Case Report

A novel surgical technique for treatment of cervical vertebral stenotic myelopathy (wobbler syndrome) in a filly


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1. Introduction

Cervical vertebral stenotic myelopathy (CVSM), also known as equine wobbler syndrome or cervical ataxia, is a devastating neurological syndrome resulting from compression of the spinal cord at the cervical region. This report describes a novel surgical technique for treatment of 16-month-old Arabian filly with CVSM. The filly showed grade 4 ataxia, hypermetria, weakness of the hind limbs, stumbling during walking, and abnormal gait. Case history, clinical signs and myelography revealed spinal cord compression between the C3 and C4 and C4-C5. The filly underwent a novel surgical intervention for decompression and stabilization of the point of stenosis using specially designed titanium plate and intervertebral spacer. Evidence of arthrodesis with absence of complications was confirmed by periodic radiography over eight months of postoperative care. The new technique applied in this cervical surgery was efficient for the decompression and stabilization of the vertebrae, allowing arthrodesis development and remission of the clinical signs. The obtained results encourage further assessment of this novel procedure in horses clinically affected by CVSM.

The incidence of CVSM in equine is 1.3%, with male horses being more likely to have the condition (70%–80%). Several breeds of horses like Thoroughbreds, Quarter Horses, Arabians, Morgans and Appaloosas are affected with this condition [1–5].

The most common clinical symptoms of CVSM in equine are symmetrical ataxia, dysmetria and weakness. Also, this condition leads to loss of athletic function of the affected animals [1–3].

Presumptive diagnosis of CVSM is based upon neurological findings and examination of plain lateral radiographs for presence of cervical vertebral malformation or vertebral canal stenosis using intravertebral and intervertebral sagittal ratios [6,7]. The diagnosis is confirmed by myelography [2,6], endoscopy [8] or gross and histopathological postmortem findings [1,2,4].

Euthanasia was recommended in 33%–66% of horses with confirmed or suspected CVSM [5]. However, surgical intervention could be tried for treatment of this problem in horses but the costs, outcomes and invasiveness of the used surgical techniques make the surgical intervention controversial [2]. In addition, the spinal surgeries require specialized equipment and surgeon experience. Despite these concerns, several horses have been improved and returned to their previous use after cervical vertebral surgical interference [9].

There are three current surgical procedures for treatment of CVSM including: ventral interbody fusion with kerf cut cylin-

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ders, ventrally placed locking compression plate fixation and dor-
sal laminectomy [10]. The first technique is the commonly applied
procedure for cervical stabilization. All of these procedures have
many disadvantages like instability in tension, anatomical consid-
eration like the shape of the ventral vertebral body and limited
flexibility in screw placement with the construct [11]. Moreover,
several complications are recorded such as seroma, right laryngeal
hemiplegia, colitis, implant migration, implant failure, spinal cord
edema and vertebral fracture [10,12].

Therefore, there is a great need for development of new surgical
techniques to overcome the aforementioned drawbacks, minimize
the complications and improve outcomes of the surgery. This study
evaluated the clinical outcomes and complications of a new surgi-
cal technique for cervical stabilization in a 16-month-old Arabian
filly with CVSM. We hypothesized that this novel surgical tech-
nique would provide greater level of improvement postoperatively
with fewer catastrophic complications in comparison with the cur-
cent described procedures.

2. Case presentation

A 16-month-old Arabian filly was presented to the surgery
clinic at Faculty of Veterinary Medicine, Cairo University, Egypt,
with symmetrical grade 4 ataxia.

According to the owner information, the filly showed mild
lameness just after birth and the lameness became more severe
over time. There were no histories of any trauma, ataxic horse in
the family, transportation from its locality and contact with un-
known animals.

Upon presentation, the filly showed spasticity and weaken hind
limbs, stumbling, toe dragging, hypermetria during walk and trot
as well as truncal sway at walk. Tight circling revealed swinging
of the outer hind limb very wide, pivoting on the inside limb. In
addition, the filly could not be walked backward with a risk of loss
of balance and falling.

