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CLINICAL EVALUATION OF ONLAY DOUBLE LAYER POLYESTER MESH FOR REPAIRING LARGE UMBILICAL HERNIAS IN BUFFALO CALVES

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ABSTRACT

Umbilical hernias are a common issue in buffalo calves and can vary in their causes and treatment. While herniorrhaphy is a viable option for smaller hernias, larger hernias with diameters greater than three finger widths typically require the use of prosthetic materials for a successful and tension-free repair. This study aimed to evaluate the effectiveness of using a double layer polyester mesh to repair umbilical hernias in ten buffalo calves with hernial rings sizes ranging from ⩽11 cm in width. The study found that the use of a double layer of polyester mesh was successful in repairing hernias without any complications. Ultrasonographic examination was performed daily to assess the healing progress of the hernias. The use of a mesh allowed for tension-free repair and reduced the risk of recurrence. This technique may be a useful alternative for repairing larger umbilical hernias in buffalo calves. Overall, this study highlights the importance of using appropriate techniques for repairing umbilical hernias in buffalo calves, particularly when dealing with larger hernias. The use of prosthetic materials, such as a double-layer polyester mesh, can provide a successful and tension-free repair, reducing the risk of complications and recurrence.

Keywords: *Bubalus bubalis*, buffaloes, umbilical hernia, herniorrhaphy, polyester mesh, buffalo calves, abdominal surgery

INTRODUCTION

Hernias, defined as a protrusion of body cavity contents through an opening in the body wall, are a common defect in domestic animals, including buffalo calves Moustafa and Hamed (2020). Umbilical hernias in buffalo calves occur due to failure of normal umbilical ring closure or accidental trauma, resulting in the protrusion of abdominal contents into the subcutis Kumar *et al.* (2017); Moustafa and Hamed (2020); Reyes Avila *et al.* (2013). Genetic factor, type of collagen fiber and its tensile strength is important for hernias in buffalo calves (Labik *et al*., 1977; Herrmann

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et al., 2001). Young calves, with umbilical cord contamination and infection may lead to delayed umbilical ring scaring and is predisposing factor for hernias (Herrmann *et al*., 2001). Excessive traction and close cutting of the umbilical cord increase the incidence of hernias in calves (Rahman *et al*., 2017). Umbilical hernias in ruminant calves occur with average frequency 1.8 up to 82% of the umbilical pathologies Herrmann *et al.* (2001); Spadola *et al.* (2022); Virtala *et al.* (1996), large umbilical hernial rings more than 3 cm was about 15% of the recorded umbilical hernia Spadola *et al*. (2022).

Various surgical techniques for hernia treatment have been described. Closed and open herniorrhaphy are recommended for simple and small (not more than 3 cm) hernial rings Rafid *et al*. (2018); Spadola *et al.* (2022); Sutradhar *et al.* (2009). Hernioplasty with application of biological or synthetic mesh is recommended in large hernia Rafid *et al.* (2018).

Surgical synthetic meshes, such as polypropylene, polyester, nylon, polytetrafluoroethylene, or steel, have been used for the repair of large abdominal wall defects, but their high cost may limit their use in calves Doijode and Beerappa (2019); Elango *et al.* (2017). Various techniques for hernioplasty, such as sublay, in-lay and onlay, have been described Melkemichel *et al.* (2022); Pereira and Gururaj (2023). The onlay mesh technique is noted as the easier technique Melkemichel *et al.* (2022). Tissue reaction and seroma is common finding with onlay mesh uses (Pereira and Gururaj, 2023), The purpose of this study was to investigate the outcome of using onlay economic double layer polyester mesh in typical herniorrhaphy of buffalo calves' large umbilical hernias (⩾11 cm).

