters (including spaces) and no more than 4 figures or tables.

FORMAT

All manuscripts (review, original articles and case reports) must have the following structure.

Language - English or Italian.

Title - The title of the manuscript has to be short and explicative and written on the front of the first page. Under the title, names of authors should be given indicating the surname and the name (e.g., Smith Tom). Institutional addresses are displayed below the author names; footnotes referring from author names to displayed addresses should be numbered. The full name, mailing address, phone number, and e-mail address of the corresponding author should appear directly below the affiliation lines on the title page. The corresponding author will be identified by a symbol footnote (e.g., Smith Tom*) and e-mail address below the affiliation lines on the first page of the published article (e.g., *Corresponding author: Smith Tom, University of …).

Abstract - Abstract has to be placed on the second page of the manuscript and written in English. Abstracts should be limited from 300 to 500 words. The abstract disseminates scientific information through abstracting journals and is a convenience for readers. Exclude references, figure or table.

Key Words - After the abstract, list 3 to 5 key words have to be placed. In case of manuscripts written in Italian, the key words have also be translated into English.

Body of the Paper - The manuscript of the original articles must show the following outline: introduction, materials and methods, results, discussion, conclusions, acknowledgments and bibliography. Regarding the reviews, the outline is not expected, but the topic must be clearly argued and divided in chapters.

The text should be typed in Microsoft Word preferably, or OpenOffice or Rich Text Format, with lines and pages numbered consecutively, using Times New Roman font at 12 points. All margins should be at least 2 centimeters, single spacing and cannot exceed the number of characters (including spaces) indicated in the previous section for each type of manuscript.

Tables and Figures - Tables, graphs and images must be included in the manuscript text and numbered (Arabic numerals). The titles or captions should describe concisely the data shown, sufficiently detailed and comprehensible to the reader. Tables and figures should be placed in separate sections at the end of the manuscript.

References - The references must be selected by the authors (not more than 30, except in a review) and should be cited in the text with a serial number in round brackets and listed in the same numerical order in the bibliography.

For articles from journals you should indicate: surname and first initial of the author and co-author/s names, year of publication, article title, abbreviated indication of the magazine (Index Medicus), volume number, number of first and last pages.

For citations to articles or chapters contained in textbooks, you should indicate: surname and first initial of the Author and co-author/s names, year of publication, chapter's title, book title, volume number (if more than one volume) editors, edition, first and last page of the chapter, publishing house and its location.

Examples:

- ***Journals*** - *Galey F.D., Terra R., Walker R., Adaska J., Etchebarne M.A., Puschner B., Fisher E., Whitlock R.H., Rocke T., Willoughby D., Tor E. (2000). Type C botulism in dairy cattle from feed contamined with a dead cat. J Vet Diagn Invest, 12: 204-209.*
- ***Books*** - *Gustafson D.P. (1986). Pseudorabies. In: Diseases of swine, Ed. Dunn H.W., 5th ed., 274-289, Iowa State University Press, Ames, IA.*
- ***Conferences*** - *Barbano D. M. (1996). Mozzarella cheese yield: Factors to consider. Page 29 in Proc. Wisconsin Cheese Makers Mtg., Madison. Ctr. Dairy Res., Univ. Wisconsin, Madison.*

SUBMISSION OF MANUSCRIPTS

The manuscripts have to be submitted exclusively on the following link: **www.largeanimalreview.com**

Informations: Dr. Enrico Fiore - Technical Editor
largeanimalreview@sivarnet.it