Clinical examination revealed no abnormalities in the body
temperature, heart and respiratory rates, lymph nodes and mucous
membranes. The filly had normal urination, defecation and food
intake and showed no symptoms of infectious diseases. Complete
blood count, serum chemistry, micro- as well as macro-element
and vitamin E analysis showed no abnormalities.

On palpation of the neck, stiffness and reluctant to flex easily
were noticed. The animal responded painfully to the neck flexion
test.

Based upon Mayhew scale, the filly showed 4/5 gait deficits be-
cause the animal was very ataxic and nearly fell at normal gaits,
in tight circles or backing [13]. The neurological investigation re-
sulted in normal mental status of the animal, absence of cranial
nerve deficits (absence of impaired vision, head tilt, and inability
to eat, drink or swallow) and normal spinal reflexes according to
Johnson [14]. Based on results of the neurological examination, the
lesion was localized to the cervical spinal cord. Therefore neck ra-
diography was performed. Lateral cervical radiography revealed no
abnormalities (Fig. 1).

Based upon the case history and clinical, neurological as well as
radiography findings, congenital wobbler syndrome was suspected.
The diagnosis was confirmed by lateral cervical myelogram using
50 mL Iohexol contrast agent injected under general anesthesia
through atlanto-occipital space into subarachnoid space after as-
piration of 50 mL cerebrospinal fluid (CSF) [15]. Radiographs were
then taken immediately to visualize areas of spinal cord compres-
sion when the neck was neutral, flexed and extended. The CSF
was sent to the laboratory for routine examination. The myelo-
gram revealed dynamic compression of cervical spinal cord during
flexed position of neck at C3 – C4 and C4 – C5 levels as shown in
Figure 2. The compression of cervical spinal cord at C3 – C4
was more severe than at C4 – C5 levels. The laboratory analysis
revealed normal clear and colorless CSF. Also CSF had normal pro-
ctein concentration (60mg/dl), normal cell count (4 mononuclear
cells/μL), absence of RBCs and eosinophils.

Prior to the surgery, systemic antibiotics (potassium penicillin
at a dose of 22 000 IU/kg IV and gentamicin at a dose of 6.6
mg/kg IV) and non-steroidal anti-inflammatory phenylbutazone
(4.4 mg/kg IV) were given to the filly.

The filly was sedated with Xylazine HCl at a dose of 1.0 mg/kg
IV for premedication and general anesthesia was induced with Ke-
tamine HCl at a dose of 2.2 mg/kg IV and diazepam at a dose of
0.1 mg/kg IV. General anesthesia was maintained by sevoflurane
inhalant in oxygen.

For a ventral approach to the cervical spine, the filly was posi-
tioned in dorsal recumbency with the head and neck in a slightly
extended position and held in position by a foam cushion that sta-
bilized the neck in a vertical position. The forelimbs were tied in
a moderately flexed position and pulled somewhat caudally. The
steps of surgery are shown in Figure 3. About 20-cm skin inci-
sion was performed on ventral midline, centered over the affected
cervical vertebrae. By blunt dissection, the sternohyoid and ster-
nothyroid muscles were separated on the midline to the level of
the trachea, which was exposed and reflected to the left side. The
trachea, carotid artery and vagosympathetic trunk were protected
with moistened gauze pads, and a wound retractor was positioned
at the incision to access the longus colli muscle. After digital pal-

Figure 1. Lateral radiograph demonstrating normal cervical vertebrae.

Figure 2. Myelogram demonstrating dorsal dye column compression in the dy-
namic (flexion) phase. Arrows point to areas of dorsal dye column compression.
pation of the ventral aspect of cervical vertebrae, the longus colli muscles were reflected from the cervical vertebral bodies by dissection.

Levelling the ventral surface of C3-C4 was performed by removing the ventral crest with a rongeur. The intervertebral spacer (Fig. 4) was placed vertically on the overlying part of C3 vertebral fossa to define the margins that should be removed to prepare the template for the spacer. These borders were removed using chisel and hammer. The intervertebral disc was then removed carefully using the bone curette.