MATERIALS AND METHODS

Animals and case presentation

The current study was conducted on twenty buffalo calves (15 females and 5 males) presented to a polyclinic with umbilical hernia, aged between 6 to 11 months and weighing between 110-185 kg. Out of the twenty calves, two had irreducible hernias and eighteen had simple reducible hernias, with hernial ring diameter ⩽11 cm (large hernias). The current investigation took place over a period from April 2018 to august 2022. Ten animals were treated with typical herniorrhaphy (9 females and 1 male) and assigned as (G1), and the other ten calves treated with onlay mesh application after typical herniorrhaphy performed (G2). The current study was ethically approved from the research ethics committee of the faculty of veterinary medicine, Damanhour University and all methods were performed in accordance with the relevant guidelines and regulations.

Surgical procedures

Typical herniorrhaphy (G1- n=10): Food withheld for 24 h before surgery. At the time of surgery NSAID (flunixin meglumine) and antibiotic (penicillin) were administered. The animal is positioned in dorsal recumbency, and the ventral abdomen is clipped. Anesthesia is established by intramuscular administration of xylazine HCl 0.3 mg/kg Bwt followed by infiltration of 15 to 20 ml of 2% lidocaine. The surgical site is disinfected with alcohol swabs and povidone iodine solution and draped. A skin incision is made around the hernial ring, and dissection is made to loosen the connective tissue from the body wall. The body wall ring is incised to create a circular opening into the peritoneal cavity. The body wall is closed

using silk number 1 in interrupted horizontal mattress pattern. Onlay mesh application (G2-n=10): Previous steps were performed then, a pre-autoclaved double layer polyester mesh is trimmed and secured 11.5 cm beyond the margin of the skin/ subcutis and anchored with multiple simple interrupted sutures using number 0 silk. Wound closure and postoperative care (n=20): Subcutaneous tissue is sutured with 1/0 polyglactin sutures in simple continuous pattern and skin is closed with number 1 polypropylene interrupted horizontal matters (Figure 1). Postoperative care consisted of administering flunixin meglumine as a nonsteroidal anti-inflammatory at a dosage of 1.1 mg/kg body weight given intramuscularly, in addition to penicillin-streptomycin at a dosage of 1 mg /25 kg body weight given intramuscularly. Daily dressing of the suture line was performed with 5% povidone iodine solution. The skin sutures were removed after 10 to 15 days postoperative (Figure 1).

Assessment

For local surgical site complications, the evaluation process spanned four months and encompassed assessments of general health status, feasibility of the procedure, postoperative complications such as seroma, wound infection, recurrence as well as gross and ultrasonographic evaluations of the wound every 5 days up to 4 months post operative. Technical feasibility was defined as the ability to easily conduct the procedure including time consumed and materials and tools required. Systemic complications related to surgery were assessed for up to 7 successive days postoperative and includes general health changes especially fever and anorexia.

Statistical analysis

A descriptive statistical analysis was conducted, using R Core Team (2020), the independent T test was conducted, and data were plotted as mean ± S.E, data considered significantly different at p value ≤ 0.05.

RESULTS AND DISCUSSIONS

In the study presented here, we assessed the effectiveness of using an onlay mesh application along with typical herniorrhaphy for the repair of umbilical hernias in 10 buffalo calves (Figure 2).

All twenty procedures were performed successfully. The mean operative time was 47.4±3.8 minutes in Group 1. The average operative time for herniorrhaphy only (from skin incision to the end of hernial ring closure) was 32.5±4.7 minutes. Onlay application of polyester mesh was applied successfully although reports remarked the sublay pattern as the most common for hernioplasty in cattle Rafid *et al.* (2018). The application of an onlay mesh together with herniorrhaphy is designed to provide additional support to the repaired abdominal muscles, thereby preventing recurrence due to potential suture rupture, knot slippage, or failure of the abdominal muscle to heal. This method is believed to expedite the healing process and reduce the duration of veterinary care, particularly in highly active buffalo calves. This is a crucial consideration for buffalo calves, especially in rural areas where accurate and long-term postoperative follow-up can be challenging. We believe that this work is pioneer for buffalos' calves onlay mesh use along with typical herniorrhaphy, unlike other studies that investigated the onlay mesh application without herniorrhaphy Kassem *et al.* (2014); Kiranjeet *et al.* (2012). We used a textile,

