[Orthopaedics]

Pelvic Fractures in Professional Cyclists: A Report of 3 Cases

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Background: Professional riders demonstrate increased risk factors for such injuries including both extensive time on the bike in addition to a possible underlying osteopenia secondary to the nonimpact nature of the sport.

Hypothesis: Nonoperative management of stable, nondisplaced pelvic fractures in professional cyclists offers excellent results.

Study Design: Case series.

Methods: Three cases of professional cyclists with pelvic fractures were reviewed.

Results: All 3 cyclists were able to return to professional competition and remain symptom free.

Conclusion: Accurate early diagnosis of pelvic fractures, with the aid of computed tomography, is crucial. Early non-weightbearing with a progression to weightbearing as tolerated and early return to stationary training are appropriate. Accurate diagnosis and careful nonoperative management of stable, nondisplaced pelvic fractures in professional cyclists offers excellent results.

Clinical Relevance: Accurate diagnosis of pelvic fractures in high-demand athletes with few complaints and no obvious findings on plain film radiographs. Control of weightbearing and competitive status to prevent injury progression. Gauged return to competition at professional level.

Keywords: professional cycling; bicycle racing; pelvic acetabular fractures

With the increasing popularity of competitive cycling in America, it is reasonable to assume that crash-related injuries will continue to increase.⁴ For professional riders the major risk factors for such injuries include both extensive time on the bike and roadways in addition to a possible underlying osteopenia secondary to the nonimpact nature of the sport.¹²

It can be assumed that clavicular and other minor fractures comprise the bulk of musculoskeletal trauma for professional cyclists, while the incidence of major bony injury such as pelvic fracture is relatively uncommon. When these injuries do occur, there is the potential that they may be misdiagnosed and improperly managed.¹

Even with the growing popularity of cycling in America and the raised awareness of professional racing, the current orthopaedic and trauma literature demonstrates a paucity of information related to skeletal cycling injuries. While acetabular fractures in competitive cyclists have been briefly studied, little remains

known in reference to other types of pelvic injuries in these athletes.² The authors present 3 cases of pelvic fractures in professional road cyclists in an effort to increase awareness in correctly diagnosing and effectively managing these injuries.

CASE 1

A 26-year-old male professional cyclist fell directly on his right hip while competing in a road race in Belgium. He complained of immediate pain to the hip significant enough to force his withdrawal from the race. Initial plain film radiographs demonstrated no evidence of pelvic or hip fracture. He was able to ride again 2 days later with pain in the right hip and a severe limp while ambulating.

Due to the amount of persistent pain experienced 5 days after falling, a bone scan was obtained and demonstrated increased uptake in the right acetabulum. The rider was then made non-weight bearing on the right lower extremity until seen by an

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Figure 1. Anteroposterior pelvic radiograph 2 weeks after a fall demonstrating no evidence of fracture.

orthopaedic specialist, who subsequently allowed him to bear weight.

Approximately 2 weeks after his initial injury, he returned to the United States for evaluation of a possible right acetabular fracture. He presented with complaints of right hip pain with prolonged walking or getting on a bike. He had been ambulating without crutches but had not been able to resume riding the bike because of pain. He also complained of mild paresthesia in the right foot. Significant findings on physical examination included an antalgic gait with normal reflexes, sensation, and strength of the bilateral lower extremities. There was pain on passive right hip flexion and with internal rotation, but no palpable points of tenderness.

Plain film radiographs again demonstrated no evidence of fracture (Figure 1). An MRI of the right hip demonstrated a nondisplaced fracture of the right acetabulum involving the tectum, medial acetabular wall and anterior column extending to the junction of the anterior column with the superior pubic ramus (Figure 2).

The patient remained non-weight bearing on the right lower extremity for 1 week after MRI findings with progression to weight bearing as tolerated. Three weeks after initial injury, he rode the stationary bike without incident. Final plain radiographs were repeated at this time demonstrating no displaced fragments and new bone formation along the medial acetabular wall (Figure 3). Six weeks after initial injury he resumed riding on the road while avoiding competition for another 2 weeks. The cyclist returned to competition 8 weeks after initial injury and remained free of further symptoms. He has reportedly performed at the same level of ability as prior to injury. Currently, 2 years after injury, the patient is training and racing competitively with no pain.

CASE 2

A 36-year-old male professional cyclist was involved in a crash and fell on his right side while hyperextending his left hip

secondary to his foot remaining clipped in the pedal. He complained of right hip pain after the crash but continued to race for 1 week postinjury, during which time he continued to have pain while seated on the bike. The pain was alleviated by frequently standing on the pedals while racing.

Two weeks after injury he noted improvement of his hip pain, but decided to seek medical attention due to the persistent nature of the pain. Physical examination revealed full range of motion of the hip with no hip pain and no radicular symptoms. The only area of significant tenderness with palpation was lateral to the left pubic symphysis.

Plain films of the left hip revealed a minimally displaced left inferior pubic ramus fracture (Figure 4). He was subsequently sent for an MRI of the pelvis, which demonstrated marrow edema indicating fractures in the left superior and inferior pubic rami, as well as the left ischial tuberosity (Figure 5). He was instructed not to ride for approximately 1 month and then to begin a gradual return. He was seen approximately 2 months after initial injury and had a normal physical examination. He returned to competitive cycling without any residual symptoms. Currently, 3 years after the original injury, the patient is pain free and is able to cycle at a high competitive level without symptoms.

CASE 3

A 32-year-old male professional cyclist was involved in a collision with a motor vehicle while training. He was struck on the left side, but was ambulatory at the scene with no injuries other than mild hip pain and a left thigh contusion. Initial plain films of the pelvis obtained in the emergency department were normal. The patient was initially able to ride without pain; however, after several days he began to notice increased pain in the right groin while ambulating or with extended rides (more than 4 hours).

