Lag Screw Fixation of a Slab Fracture in the Third Carpal Bone in a Korean Racehorse

Yeong-Hun Kim*,** and In Ho Cho**1

*Doctor Im Horse Clinic, Gwacheon 13822, Korea
**Korea National Sport University, Seoul 05541, Korea

(Received: May 07, 2020 / Revised: June 25, 2020 / Accepted: July 01, 2020)

Abstract: A 3-year-old male Thoroughbred serving as a Korean racehorse named RAON PORTEOUS presented with acute lameness concomitant with edema and fever in the right carpal joint after completing a horse race. Through radiological examination using lateromedial oblique, flexed lateromedial oblique and dorsopromixal-dorsodistal oblique views, the horse was diagnosed with a slab fracture in the 3rd carpal bone of right forelimb. The fracture was surgically approached and corrected by applying 4.5 mm lag screw fixation during surgery. At eight months post-surgery, the horse was able to return to racing and has had successful racing performances with two wins and several prizes in the last 8 months. This is the first reported case of the successful use of lag screw fixation surgery in Korea with the horse showing complete recovery from a severe injury that is often considered fatal in a racehorse.

Key words: racehorse, 3rd carpal bone, slab fracture, lag screw fixation.

Introduction

The carpal joint is a common injury site in racehorses, and carpal joint injury concomitant with osteoarthritis, osteochondral fragments, or slab fractures is one of the main reasons for lameness, which significantly affects the performance of racehorses (3,7). Racehorses, particularly young horses are predisposed to carpal joint injury due to hyper-extension of the carpal joint during repetitive concussive work and the requirement for intensive exercise and high-speed performance (9). Performance immaturity, conformational defects, fatigue, improper foot trimming or shoeing, and inappropri-

Table 1. Details on the Korean racehorse RAON PORTEOUS (http://studbook.kra.co.kr/html/info/ind/s_majuck.jsp)

<table>
<thead>
<tr>
<th>Horse Name</th>
<th>RAON PORTEOUS</th>
<th>Registration Number</th>
<th>038305</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foaling Date</td>
<td>20-04-2015</td>
<td>Sex</td>
<td>GELDING</td>
</tr>
<tr>
<td>Color</td>
<td>Bay</td>
<td>Breed</td>
<td>Thoroughbred</td>
</tr>
<tr>
<td>Life Number</td>
<td>USA15010391</td>
<td>Country of Foaling</td>
<td>U.S.A.</td>
</tr>
<tr>
<td>Exporting Country</td>
<td>U.S.A.</td>
<td>Imported Date</td>
<td>23-12-2016</td>
</tr>
<tr>
<td>Original Name</td>
<td>Colt out of HARBOR CRUISE</td>
<td>Breeder</td>
<td></td>
</tr>
<tr>
<td>Owner</td>
<td>Raon Industrial Co., Ltd.</td>
<td>Stud Book Reference</td>
<td>American Stud Book VOLUME 32</td>
</tr>
<tr>
<td>Foal Registration Date</td>
<td>02-11-2018–22-07-2019</td>
<td>Racehorse Registration</td>
<td></td>
</tr>
<tr>
<td>Sire Name</td>
<td>Street Boss</td>
<td>Country of Foaling</td>
<td>U.S.A.</td>
</tr>
<tr>
<td>Dam Name</td>
<td>Harbor Cruise</td>
<td>Country of Foaling</td>
<td>Foaling Year</td>
</tr>
<tr>
<td>Race Records</td>
<td>11 Runs 4 Wins 1 Second</td>
<td>Total Earning</td>
<td>192,900,000 KRW</td>
</tr>
<tr>
<td>Foreign Race Records</td>
<td>UNRACED</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1Corresponding author.
E-mail : judo69@knsu.ac.kr
ate track surfaces are common sources of injury of the carpal bones (9). Fractures of the third carpal bone in horses most frequently involve slab fractures that extend from one to another articular surface (10). Often, slab fractures are severe cracks throughout the third carpal bone between joints, and the fractures are commonly divided into two clinical patterns: frontal plane fracture or sagittal plane fracture (10). Notably, frontal plane fractures occur most commonly in Thoroughbred racehorses (10). The primary therapeutic methods for carpal joint fractures include surgical and non-surgical treatments (6). Small chip fractures can be removed arthroscopically, and horses demonstrating non-displaced carpal fractures are usually able to return to racing after non-surgical treatments such as stall resting and intra-articular injections (6). However, degenerative osteoarthritis can be induced in those cases; thus, such cases require careful and continuous monitoring (4). Prognoses for slab fractures with clinically degenerative signatures are usually poor and, compared to non-surgical methods, surgical methods can provide better clinical outcomes (6). The purpose of this report is to describe a successful outcome following lag screw fixation of a slab fracture of the 3rd carpal bone in a Korean Thoroughbred racehorse.