non-prosthetic, soft, knitted, non-degradable, skin friendly 100% polyester mesh folded into a double layer and sutured to the abdominal muscle with absorbable sutures. Similar non-prosthetic meshes were used successfully for the treatment of hernias in animals Kiranjeet *et al.* (2012). According to Rastegarpour *et al.* (2016) the light weight knitted synthetic non-degradable mesh have the advantage of low recurrence rate, similarly current work had showed low recurrence rate (Figure 3) using more economically double-layer polyester mesh throughout the evaluation period. Results obtained revealed that the used polyester mesh is biocompatible and with elevated tensile strength that protect the abdominal viscera and musculature, this finding previously proved by Rastegarpour *et al.* (2016); Elango *et al.* (2017). Many authors (Spadola *et al*., 2017) stated that, hernial sac is usually highly vascular and this assure constant elevated level of blood supply, cellular elements and higher tissue reaction at the surgical theater, this guaranteed biocompatibility through formation of adhesive insulating fibrin layer over the mesh used. The classic non degradable prosthetic mesh is almost woven Cobb *et al.* (2009); Deeken and Lake (2017), the mesh used here was knitted with large pores. This study outcomes have showed that knitted wide pore mesh was adequate for the procedure. surgically used materials should be nontoxic, physically, chemically, immunogenically inert with little inflammatory responses Elango *et al.* (2017). However, due to its hydrophilic property of the polyester mesh used, seroma recorded for long periods postoperative (Figure 3). Many authors Klinge and Klosterhalfen (2012) stated that the meshes with large pores reduce the rate of infection as they harbor less infection compared to the small and micro meshes, the current study showed non-significant difference between the conventional (no-mesh) technique and uses of knitted large pores polyester mesh (Figure 3). This work has showed that double layer mesh significantly improves strength (no recurrence) and reduce adhesion, similar findings previously reported in human, goats, and equines Cobb *et al.* (2009); Vilar *et al.* (2011, 2009), alas prolog seroma and edema as also reported by Vilar *et al.* (2009) in equine. Ultrasonographic imaging of the operative site in our study revealed the continuation of mild edema for up to two months postoperative and formation of adequate fibrous tissue at the surgical site.

CONCLUSION

In conclusion, the present study demonstrated that using a textile grade polyester mesh for herniorrhaphy followed by onlay mesh application is a feasible and reliable method for treating umbilical hernias in buffalo calves. The use of a double-layered polyester mesh sutured to the abdominal muscle with absorbable sutures provided good resistance to tension of the abdominal wall. Ultrasound examination allowed for reliable identification of the mesh, monitoring of postoperative edema. The use of textile polyester mesh is cost-effective (0.01: 10 US dollar) when compared to prosthetic mesh for 15×15 cm area and could be a viable alternative to other prosthetic mesh and biomaterials for the treatment of large hernial defects in buffalo calves.

