Case Report

Unilateral polydactyly in two foals

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Summary

This case report describes unilateral supernumerary digits of the forelimb in two foals. A diagnosis of polydactyly of the right forelimb in one case and of the left forelimb in the other was made by clinical examination and radiographic interpretation. Surgical excision was performed under general anaesthesia with a good cosmetic and functional outcome in both cases.

Introduction

Polydactyly is a congenital anomaly defined as the presence of supernumerary digits (Giofre et al. 2004). It has been described in different species and its occurrence in horses is rare (Barber 1990). In about 80% of the equine cases reported, the supernumerary digits are found on the medial aspect of a forelimb (Frew and Wright 1990; Trumble 2005); however, bilateral or pelvic limb involvement has been reported (Carstanjen et al. 2007).

The aetiology of polydactyly in horses remains unknown; however, it has been associated with adactyly, congenital arthrogryposis and jaw abnormalities. The most accepted classification for polydactyly is: (1) the teratological form or schistodactyly that results from teratogenic splitting of the bipodial elements, predominantly of metacarpal and metatarsal bones II and IV, (2) the atavistic form in which the supernumerary digit arises from the distal end of metacarpal or metatarsal II and IV, similar to the three digit ancestors of the horse, and (3) the bilateral symmetric inherited form is an inherited condition in dogs and poultry, which is also suspected to occur in horses (Barber 1990). Polydactyly may be associated with serious complications, including angular limb deformities and joint instability (Trumble 2005).

This report describes two successful cases of unilateral medial polydactyly in foals treated surgically, including one individual with a long-term outcome.

Description case 1

A 4-month-old Thoroughbred filly was referred to the first author’s clinic for surgical removal of a supernumerary digit on the right forelimb. Clinically, the filly was healthy with no lameness or locomotion disturbances. The studfarm had no history of polydactyly and the sire and dam were anatomically normal. The right forelimb presented with a small supernumerary digit on the medial aspect above the fetlock. The digit had a hoof with a small concave sole without an ergot (Fig 1). The filly showed no signs of pain on palpation or manipulation of the digit.

Radiographs revealed a supernumerary digit originating from distal metacarpal bone II with development of the three distal phalanges and a single proximal sesamoid bone (Fig 2). No abnormalities were detected in the contralateral limb or hindlimbs.

The clinical and radiographic findings of this case were considered to be the atavistic or developmental form. Surgical excision was suggested for cosmetic reasons and in order to prevent possible injury during training in the future.

Description case 2

A 2-day-old Selle Français foal was presented to the fourth author’s clinic with a supernumerary left forelimb digit (Fig 3). The extra digit was not sensitive to palpation and appeared to be joined to the medial proximal third metacarpal bone ending at the level of the fetlock in a small corneal extremity. A moderate valgus angular limb deformity of the fetlock was evident.

Radiographs revealed the presence of a hypertrophied metacarpal bone II, articulating distally with two proximal sesamoid bones and an incomplete proximal phalanx (Fig 4). There was also a rudimentary metacarpal bone I articulating with carpal bone I and an adaptive hypertrophy of the radial carpal bone. Surgical excision was also performed in this case.

Surgical technique

Two surgical methods have been described for the excision of supernumerary digits: (1) ex-articulation of the fetlock joint or (2) osteotomy and amputation from distal metacarpus II (Stanek and Hantak 1986). The second method which yields a better cosmetic result was performed in both of these cases.

Anaesthesia and medication

Pre-anaesthetic clinical examination and haematology findings were within normal limits. One hour prior to anaesthesia, the foals received procaine benzylpenicillin (22.000 IU/kg bwt i.m.), gentamicin (6.6 mg/kg bwt i.v.) and flunixin meglumine (1.1 mg/kg bwt i.v.). Premedication administered was: detomidine (0.02 mg/kg bwt i.v.) and butorphanol (0.04 mg/kg bwt i.v.).

General anaesthesia was induced with diazepam (0.05 mg/kg bwt i.v.) and ketamine (2.2 mg/kg bwt i.v.). The foals were intubated with an orotracheal tube and placed in lateral recumbency for a medial approach to the lowermost limbs. General anaesthesia was maintained with isoflurane vaporised in oxygen. The cardiovascular status was...
monitored by means of electrocardiogram, pulse oximetry and invasive arterial pressure. The foals received i.v. Ringer's lactate at 4.4 mL/kg bwt/h.

**Surgical anatomy and procedure**

The affected forelimb was prepared aseptically from the carpus distally to the level of the hoof. A tourniquet was placed proximal to the carpus to facilitate haemostasis during surgery.

An elliptical incision around the supernumerary digit was performed from 10 cm proximal to the actual metacarpophalangeal joint and continued distally to curve around both the dorsal and palmar aspect of the base of the supernumerary digit (Fig 5). The subcutaneous tissue was bluntly dissected to the level of the periosteum of the supernumerary digit.

The supernumerary digit of Case 1 presented similar skeletal anatomy to a normal digit with a metacarpophalangeal joint with only one proximal sesamoid bone (Fig 6), three phalanges with proximal and distal interphalangeal joints. The soft tissue anatomy comprised an extensor tendon inserting on dorsoproximal P3, superficial and deep flexor tendons, and a suspensory ligament with distal sesamoidean ligaments either side of the sesamoid bone. Innervation and vascularisation were supplied by a singular axial vein-artery-nerve bundle.