Case

The Korean racehorse, RAON PORTEOUS (Table 1), was presented to the hospital at Let’s Run Park in Seoul, Korea, after a race (April 1, 2018) with severe lameness of the right forelimb. A fever and edema in the right knee were revealed upon examination, and his carpus presented as the source of severe pain in a flexion test. Radiographical examination via lateromedial oblique (Fig 1A), flexed lateromedial oblique (Fig 1B) and dorsopromixal-dorsodistal oblique views (Fig

![Fig 1. Pre-operative lateromedial oblique (Fig 1A), lateromedial oblique (Fig 1B) and dorsopromixal-dorsodistal oblique (Fig 1C) views of carpal bone.](image-url)
Fig 2. Intraoperative radiographic projections of a slab fracture of the third carpal bone. (A) and (B) Percutaneous needle markers. (C) 4.5 mm guide hole. (D) 2.5 mm threaded hole. (E) 4.5 mm diameter cortex screw.
Yeong-Hun Kim and In Ho Cho

2B) revealed a fracture in the third carpal bone. The distance from the dorsal border of the third carpal bone to the fracture line was 13.26 mm in the dorsopromixal-dorsodistal oblique view. To resolve the fracture, we performed surgery using a lag screw fixation method.

After tranquilization with detomidine (Provet, Turkey), anesthesia was induced by injection of ketamine and diazepam. After induction of anesthesia, the horse was intubated endotracheally and positioned in right lateral recumbency. To perform the surgery, anesthesia was maintained with halogen and oxygen. Hartman’s solution was intravenously administered at a rate of approximately 10 mL/kg/h throughout anesthesia. Radiographs were taken before limb preparation, and draping was used to ensure repeatability of the precise previously determined projection that aligned with the fracture plane. Percutaneous marker needles (22 gauge) were placed under radiographic guidance (Fig 2A and B). A vertical stab incision (< 1 cm in length) using a No. 11 blade was made through the skin and directly onto the surface of the third carpal bone. A 4.5 mm guide hole was then created along the line of the spinal marker needle to the fracture plane (Fig 2C). A 2.5 mm threaded hole was then drilled to the depth determined from the preoperative radiographs, and the depth checked with a depth gauge (Fig 2D). The screw hole was countersunk and tapped before an appropriate length 4.5 mm diameter cortex screw was inserted and tightened (Fig 2E).

The horse was monitored after the operation. Procaine penicillin G (Green Cross Veterinary Products Co., Ltd, Korea) and Flunixin (Dongbang, Korea) were injected. Post-operative radiology was performed on 8th day after the surgery with same view above (Fig 3A, B and C). A sterile dressing was placed over the incisions and the operative limb with the carpus was supported with an elastic bandage over cotton. Bandages were changed every two days and maintained for

Fig 3. Post-operative (after 8 days) lateromedial oblique (Fig 1A), lateromedial oblique (Fig 1B) and dorsopromixal-dorsodistal oblique (Fig 1C) views of carpal bone.
two weeks, and stall resting was provided for one month. The horse was sent to the Raon farm on Jeju Island after being discharged from the hospital and put to pasture.