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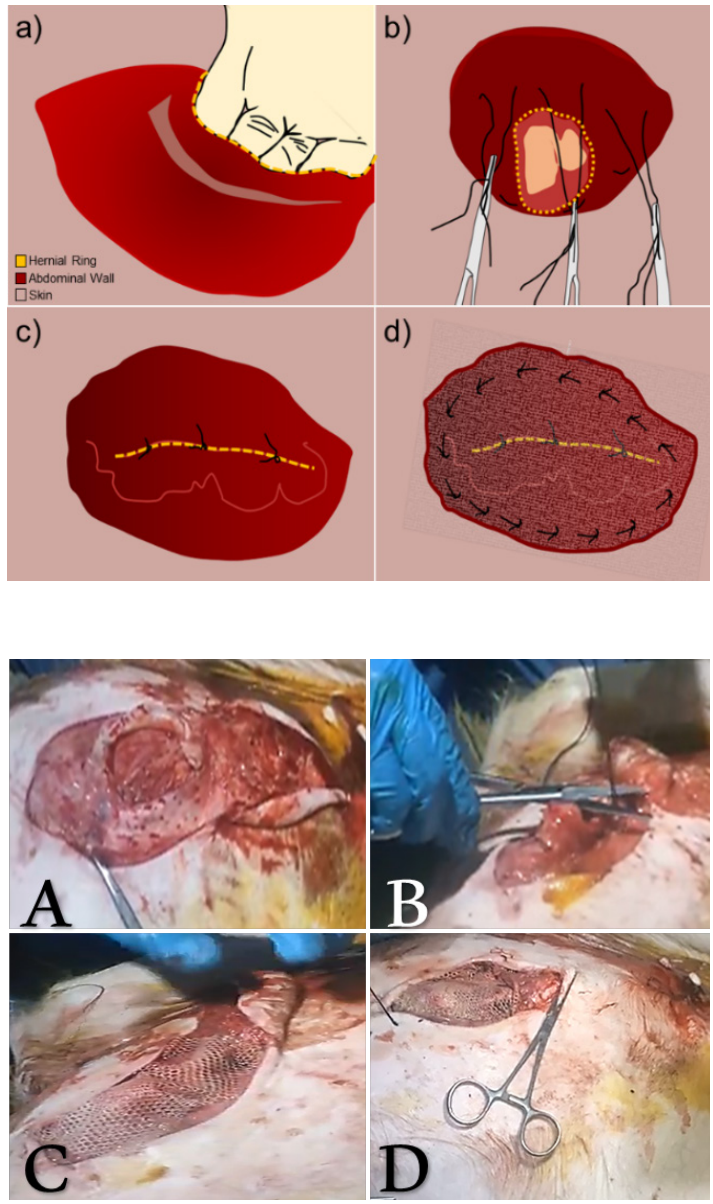

Figure 1. Herniorrhaphy and onlay mesh implant. a, A: presentation of the hernia; b, B: application of multiple horizontal mattress; c, C: closure of the hernial ring and d, D: implantation of onlay polyester mesh.

