Application of the Polyvinylchloride Pipe as a Splint for Comminuted Fracture of the Proximal Phalanx (PI) in a Pony

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ABSTRACT

A 9-month old crossbred, 165 kg, male painted pony was presented with severely lameness, pain, and swelling of the proximal phalanx (PI) of the right forelimb. A history taking revealed an accidental slippery at the pasture while it was running. Radiographic examination revealed severely comminuted fracture of the proximal phalanx (PI). External coaptation was performed as fracture stabilization method. The pony was anesthetized and subsequently, the ¾ limb supporting Robert Jones bandage (RBJ) was applied by using a larger of cotton wrap with external support from a polyvinylchloride (PVC) pipe. The inner layer of RBJ was changed every two weeks but the PVC pipe was used until the fracture healed. An optimum fracture healing and a good return to function were achieved within a period of 7 months. However an athletic function may not possibly gain. The advantage of using the PVC pipe is a lower cost of treatment when compared to other commercial...
fiberglass cast. The effectiveness of using the PVC pipe in this report support the role of this material as an alternative for treatment of severely comminuted PI fracture in young pony.

Key words: proximal phalanx, comminuted fracture, polyvinylchloride pipe, splint

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Introduction

Comminuted fracture of the proximal phalanx (P1) can cause acute, non-weight bearing lameness. This condition usually results in limb deformity of equine patients. The comminuted fracture of P1 can occur during racing or as pasture accident injury (Richardson 1999). Theoretically, the comminuted fracture of P1 can be defined as several fracture lines with three or more major segments of bone (Denny 1989, Kraus et al 2004). Two types of PI comminuted fracture, moderate and severe, are defined in equine species (Kraus et al 2004). The moderate comminuted PI fracture is the fracture having one fragment that extended the length of the bone (intact cortex) which is possible to be reconstructed with internal fixation. In contrast, the fracture that have no intact length of cortex and all fragments of bone could not be reconstructed is characterized as severely comminuted PI fracture (Kraus et al 2004). At least two radiographic views, dorsopalmar and lateromedial, are needed for accurate diagnosis (Denny 1989).

Principally equine fracture treatment methods can be divided to conservative and surgical methods (Auer 1999). Conservative treatment can be stall rest, external coaptation, for instance splints or casts. The surgical treatment can utilize external fixation that can be used transfixation or external fixator device (Auer 1999, Joyce et al 2006). The common complications from all methods are; bone infection, nonunion, contralateral limb injury due to weight shifting. Euthanasia may be required in some cases. Generally, the P1 fracture of horse is always severely comminuted type making it become a good candidate to be treated with external coaptation, for instance, a cast with transfixation pin or with an external skeletal fixation apparatus (Richardson 1999). However aforementioned techniques and materials are always expensive for the horse owners. Appropriate limb stabilization, such as, Robert Jones bandage (RJB), is needed at the beginning (Campbell 1996) followed by, the external coaptation that applies to stabilize the fracture and to partially support the weight bearing of the affected limb (Smith 2006). The moderately PI comminuted fracture may require only lag screw technique or in combination with dynamic compression plate to reconstruct the bone fragment (Kraus et al 2004). One example of the external coaptation is walking cast technique being considered as the treatment option of severely PI comminuted fracture (Denny 1989).

The purpose of this article was to report an outcome from the technique using external coaptation by applying polyvinylchloride (PVC) pipe and cap as a splint to stabilize the severely PI comminuted fracture in a young pony.
History and physical examination

A nine-month crossbred painted pony, weighing 165 kg, was presented to the equine clinic, Kasetsart University Veterinary Teaching Hospital at Kamphaengsaen with severely (grade 4 or 5) lameness, signs of pain and swelling of the proximal phalanx (PI) of the right forelimb. There was no opened wound at fracture site. From history taking, a pony had a pasture accident (slip and fall accident) five days ago and had showed sudden lameness. Previous treatments were nonsteroidal anti-inflammatory drug administration and temporary external coaptation made from several wood sticks to provide stabilization of the lower limb (fetlock to hoof). At the equine clinic, general physical examination and orthopedic examination were performed. The degree of lameness was still within an acceptable limit for treatment.

Radiographic examination

The radiography of the distal right forelimb was performed in lateromedial and dorsopalmar views. From the radiographic images, the pony had the severely P1 comminuted fracture demonstrated without an intact strut. A lack of inherent stability of bones and soft tissue swelling of the fetlock and pastern area were detected (figure 1 A, B).