Partial head osteotomy of C4 was performed using hammer and chisel at 45 degrees from the vertical to accommodate placement of the titanium intervertebral spacer. Then, the vertebral fossa of C3 was curetted under saline irrigation as deep as the spacer could be placed and fully embedded without any protrusion above the level of the vertebral body to avoid over bending of the plate. The intervertebral titanium spacer (2 cm x 2 cm x 0.5 cm) was fully inserted into the defect using the spacer handle and placement was confirmed fluoroscopically. After inserting the spacer in the curetted cavity, an awl was used instead of the drill bit to avoid hitting the spinal cord, to insert the screws. An entry in the head of C4 for the screw was carried out by the awl. Straight pedicle was pushed through the spongy bone of the body of C4 to the nearest point of the spinal cord. Then, 6.5 mm cancellous, self-tapping low profile 20 mm long screw was inserted and tightened with the driver. A second screw was inserted and tightened as the first screw and both screws’ heads were embedded in the spacer.

After measuring the length from the center of C3 to the center of C4, the appropriate titanium plate was applied (10 cm long x 4 cm wide x 6 mm thick) after bending as needed (Fig. 4). The awl was used to prepare entry for the pedicle in each hole of the plate. The pedicle was marked considering the depth of the vertebral body plus 6 mm (plate thickness), then pushed in the vertebral body. Four 6 mm diameter x 25-30 mm long titanium self-tapping cancellous screws with reversed serrations (to obtain maximum purchase in the bone) were used to fix the plate into the cranial and caudal vertebrae, 2 cm from the defect on either side of midline and 2 cm cranial or caudal to the edge of the spacer to obtain maximum holding in spongy bone of vertebral body. The screws were inserted diagonally then washer was fixed over the heads to minimize the risk of screw bulging out.

The position of the plate and screws was confirmed by intraoperative radiography before wound closure.

Lavage of the incision was carried out by normal saline. The deep muscles were sutured in simple continuous pattern with 1 polyglactin 910 (Egycryl, Taisier-Med, Egypt). Then the superficial muscles and subcuticular layers were sutured by simple continuous pattern with 0 polyglactin 910. The skin wound was closed by stainless steel staples and covered with adhesive bandage. The filly recovered well from general anesthesia.

Postoperative care included; potassium penicillin 22 000 IU/kg IV every 6 hours and gentamicin 6.6 mg/kg IV every 24 hours,
phenylbutazone 4.4 mg/kg IV every 12 hours for 4 days as well as subcutaneous injection of 3000 IU anti-tetanic serum at once. The wound was daily dressed with povidon iodine solution and the skin stitches were removed after 10 days of surgery.

The filly was confined to a stall for the first month postoperatively. Then, stall/run turnout with hand-walking was done 10 minutes twice daily for the second month postoperatively. After two months postoperative, the filly was allowed access to small paddock turnout with hand-walking 30 minutes twice daily. Then, the filly was allowed to retain normal exercise, training and turnout after 3 months post-surgery. The filly was followed up for eight months postoperatively through clinical findings, neurological assessment, radiography and owner contact.

No complications were recorded in this case up till eight months postoperatively. Only moderate seroma around the neck was observed at the second day of surgery, therefore one of the lowest skin stitches was removed in order to drain the fluid.

Neurological examinations based on the modified Mayhew scale were performed prior to surgery and at three and eight months postoperatively. The examinations were videotaped and assessed by two equine specialists who were blinded to time points. Ataxia improved from 4/5 (before surgery) to 0/5 at three and eight months postoperatively (Video 1).

Cervical radiography was carried out before surgery and postoperatively following recovery from general anesthesia, and at 3 months postoperatively. The radiographs were examined for implant failure, implant migration, stability and angulation of the spinal unit. All postoperative radiographs revealed placement of the plate and spacer in place and no radiographic abnormalities. Evidence of complete cervical arthrodesis and stabilization was noticed in the radiograph at 3 months postoperative (Fig. 5).

3. Discussion

Cervical vertebral stenotic myelopathy (CVSM) is the classic form of the wobbler syndrome and is produced by spinal cord compression at the cervical level.

The hypothesis of this study was accepted and the filly was completely recovered from CVSM after treatment with the new surgical technique. The new technique consists of decompression of the spinal cord through cervical arthrodesis and stabilization using specialty designed titanium intervertebral spacer and plate.