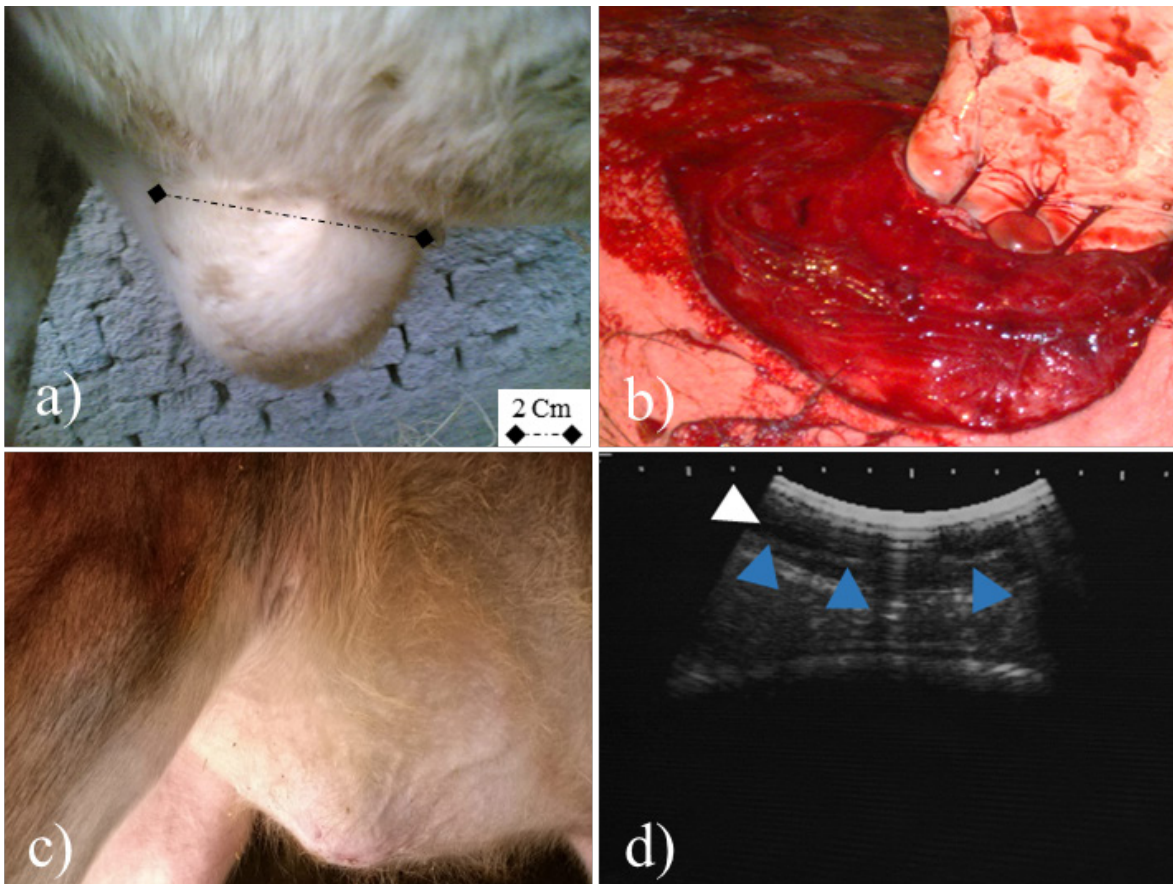

Figure 2. Before surgery; a) hernial sac and b) large hernial ring. After onlay mesh hernioplasty; c) no hernial sac with slight bulge, and d) ultrasonographic image of the surgical site showing the mesh line (blue arrowheads) and seroma beneath the mesh (white arrow).