External coaptation

No opened wound was detected at the fracture site. Since there was no intact length of cortex, the reconstruction of bone fragments was not possible. Therefore non-surgical method using external coaptation was chosen. Due to money constraint and non-athletic career of the horse, the alternative material was selected to replace an expensive fiberglass cast to minimize the cost of the treatment. The polyvinylchloride (PVC) pipe was selected as an alternative splint. The PVC pipe can be divided in a half splint and use as one or two plastic gutter splint covering around RBJ bandage at the fracture area, depending on anatomy and treating purposes (Campbell 1996). Since the pony was still young and had light weight as well as the a pony leg was rather small in size, we decided to use total PVC pipe as a splint and cover the bottom PVC hole with PVC cap. The pony was sedated with Xylazine hydrochloride (1.1 mg/kg body weight) and anesthetized with Ketamine hydrochloride (2.2mg/kg body weight). The duration of anesthetic drug was long enough for the external coaptation procedure. The heel of affected limb must be adjusted to an elevating position and interphalangeal joints have to flex in order to make PI and third metacarpal bone in the longitudinal alignment (Richardson 1999). Subsequently, the standard Robert Jones bandage (RBJ) was applied for 3/4 of total limb length and was supported with large amount of cotton wool (1.5 times thicker than that from
distal third) in upper one third of the bandage. Then the polyvinylchloride (PVC) pipe (diameter about 4.5 inches) was applied to cover the limb from hoof to mid radius level. An elastic tape was placed around the proximal end of PVC pipe and skin and the distal end of the pipe was closed with PVC cap. The RBJ was changed every 2 weeks otherwise it had been loosed, but the PVC pipe was used until the fracture healed. The pain-killer, phenylbutazone (2.2 mg /kg body weight, orally, BID) was given to the pony for three weeks. The pony was confined in box stall before sent it back to pasture for four weeks. This technique was performed for seven months and the radiographic images were evaluated.

Results

The complete, transarticular fracture of PI with overriding pieces was detected in radiography (figure 1 A, B). The severely comminuted fracture of PI was diagnosed. Periarticular soft tissue swelling indicated soft tissue injuries around the fetlock joint (e.g. joint capsule, tendons and ligaments).

Figure 1 Showing the radiographic images of severely comminuted PI fracture both dorsopalmar (A) and lateromedial (B) views (before using PVC as external coaptation device)
Figure 2 Showing the radiographic images of healing comminuted PI fracture (after 7-month PVC – external coaptation) both dorsopalmar (A) and lateromedial (B) views.

Treatment with PVC pipe coaptation yielded optimal healing with a good consolidation of the callus across the fracture line after 7-month coaptation (figure 2 A, B). Since the foal was young, the proximal phalanx remodeled and developed closely to the normal axis. Telephone follow up was used to assess the outcome of treatment. A successful outcome was given to the pony in which the fractures healed and, if planned, was able to use for breeding. Two years after the removal of the PVC pipe the owner reported that the pony had enlarge fetlock but walked comfortably in the pasture and had been prepared for breeding purpose.

Discussion and conclusion

Generally, the fetlock joint effusion and pain due to the PI fracture are always found by the veterinarian. In this case, slip and fall accident, the bony column of PI could receive enormous load from movement of body. The sagittal ridge of third metacarpal bone acts as a pile driver upon loading causing the PI broken and displaced in the direction of sagittal, frontal and transverse plane. If PI fracture occurs in a race horse, the trotting after diagnostic anesthesia should not be done since the complete bone fracture may happen. The comminuted PI fracture of this pony was not the candidate for the surgical treatment because none of intact strut of bone was found. If an intact medial strut of bone is presented, the lag-screw reconstruction can be done (Denny 1989, Richardson 1999).

Generally, the treatment option for severe PI fracture is aimed to use transfixation casting or external fixator for salvage. One example of the external coaptation is walking cast technique being considered as the treatment option of PI comminuted fracture (Danny 1989) otherwise, the treatment with a simple external coaptation such as fiberglass cast, is recommended. Fiberglass cast can be collapsed or cracked causing the moister distributed inside the cast. This probably causes infection at the fracture area. However, we decided to use polyvinylchloride (PVC) pipe and cap as the coaptation device. During applying RBJ bandage, the elevation of affected heel and flexion of the interphalangeal joints were performed to prevent the tendons and ligaments on the palmar aspect subject to more injury. A compression RBJ was applied on the affected limb to stabilize the bone fragments in certain degree and to reduce soft tissue swelling.

In walking cast technique, the weight of the limb transmitted from the pin through the steel frame attaching at the hoof (Denny 1989). Half limb cast also reduced transferring of weigh-bearing load to the distal part of the limb (Schneider et al 1998). Since the upper one third of PVC pipe was extra fit to the RBJ bandage by extra thickness of cotton wool, the weight of PI fracture limb probably diverted to the PVC pipe splint covered the affected limb.
The future enormous callus of PI fracture could make PI shortening, partial ankylosis of the fetlock, osteoarthritis resulting in lameness (Denny 1989). The normal contralateral limb had to be loaded more weight and could develop laminitis or tendinitis of the deep digital flexure tendon (Denny 1989). However, there was no complication of contra-lateral limb. This was probably due to the pony body weight diverted to the PVC pipe and cap. Additionally, the pony was young and the body weight was not much helping the fracture successfully healed. Since the pony was a painted pony, the owner decided to use the pony for the breeding purpose. In conclusion, the PVC pipe as splint combining with the RBJ bandage for external coaptation caused optimum fracture healing for severe comminuted PI fracture in a pony. The advantages of PVC pipe are cheap, strong and easy to find as well as water resistance. The result from this report suggests that the PVC pipe and cap could be an alternative external coaptation device for the equine veterinarians in practice, especially for fracture stabilization of the young pony.

References


