

Hernia formation after single-stage umbilical vein marsupialization in three foals diagnosed with omphalophlebitis.

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July 8, 2021

Abstract

Omphalophlebitis in foals is treated with complete resection of the affected umbilical remnants. When total resection cannot be accomplished, umbilical vein marsupialization can be implemented with minimally reported complications. This case series highlights hernia formation as a potential complication following one-stage umbilical vein marsupialization.

Title: Hernia formation after single-stage umbilical vein marsupialization in three foals diagnosed with omphalophlebitis.

Running Head: Hernia formation after umbilical marsupialization in foals.

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Grant/financial support: None

Disclosure : The authors have no conflicts of interest to declare related to this report.

Meeting/Presentation: None

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Acknowledgements

Author Contributions: Klein C, DVM: Drafted, revised, and approved the submitted version of the manuscript; Caston S, DVM, DACVS-LA: Revised the manuscript drafts critically and approved the submitted version of the manuscript; Troy JR, DVM, DACVS-LA: Revised the manuscript drafts critically and approved the submitted version of the manuscript.

Key Clinical Message

This case series highlights hernia formation as a potential complication following one-stage umbilical vein marsupialization in foals diagnosed with omphalophlebitis and should be considered as a possible post-operative complication.

Abstract

Objective: To describe the clinical presentation and long-term outcome of three Percheron foals with omphalophlebitis that developed abdominal hernias following one-stage umbilical marsupialization treatment.

Study Design: Short case series

Animals : Three Percheron foals

Methods : Omphalophlebitis is a common disease process resulting in a variety of morbidities and sometimes mortality. Complete resection of affected umbilical remnants is highly successful, but when total resection cannot be accomplished umbilical vein marsupialization can be implemented with minimally reported complications. Umbilical vein marsupialization was performed on three foals with extensive omphalophlebitis using the one-stage paramedian translocation technique in conjunction with long term antimicrobial therapy.

Results: Long term follow-up revealed herniation at the marsupialization site in all three foals. Two foals were treated with herniorrhaphy at the prior marsupialization site. One foal died due to septic peritonitis three months after marsupialization.

Conclusion : This case series highlights hernia formation as a potential complication following one-stage umbilical vein marsupialization in foals diagnosed with omphalophlebitis and should be considered as a possible post-operative complication.

Key Words

Omphalophlebitis, marsupialization, umbilical vein, hernia, foal

1. Introduction

Omphalophlebitis is a pervasive and deleterious pathology encompassing a broad age span of foals or calves.¹⁻⁴ Left undiagnosed, omphalophlebitis frequently results in fatal secondary complications, such as septic arthritis, physitis, pneumonia, diarrhea, intraabdominal adhesions, and/or septicemia.^{1,3-7} Treatment options involve broad-spectrum antimicrobial therapy which may be combined with umbilical remnant excision.^{1,3,6-9} Surgical excision reportedly enhances survival rates compared to antimicrobial treatment alone.^{6,7}

Umbilical remnant excision has been documented employing ventral celiotomy or laparoscopy.^{2,5-7,10,11} Omphalophlebitis cases with liver involvement carry a poorer prognosis, with up to 50% mortality.^{1,6,8,12} Umbilical vein marsupialization is advocated to promote drainage when complete resection cannot be attained by ventral midline celiotomy or laparoscopy.^{1,5,6-9,13,14}

A one stage or two stage procedure for umbilical vein marsupialization have been described in foals and calves.^{8,9,13,15-18} In one-stage marsupialization, the umbilical arteries and urachus are routinely resected prior to paramedian translocation of the umbilical vein through a separate incision to the right of midline.^{8,13-18} Two-stage marsupialization incorporates the umbilical vein into the cranial aspect of the incision and a second procedure is required to remove the umbilical vein remnant and close the remaining body wall defect.^{9,13,15,19} Advantages and disadvantages of both techniques have been reported, such as cellulitis at the marsupialization site.^{8,9,13-15,17-19} In one report, 46% of calves developed a hernia at the marsupialization site.¹⁴ Currently, there are no reports detailing hernia development following one stage marsupialization of the umbilical vein in foals. This report describes hernia formation in three foals following one stage umbilical vein marsupialization for extensive omphalophlebitis.

2. Materials and Methods

This work was performed at the Department of Veterinary Clinical Sciences, Iowa State University Lloyd Veterinary Medical Center, Ames, Iowa.