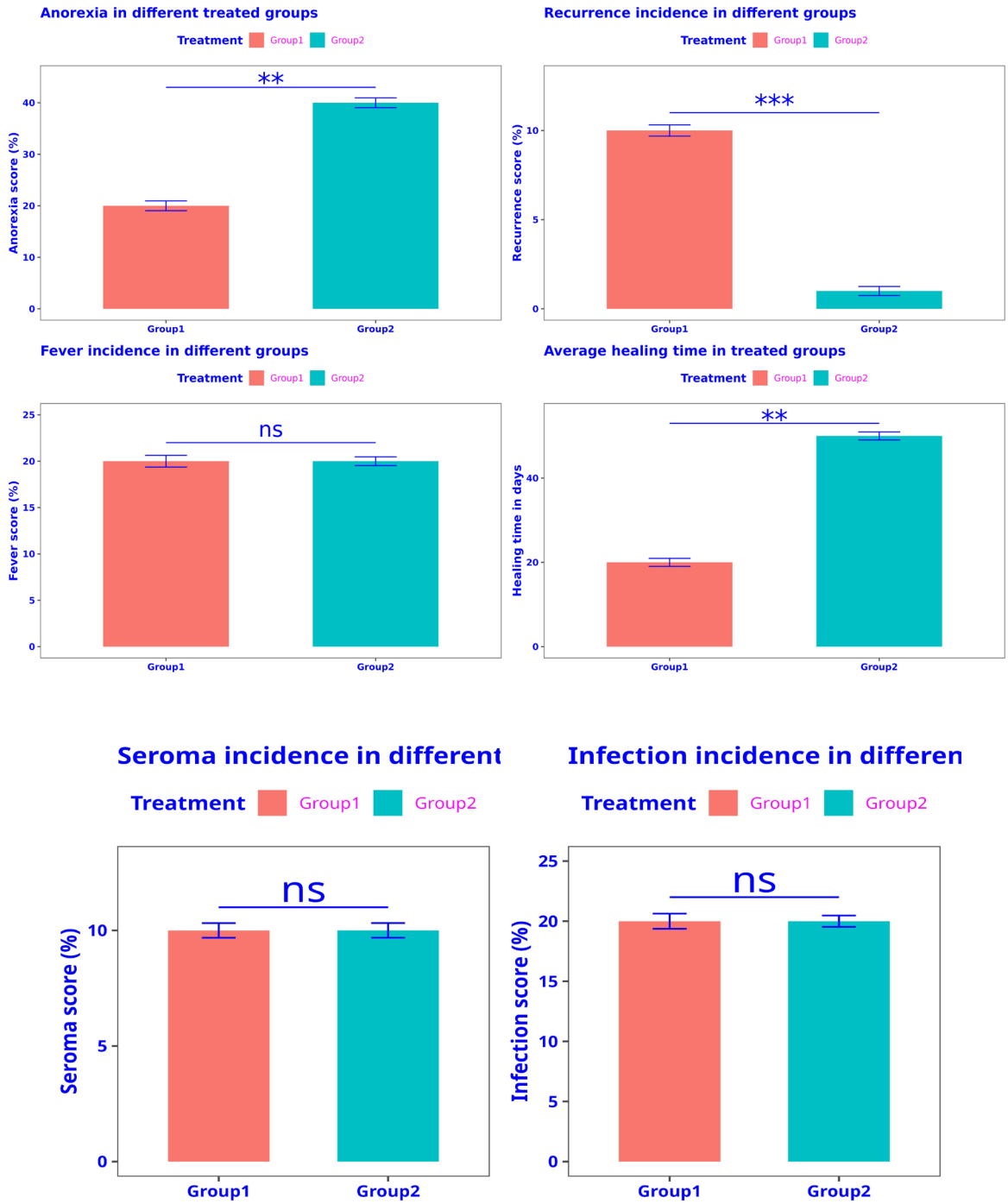

Figure 3. Post operative local and systemic complications at the different groups. Means considered significantly different at p value ≤0.05.

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REFERENCES

Cobb, W.S., R.M. Peindl, M. Zerey, A.M. Carbonell and B.T. Heniford. 2009. Mesh terminology 101. *Hernia*, **13**(1): 1-6. DOI: 10.1007/s10029-008-0428-3

Deeken, C.R. and S.P. Lake. 2017. Mechanical properties of the abdominal wall and biomaterials utilized for hernia repair. *J. Mech. Behav. Biomed.*, **74**: 411-427. DOI: 10.1016/j.jmbbm.2017.05.008

Doijode, V. and G. Beerappa. 2019. Hernioplasty for treatment of ventral hernia using nylon mesh in ruminants. *Journal of Entomology and Zoology Studies*, **7**(3): 433-436.

Elango, S., S. Perumalsamy, K. Ramachandran and K. Vadodaria. 2017. Mesh materials and hernia repair. *Biomedicine*, **7**(3): 16. DOI: 10.1051/bmdcn/2017070316

Herrmann, R., J. Utz, E. Rosenberger, K. Doll and O. Distl. 2001. Risk factors for congenital umbilical hernia in german fleckvieh. *Vet. J.*, **162**(3): 233-240. DOI: 10.1053/tvjl.2000.0567

Kassem, M.M., M.H. El-Kammar, A.S. Korittum and A.A. Abdel-Wahed. 2014. Using of polypropylene mesh for hernioplasty in calves. *Alexandria Journal of Veterinary Sciences*, **40**(1): 112-117. DOI: 10.5455/ajvs.47290

Kiranjeet, S., M. Kant, V. Sangwan, A. Kumar, A. Arun and N. Saini. 2012. Hernioplasty using nylon mesh for massive ventral abdominal hernia in adult bovine. *Indian J. Anim. Sci.*, **82**(10): 1153-1155. DOI: 10.56093/ijans.v82i10.24284

Klinge, U. and B. Klosterhalfen. 2012. Modified classification of surgical meshes for hernia repair based on the analyses of 1,000 explanted meshes. *Hernia*, **16**(3): 251-258. DOI: 10.1007/s10029-012-0913-6

Kumar, P.R., V.D. Prasad, M. Sreenu, N. Krishna and M. Raghunath. 2017. Surgical management of hernia - A clinical study of 18 buffalo calves. *Intas Polivet*, **18**(2): 359-361.

Labik, K., P. Horin, L. Mikulas and J. Havrankova. 1977. Hereditarily conditioned cases of atresia ani hernia umbilicalis and syndactylia in cattle. *Acta Vet. Brno*, **46**: 111-122.