Wobblers can be caused by genetic spinal abnormalities, injury or infection injury such as equine protozoal myeloencephalitis [16]. In this respect, the cause of the present case is suspected to be congenital cervical vertebral malformation. Mostly, CVSM is caused by cervical spinal cord damage because this part of the spine is highly mobile.

The presented filly suffered from ataxia, abnormal gait, stumbling and stiff neck (Grade 4/5, Mayhew system). Mayhew system assigns a number 0 to 5. The characteristics of each grade are as follows: Grade 0: normal, Grade 1: minimal neurological deficits noted with normal gaits, Grade 2: mild abnormal gaits seen at a walk, Grade 3: easy to see at a walk and look like a drunken camel, Grade 4: very ataxic and will fall especially in tight circles or backing and Grade 5: recumbent animal.

The clinical signs of CVSM in equine are neurological in origin due to the disruption of signals between the brain, spinal cord and rest of the body [17]. Similar findings were recorded in Thoroughbred yearling [18].

Plain radiography has limited diagnostic value in horses with CVSM as it only allows observation of the top and side of the spinal column. It is not possible to observe the spinal cord with x-rays. Therefore, we confirmed the diagnosis of the present case by myelography. Advanced diagnostic imaging like CT and MRI is also recommended to confirm CVSM in equine [19] but we did not use them in the present case due to their unavailability.

Sometimes, horses with CVSM respond well to treatment and can return to normal work. However, other cases of wobblers can be permanent and progressive [4–6]. Therefore, early diagnosis and treatment are crucial to avoid poor outcomes. Until now, very limited options are available to treat horses with CVSM, most of them being euthanized. However, this option is not suitable for many horse owners [18].

Patient positioning has a crucial role in vertebral surgery than in other surgeries and needs more attention by the surgery team. For a ventral approach to the cervical vertebrae, the horse is positioned in dorsal recumbency with the head and neck extended and held in position by a foam cushion or custom made wedge pads that stabilize the neck in a vertical position [11]. The forelimbs are tied in a moderately flexed position and moved somewhat caudally for accessing the caudal neck and positioning of the X-ray equipment [20]. Also, radiographic images during vertebral cervical surgeries are essential pre-, intra- and postoperatively.
The surgery aims to fuse the vertebral bodies responsible for the compression. Once the cause for the narrowing is eliminated, the spinal cord needs time to heal [11,18]. Therefore, complete recovery of the present case was recorded after three months of surgery.

In this case report, we described an alternative surgical procedure for use in equine CVSM. We used a specially designed titanium plate with screws for cervical stabilization in the presented filly. This technique resulted in osseointegration within 3 months with no complications like implant failure, migration or spinal unit instability reported. In addition, the polyaxial pedicle screw head allowed for increased screw placement options in comparison with the previously described procedures, particularly locking compression plate method that is limited by the anatomical consideration of the ventral keel of the cervical vertebrae [9].

Regarding our novel technique, removing the ventral crest and levelling the ventral surface of C3-C4 is one of the most important steps in our technique to produce an appropriate alignment between the vertebrae and the plate, so rongeur was preferred. One of the challenges in this technique was determining the inclination angle of partial head osteotomy of C4 and we recommend an angle of 45 degrees to achieve superior outcome for more fixation and minimum complications. We used hammer and chisel during partial osteotomy for more accuracy and safety. Moreover, we used a curette for removing the intervertebral disc after measuring its depth on the radiograph to avoid injury of the spinal cord by marking the curette on the basis of the radiograph. Removal as much as possible from the intervertebral disc was carried out to obtain the best result of arthrodesis as mentioned before [9]. The size of intervertebral spacer should be smaller than the size of the vertebral body. Therefore, we used 2cm x 2cm x 0.5cm titanium intervertebral spacer.

Due to financial concern, we preferred to correct the compression at C3-C4 where the compression was more severe than that at C4-C5. Interestingly the arthrodesis and stabilization at C3-C4 improved also the compression of spinal cord at C4-C5. Therefore, the filly recovered eventfully without any complications.

Owner cooperation and commitment before surgical interference are absolutely necessary and they must be completely informed of the risks, financial liability, and responsibility involved in making such a decision. Our results obtained in this case study encourage further assessment of this novel procedure in horses clinically affected by CVSM.

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Supplementary materials


References