2.1 Case 1

2.1.1 Clinical presentation

A 7-day-old Percheron colt was presented for evaluation of pyrexia and wet umbilicus. The colt was febrile (39.4°C; reference range: 37.5-38.6°C), but bright, alert, and responsive. The remainder of his vital parameters were within normal limits. The umbilicus was moderately enlarged, with no heat, pain or discharge appreciated.

Ultrasonographic evaluation revealed moderately enlarged umbilical arteries and urachus with an abscess at the caudal aspect of the umbilicus. Measurements of the umbilical remnants were not recorded. A complete blood count revealed mild leukocytosis (17,050 cells/uL; reference range: 5-12 x10³/uL) characterized by neutrophilia (15,580 cells/uL; reference range: 2.18-6.96 x10³/uL).

Umbilical surgical excision was recommended and elected by the owner. Pre-operative ceftiofur sodium (5 mg/kg, intravenously, q 12 hours), flunixin meglumine (1.1 mg/kg, intravenously, q 24 hours) and omeprazole (1 mg/kg, orally, q 24 hours) were administered.

2.1.2 Surgery

At surgery, a one stage umbilical vein marsupialization was performed due to a severely enlarged and friable umbilical vein that continued into the liver.⁸ The colt was placed in dorsal recumbency. A fusiform-shaped skin incision was made around the umbilicus and sharp dissection was used to enter the abdomen. The umbilical vein was transected as far cranial as possible without leading to contamination. The umbilical vein remnant was exteriorized through a secondary 6 cm incision to the right of midline. The vein marsupialization was sutured in place with simple interrupted sutures using 2-0 poliglecaprone 25 to the abdominal wall, subcutaneous tissue and skin. An abdominal lavage with sterile physiologic saline was performed prior to ventral midline incision closure. The incision was closed in a simple continuous pattern –2 USP polyglactin 910 for linea alba, 2-0 USP poliglecaprone 25 for subcutaneous layer, 2-0 USP poliglecaprone 25 for skin. An Ioban bandage was placed over the marsupialization and omphalectomy incisions for recovery.

Post-operatively the foal was continued on antibiotics and omeprazole for 6 days. Flunixin meglumine was continued for 3 days.

The umbilical vein was rinsed in dilute chlorhexidine solution twice daily during hospitalization. The foal was discharged alive after 6 days of hospitalization on trimethoprim sulfamethoxazole (30 mg/kg, orally, q 12 hours) for 7 days and twice daily spraying of the marsupialization site with dilute chlorhexidine solution.

2.2 Case 2

2.2.1 Clinical presentation

A 2-day-old Percheron colt was presented for lethargy and urine dripping from the umbilicus. The colt was lethargic and febrile (39.2°C; reference range: 37.5-38.6°C) on presentation with a firm and subjectively enlarged umbilicus. Ultrasonographic evaluation revealed moderate enlargement of the umbilical vein extending cranially and mild umbilical artery enlargement. IgG stall side snap test revealed partial failure of passive transfer (400 mg/dL; reference range: >800 mg/dL). Initial therapy included intravenous plasma transfusion 1L, antibiotics (ceftiofur sodium 5 mg/kg, intravenously, q 12 hours and amikacin sulfate 25 mg/kg, intravenously, q 24 hours) and flunixin meglumine (1.1 mg/kg, intravenously, q 24 hours).

Forty-eight hours after presentation, hematology revealed leukopenia (2,140 cells/uL; reference range: 5-12 x10³/uL) characterized by profound neutropenia (663 cells/uL; reference range: 2.18-6.96 x10³/uL) and hyperfibrinogenemia (700 mg/dL; reference range: 300-500 mg/dL).

2.2.2 Surgery

Omphalectomy with umbilical vein marsupialization was recommended and elected by the owner. An enlarged, thickened, and friable umbilical vein was identified, and a single stage marsupialization was performed as described in *Case 1*.

Post-operatively, ceftiofur sodium (5 mg/kg, intravenously, q 12 hours; 1 day) and flunixin meglumine (1.1 mg/kg, intravenously, q 24 hours; 1 days) were continued. The foal was discharged one day post-operatively, continuing antibiotics (ceftiofur sodium 5 mg/kg, intramuscularly, q 12 hours) for 5 days.

2.3 Case 3

2.3.1 Clinical Presentation

An 8-day-old Percheron filly was presented for evaluation of a wet umbilicus. The foal was bright, alert and afebrile with normal vital parameters. The umbilicus was wet and subjectively enlarged on palpation.