Melkemichel, M., L. Stjärne, S. Bringman and B. Widhe. 2022. Onlay mesh repair for treatment of small umbilical hernias ≤ 2 cm in adults: A single-centre investigation. *Hernia*, **26**(6): 1-7. DOI: 10.1007/s10029-021-02509-2

Moustafa, A.M. and M.A. Hamed. 2020. Comparison of primary incisional umbilical hernia closure in calves and buffalo calves with and without assistance for prosthetic mesh. *Alexandria Journal for Veterinary Sciences*, **67**(2). DOI: 10.5455/ajvs.2028

Pereira, C. and S. Gururaj. 2023a. Onlay versus sublay mesh repair for incisional hernias: A systematic review. *Cureus*, **15**(1): e34156. DOI: 10.7759/cureus.34156

R Core Team. 2020. *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria.

Rafid, H.F., S.H. Al-Husseiny and A.N.A. Al-Ameer. 2018. Surgical treatment of hernia in cattle: A review. *Al-Qadisiyah Journal of Veterinary Medicine Sciences*, **17**(2): 61-68. DOI: 10.29079/vol17iss2art506

Rahman, M.M., S. Sultana, M.Z. Ali and M.Z. Hassan 2017. Prevalence of umbilical hernia of calves and its risk factors at tangail sadar of bangladesh. *Asian-Australasian Journal of Bioscience and Biotechnology*, **2**(2): 154-158. DOI: 10.3329/aajbb.v2i2.64381

Rastegarpour, A., M. Cheung, M. Vardhan, M.M. Ibrahim, C.E. Butler and H. Levinson. 2016. Surgical mesh for ventral incisional hernia repairs: Understanding mesh design. *Plast. Surg.-Chir Plas*, **24**(1): 41-50. DOI: 10.4172/plastic-surgery.1000955

Reyes Avila, I.R., A. Rodriguez Maceo, Y. Ramirez Perez, A. Cuesta Guillen and Y. Gongora Pupo. 2013. Presence of hernias in buffalo calf and their answer to the surgical therapy. *Redvet*, **14**(4).

Spadola, F., G. Costa, M. Morici, C. Interlandi, B. Nastasi and M. Musicò. 2017. Autologous prosthesis for the surgery of two simultaneous hernias in a calf. *Large Anim. Rev.*, **23**(5): 195-197.

Spadola, F., V.C. Neve, G.L. Costa, M. Musicò, A. Spadaro, F. Antoci, O. Cavallo and G. Cascone. 2022. Surgical approach and etiopathogenetic considerations to the umbilical tumefactions in cattle: Case review in twenty years (2000/2020). *Vet. Anim. Sci.*, **17**: 100258. DOI: 10.1016/j.vas.2022.100258

Sutradhar, B.C., M.F. Hossain, B.C. Das, G. Kim and M.A. Hossain. 2009. Comparison between open and closed methods of herniorrhaphy in calves affected with umbilical hernia. *J. Vet. Sci.*, **10**(4): 343-347. DOI: 10.4142/jvs.2009.10.4.343

Vilar, J.M., J.A. Corbera and G. Spinella. 2011. Double-layer mesh hernioplasty for repairing umbilical hernias in 10 goats. *Turk. J. Vet. Anim. Sci.*, **35**(2): 131-135. DOI: 10.3906/vet-1006-365

Vilar, J.M., F. Doreste, G. Spinella and S. Valentini. 2009. Double-layer mesh hernioplasty for repair of incisional hernias in 15 horses. *J. Equine Vet. Sci.*, **29**(3): 172-176. DOI: 10.1016/j.jevs.2009.02.001

Virtala, A.M., G.D. Mechor, Y.T. Gröhn and H.N. Erb. 1996. The effect of calfhood diseases on growth of female dairy calves during the first 3 months of life in new york state. *J. Dairy Sci.*, **79**(6): 1040-1049. DOI: 10.3168/jds.S0022-0302(96)76457-3