Case 2 had a defined metacarpophalangeal joint with two proximal sesamoid bones with flexor and extensor tendons. The skeletal anatomy differed as the second and third phalanges were absent; the supernumerary digit ended with a tapered first phalanx supplied by biaxial vein-artery-nerve bundles.
The extensor tendon was isolated and transected at the origin on the medial aspect of the long digital extensor tendon (Fig 7). Blood vessels were identified, ligated and transected at the most proximal aspect of the incision. Neurectomy of the nerves was performed above the level of the planned osteotomy.

Blunt dissection of the soft tissue between the supernumerary digit and metacarpus III was performed until about 4 cm proximal to the supernumerary metacarpophalangeal joint, allowing more movement of the extra digit and facilitating the osteotomy (Fig 8).

A bevelled osteotomy of metacarpus II was performed about 5 cm proximal to the fetlock joint with an osteotome and the edges were rounded with a bone rasp. The distal third of metacarpus II and the supernumerary digit were removed (Fig 9).

The surgical site was flushed with Ringer’s lactate before closing the periosteum in a continuous pattern with polyglycolide monofilament 3/0 to prevent new bone formation at the osteotomy site.

The subcutaneous tissue was sutured in a continuous pattern with polydioxanone monofilament 2/0. The skin was sutured in a continuous locking pattern with nylon 2/0.

The post-operative cosmetic appearance was good, the tourniquet was removed and a modified Robert-Jones bandage was placed from the hoof to the distal carpus. The foals recovered uneventfully from general anaesthesia.

Post-operative care and follow-up

Three days of antibiotic treatment (22,000 IU/kg bwt procaine benzylpenicillin i.m. b.i.d. and 6.6 mg/kg bwt gentamicin i.v. s.i.d.), 5 days of anti-inflammatory treatment (1.1 mg/kg bwt flunixin meglumine per os i.v. b.i.d.) and anti-ulcer medication (1.1 mg/kg bwt omeprazole per os s.i.d.) were administered.

The foals were discharged 5 days after admission with instructions for stable confinement for 4 weeks followed by paddock rest for a further 2 weeks. A bandage change was advised every 4 days until removal of the stitches 10 days post surgery.

Six months after the surgery, both cases were sound and no aesthetic abnormalities were visible (Fig 10).

Long-term follow-up

Long-term clinical follow-up of Case 2 was performed 2 years after surgery. There was no lameness and no angular limb deformity.

Radiological examination (Fig 11) revealed a nonreactive osteotomy site and an absence of joint instability, due to the solid fusion of the metacarpal bones II and III which appeared only partial on radiography but was shown to be
complete on MRI examination of the region (Fig 12). MRI details the cross-sectional relationship between the abnormally large well-developed first carpal bone with the second, third and fourth carpal bones articulating with their four respective metacarpal bones (Fig 13). Ultrasound examination of the proximal metacarpal area was also performed, and revealed a complete residual supernumerary palmar flexor apparatus (Fig 14). Telephone follow-up 8 years later with the owner revealed that the horse performed at the expected level as a recreational sport horse.

Discussion

To the authors’ knowledge, this is the first reported case where MRI and ultrasound have been used to better understand an equine supernumerary digit excision and the first case where the long-term outcome (8 years) is provided. Polydactyly is usually easily diagnosed by clinical examination and definitive diagnosis is made by radiographs (Ahmed 2014). Polydactyly can be associated with abnormalities in the carpal bones (Barber 1990); therefore, radiographs should include the metacarpus II, metacarpus IV and the carpus.

Classification of polydactyly in one of the three forms is important for surgical consideration. Surgical excision is mainly recommended for cosmetic reasons (Carstanjen et al. 2007). Osteotomy and amputation of the affected distal metacarpal is the technique of choice as it results in a better cosmetic result (Stanek and Hantak 1986) and ex-articulation of the phalanges of the supernumerary digit can cause post-operative lameness.

Three-dimensional cross-sectional imaging with MRI and CT has become more readily available to the equine veterinary market and is instrumental in better understanding these congenital deformities. In Case 2, it was not possible to determine if there was adequate fusion between metacarpus III and metacarpus II on the follow-up radiographs; however, the MRI images show clear evidence.
of complete fusion and resultant stability of the articulations with the distal row of carpal bones. Preoperative MRI would enable more precise surgical planning and give the surgeon a more thorough understanding of the variable skeletal anatomy and soft tissue structures associated with supernumerary digits. A recent case report used CT to
describe the features of a unilateral cloven-hoofed foal as a pseudo-polydactyly case (Valbonetti et al. 2015).

Malformations affecting the limbs are among the most common congenital malformations in human subjects (Talamillo et al. 2005). Work on chick embryonal development has helped to better understand embryonal limb development. By manipulating growth factors and grafting of limb buds (in chick embryos), it is possible to mimic different forms of polydactyly (Talamillo et al. 2005). Despite recent advances in understanding the embryonic origins of these malformations, they are highly complex and possibilities for interference are numerous.

In human subjects, polydactyly may be regarded as common and even though it may be an indicator of other potentially serious congenital defects, the understanding of the aetiology still needs much work. In equids, the aetiopathogenesis has largely been extrapolated from the human literature, so reporting on cases like this and the use of advanced imaging techniques adds to a database for this rare congenital defect.

Authors’ declaration of interests

No conflicts of interest have been declared.

Ethical animal research

Clinical case report, no ethical approval is required for this condition.

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Authorship

All authors contributed towards management of the clinical cases and preparation of the manuscript.

References