Ultrasonographic evaluation displayed moderate enlargement of the umbilical vein and left umbilical artery. Portions of the umbilical tissue appeared hyperechoic, but no acoustic shadowing was noted. A pre-operative complete blood count revealed hyperfibrinogenemia (700 mg/dL; reference range: 300-500 mg/dL) with no other significant findings.

2.3.2 Surgery

The foal was taken to surgery for an omphalectomy. Pre-operative antibiotics were administered and continued post-operatively (procaine penicillin G 22,000 IU/kg, intramuscularly, q 12 hours and gentamicin sulfate 6.6 mg/kg, intravenously, q 24 hours; 2 days). An umbilical vein marsupialization was additionally performed due to the markedly enlarged, friable umbilical vein extending to the level of the liver identified at surgery. The procedure was performed as described for *Case 1* with the umbilical vein sutured to the right of midline and subsequent routine ventral midline incision closure.

Butorphanol (0.01 mg/kg, intravenously) was administered as needed for pain control post-operatively. The foal was discharged two days post-operatively with instructions to continue antibiotics for another 7 days.

3. Results

3.1 Case 1

Twenty-one days post-marsupialization, the colt was re-presented for persistent drainage from the marsupialization site. The site was open and draining, though granulation tissue was present within the site. The omphalectomy incision was warm on palpation but otherwise normal. Ultrasonographic evaluation showed an enlarged umbilical vein coursing to the marsupialization site. An elastic tape abdominal bandage was placed over the marsupialization site to reduce risk of hernia formation.

Three months post-marsupialization, the colt developed diarrhea and extreme pyrexia per the owner. The foal was en route for evaluation but died prior to arrival. The cause of death was determined to be moderate acute fibrinous peritonitis at necropsy. Pathologic examination also revealed a visible focal outpouching of the skin, 5 cm diameter, on the anteroventral abdominal midline at the site of the previous umbilical vein marsupialization with reducible, non-strangulating herniated small intestine. There were firm fibrous adhesions of the proximal ileum and jejunum to the herniated site.

3.2 Case 2

Fourteen months post-marsupialization, the colt was re-presented for a large soft, reducible, 8 cm hernia at the previous marsupialization site (Figure 1). Peri-operative phenylbutazone (2.2 mg/kg, orally, q 12 hours) was administered. An open herniorrhaphy was performed under general anesthesia with the body wall defect repaired using 2 USP polyglactin 910 in a simple interrupted pattern. A hernia belt was placed following recovery from anesthesia. The colt was discharged two days post-operatively with instructions to continue phenylbutazone (2.2 mg/kg, orally, q 12 hours, 5 days; then q 24 hours, 5 days) and stall confinement for 30 days followed small paddock turnout for 30 days.

The colt re-presented 20 days post-hernia repair for incisional dehiscence. Ultrasonographic examination verified the body wall remained intact. The colt was discharged with instructions for continuing stall rest for another 2-3 weeks. Follow-up evaluation 3 months later revealed a small, soft subcutaneous swelling at the location of the previous herniation with an intact body wall (Figure 2).

3.3 Case 3

Fifteen months post-marsupialization, the filly re-presented for a large soft, reducible, fist-sized hernia at the site of the previous marsupialization (Figure 3). Peri-operative phenylbutazone (2.2 mg/kg, orally, q 12 hours) was administered. An open herniorrhaphy was performed under general anesthesia and the body wall defect was closed using 2 USP polyglactin 910 in a simple interrupted pattern. The filly was discharged two days post-operation with phenylbutazone (2.2 mg/kg, orally, q 12 hours, 5 days; then q 24 hours, 5 days) and instructions for strict stall confinement for 30 days, followed by 30 days small paddock turnout.

The filly presented for recheck evaluation 20 days post-hernia repair. There was firm thickening of the previous surgical site, but the body wall was noted to be intact and no dehiscence was appreciated. The filly was discharged and instructed to be on stall rest for 2-3 more weeks while the incision continued to heal. Follow-up evaluation 3 months later revealed appropriate healing of the previous surgical site with only mild thickening appreciated (Figure 4).