Physical examination was regularly performed during the 29-week period following lag screw fixation surgery. During that time, horse lameness was not identified, the horse exhibited a negative response to carpal joint flexion, and neither fever nor edema was present in the surgical area. Moreover, a fracture line was not visible on dorsopalmar, lateromedial, dorsolateral-palmaromedial oblique, and dorsomedial-palmarolateral oblique radiological views, and no degenerative lesions were identified (Fig 4A, B and C). Riding was started at a trot in a small racecourse for one week before full-scale horse training. The horse was trained at the Let’s Run Park (Seoul) racetrack during the period from 34 weeks to 36 weeks post-surgery and was raced in an official trial race at 36 weeks post-surgery. The horse returned to racing after the 36-week trial and subsequently participated successfully in six formal races with two wins until an accident resulting in a left medial sesamoid bone fracture happened in the middle of his last race at 67 weeks post-surgery.

**Discussion**

Injury of the third carpal bone could be disastrous in racehorses because a horse with such an injury needs a rest from racing, resulting in a decrease of race-related earnings, and such horses are often forced to retire as racehorses (2). This type of injury occurs mainly in 2- to 3-year-old horses, a period in which racehorses are deemed completely mature (9). After such an injury, both surgical and non-surgical treatments are possible, but both approaches require the horse to have significant resting periods for complete recovery (6). During that period, there is not only the cost of treatment but also, there is an expected loss related to the horse’s absence from racing (9). Thus, the need for carpal treatment and surgery may be determined by the horse’s career length and its potential wins, starts, and earnings (2). Although racing horses
with slab fractures could, occasionally, return to racing without surgery, most cases require aggressive treatment options. It has been reported that horses with successful carpal surgeries can exhibit considerable race performance including extended chances of winning and/or prizes immediately after recovery from surgical corrections (6). Nevertheless, among horses that ran in a race more than once, horses that underwent carpal surgery had higher earning than injured horses that underwent non-surgical treatment (6).

The incidence of slab fracture of the 3rd carpal bone is lower than that of other carpal problems; however, it still significantly occurs in many cases and can result in the forced retirement of the racehorse (3). Intriguingly, the incidence rate of right forelimb fracture is much higher than the left forelimb fracture (8). The higher fracture incidence in the right third carpal bone in Korean racehorses may be mainly attributed to the counterclockwise racing direction used by most racing tracks (10). Racing tracks with a clockwise racing direction are common in the UK and Asia-Pacific regions including Australia, Hongkong, and Japan; however, racing tracks in Korea and the U.S.A. operate in a counterclockwise direction (1,10). Compared to the left carpus, the right carpus would be more stressed when exercising counterclockwise; for example, there would be an increased load on the inside of the right carpus, the medial side of the right front limb, and the lateral side of the left front limb while turning the curve during the counterclockwise race.

Preoperative radiological evaluation of a fracture is critical to determine the characteristics of the fracture and the treatment method appropriate to the patients’ prognosis (1). Fracture-associated lysis, osteophyte formation, cartilage damage, and fracture fragmentation can be determined via radiological examination (2). The higher the grades associated with the above X-ray results, the worse the postoperative prognosis (2). The dorsoproximal-dorsodistal oblique view (sky view) is often a primary approach to the radiographic examination of the third carpal bone (4), and fracture types are mainly divided into 8 groups based on bone location and fracture appearance (10). In the current case, the horse’s fracture was a type-5 with a frontal plane slab fracture of the radial facet, without significant features of lysis associated with the 3rd carpal bone fracture, and osteophyte formation in the middle carpal joint in the injured area. Therefore, we predicted that our approach, using a lag screw fixation method, would provide a good prognosis post-surgery. In support of that prognosis, RAON PORTEOUS won two championships in six races and successfully made over $100,000 of prizes after returning from a slab fracture of the third carpal bone.

Conclusion

We believe our case report will be of high interest to a broad spectrum of veterinary medicine readers, especially those with an interest in equine medicine and widening treatment options. Until now, most Korean domestic racehorses are retired from their service immediately after diagnosis with a serious injury such as a 3rd carpal bone slab fracture. However, this report demonstrates a favorable outcome in which a Korean racehorse returned to a racetrack and successfully won races and achieved many prizes prior to retirement. We believe that this report will provide guidance for applying our treatment option in racehorses with potentially disastrous bone injuries during their career.

Acknowledgments

The authors would like to thank Cheol-Kyu Park and Youg-Woo Cheon in J&Co equine clinic for giving the information on the surgery.

References