4. Discussion

Umbilical vein marsupialization in omphalophlebitis cases is indicated when extensive infection and hepatic involvement prevents complete resection.^{1,5-9,13,14} Reported umbilical vein marsupialization complications include ascending infection, herniation in calves, marsupialization site cellulitis, incisional infection, peritonitis, or abscess formation.^{8,14,15,17,20} Two umbilical vein marsupialization techniques to encourage sustained drainage of the umbilical vein have been described.^{5,6,8,9} One-stage marsupialization employs a second paramedian incision for umbilical vein translocation while the two-stage marsupialization procedure incorporates the umbilical vein into the celiotomy incision.^{8,9,13-19}

Reported advantages of the one-stage technique include a reduced risk of herniation and incisional infection.^{8,10,13,15,18} However, herniation secondary to one stage marsupialization has been described in calves, with rates up to 40%.^{14,20} A previous study in 1995 reported no herniation in 2 foals treated with one-stage umbilical vein marsupialization.⁸ To the authors' knowledge, this is the first to report herniation as a sequela to umbilical vein marsupialization in foals using a one-stage paramedian translocation technique.

Normally, the healed marsupialized vein atrophies and the body wall defect subsequently closes.¹⁰ Marsupialization site herniation is thought to be linked with abdominal wall fragility created through vein translocation or the presence of umbilical infection.^{6,13,20-23} This was demonstrated by a study in 2004, where heifers with umbilical infections were 5.65 times more likely to develop a hernia than those without an umbilical infection.²¹ Umbilical remnant inflammation or infection is presumed to weaken the body wall, therefore delaying umbilical closure.^{6,21} A previous study of umbilical herniation in 44 foals reported no association between an umbilical infection contributing to the development of an umbilical hernia.²⁴ However, in that study, the two foals that developed herniation suffered from minor umbilical infections that were responsive to medical management with antimicrobials.²⁴ In cases of extensive umbilical infection, as in the present study, the infection is less likely to respond to medical management and would require surgical intervention for appropriate treatment, therefore increasing the risk for secondary herniation.^{3,6,7} The authors in this study propose that continued umbilical vein drainage may contribute to protracted marsupialization site closure, resulting in postoperative hernia formation.

None of the cases above were treated with the two-stage technique per surgeon preference and to reduce the necessity for a second surgical procedure. The two-stage technique incorporates the umbilical vein in the linea alba closure, where a small hernia develops that requires closure during a later procedure.^{10,13} A reduced risk of peritoneal contamination is reported with the two-stage technique, but the risk of herniation, incisional infection and dehiscence significantly increases.^{13,14,19} A previous study demonstrated this by reporting a

60% secondary herniation rate when umbilical vein marsupialization was incorporated into the incisional closure in calves with omphalophlebitis.¹⁹ Although the cases reported in the present study developed a hernia at the marsupialization site, the risk is suspected to be low as other studies have not reported hernia formation in foals from a single stage marsupialization.⁸

Previous studies have emphasized the importance of thorough and persistent postoperative management, including prolonged antimicrobial therapy and lavage of the marsupialization site, in order to achieve adequate involution of the infected umbilical vein.^{8,19} Though there is no proven method to prevent herniation of the marsupialization site, studies have suggested intraoperative and postoperative management to reduce the risk.¹⁴ Due to the possibility of the technique attaching the vein to the body wall as a cause of increased herniation rates, it has been proposed to perform three-layer fixation of the umbilical vein, incorporating the external rectus sheath, subcutaneous tissues and skin into closure.¹⁴ Additionally, an abdominal bandage has been suggested postoperatively to support the incision site.^{13,18} Future studies evaluating the effect of the three-layer fixation technique and abdominal bandage application on herniation of the marsupialization site would be indicated to determine the impact on herniation rates.

This study demonstrates that herniation can occur post-operatively following a one-stage umbilical vein marsupialization technique in foals diagnosed with omphalophlebitis. Consequently, owners should be advised that a herniorrhaphy may be required, although the risk is suspected to be low.

Author Contributions: Klein C, DVM: Drafted, revised, and approved the submitted version of the manuscript; Caston S, DVM, DACVS-LA: Revised the manuscript drafts critically and approved the submitted version of the manuscript; Troy JR, DVM, DACVS-LA: Revised the manuscript drafts critically and approved the submitted version of the manuscript.

Disclosure : The authors have no conflicts of interest to declare related to this report.

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Figure Legends

Figure 1: Case 2 – 14 months after marsupialization

Figure 2: Case 2– 17 months after marsupialization

Figure 3: Case 3 – 15 months after marsupialization

Figure 4: Case 3 – 18 months after marsupialization