Twelve days after the injury, the patient presented to his primary care physician due to mild but persistent pain. The physical examination demonstrated a normal gait with normal reflexes, sensation, and strength of the bilateral lower extremities. There was pain on passive right hip flexion and mild tenderness on palpation of the right parasymphyseal area. Plain films were again obtained and read as normal. To aid in diagnosis, an MRI was obtained, which demonstrated a fracture of the right pubic root (Figure 6).

The patient rested for 10 more days without any cycling, then was able to resume light training on a stationary trainer. Follow-up CT demonstrated no displacement of the fracture, and by 6 weeks after the injury the patient was able to resume training on the road (Figure 7). The patient was pain free 8 weeks after the injury and able to return to high-level racing, including multiday stage races, with excellent results. Currently, more than 1 year postinjury, the patient has remained pain free and is training and racing at a high level.

DISCUSSION

Competitive cycling is becoming an increasingly popular sport in America with more than 61 602 registered riders in 2006

Figure 2. MRI 2 weeks after a fall demonstrating a nondisplaced fracture (arrow) of the right acetabulum involving the tectum, medial acetabular wall and anterior column extending to the junction of the anterior column with the superior pubic ramus.

according to statistics provide by the governing body for all competitive cycling in America, USA Cycling (Andy Lee, director of communications, personal communication). This demonstrates a reported increase of 45% in riders registered during the last 5 years. Of these, approximately 270 riders are under contract with continental-based professional road racing teams, with an additional 80-plus independent riders holding professional licenses. These highly conditioned riders often spend 5 to 6 hours per day training on the road at high speed. Although these riders demonstrate great endurance, strength, and aerobic capacity, the mechanism of cycling is generally understood to be a nonimpact activity.¹²

While these riders undergo a rigorous year-round training schedule on the bike, often their programs do not incorporate impact (ie, weight bearing) exercise routines. In addition,

the huge nutritional requirements of their sport can lead to an imbalance of essential minerals, including calcium. These facts, combined with the relatively inactive lifestyle of most cyclists while off the bike, may predispose professional riders to developing early osteopenia.^{3,6,11}

Early osteopenia combined with high speeds and excessive time on the bike may present professional riders with a greater risk of having an accident involving a bony fracture. With the relatively unknown incidence and cause of fractures in professional cycling, only antidotal evidence can be cited as to when (racing vs training) and which body part is injured.⁵ In addition, anecdotal experience suggests that even after potentially devastating injuries, these riders appear to have a relatively short convalescent time, with many returning to training in the first few weeks after injury.

Figure 3. An anteroposterior right hip radiograph 3 weeks follow-up demonstrating no evidence of fracture displacement.

In 2 of the reported cases, pelvic fractures were initially misdiagnosed. In the presence of a fall associated with any pain of the hip or pelvis, anteroposterior, lateral, and Judet radiographs of the pelvis should be performed in addition to a thorough physical examination.^{7,8,10} Riders should also not compete if pain persists until other proper imaging studies have been obtained and an accurate diagnosis made.

While 2 of the reported cases were subsequently diagnosed by MRI, it is the authors' recommendation that thin-cut CT scans of the pelvis be performed if the diagnosis is still in question. Computed tomography offers the clinician a superior tool for assessing bony structures in comparison to MRI.⁹ In addition, the information gained from CT thin-cut slices may aid the surgeon in planning operative procedures if required.

As reported, these riders appear to heal well although they bore weight on the fractures almost immediately. The authors recommend that riders be kept to toe-touch weight bearing for a relatively brief period (3-4 weeks), followed by a gradual progression to weight bearing as tolerated. In addition, the authors encourage early return to training on a stationary trainer for those with radiographic evidence of early callous formation without displacement of the fracture fragments. Riders should only be allowed to return to training on the road after radiographic evidence of bony healing. A phased return

Figure 4. AP pelvis and lateral hip radiographs 2 weeks after a fall demonstrating minimal displacement (arrow) of the left inferior pubic ramus fracture.

to full competition should not be initiated until full bony healing around 8 to 12 weeks is evident. Should the rider compete and reinjure the pelvis prior to this time, the risks of a more complicated or displaced fracture could potentially be career ending.

As evidenced by this article, conservative management of nondisplaced pelvic fractures in professional cyclists offers excellent results. Correct early diagnosis with the aid of proper imaging studies is essential. Early return to training on a stationary bike with gradual progression to competition enables the rider to maintain fitness while protecting bony healing. Further research efforts could include a more precise understanding of the incidence and outcomes of musculoskeletal injuries in these athletes. In addition, a more concise outcomes-based approach to prevention, treatment, and rehabilitation protocols needs to be developed.

Figure 5. MRI 3 weeks after a fall inadequately demonstrating marrow edema (arrow) indicative of fractures to the left superior and inferior pubic rami and left ischial tuberosity.

Figure 6. MRI 3 weeks after a fall inadequately demonstrating a right pubic root fracture (arrow).

Figure 7. CT 4 weeks after a fall demonstrating pubic root fracture (arrow).

Clinical Recommendations

SORT: Strength of Recommendation Taxonomy

A: consistent, good-quality patient-oriented evidence

B: inconsistent or limited-quality patient-oriented evidence

C: consensus, disease-oriented evidence, usual practice, expert opinion, or case series

Clinical Recommendation	SORT Evidence Rating
Falls associated with hip or pelvis pain require anteroposterior, lateral, and Judet radiographs of the pelvis in addition to a thorough physical examination.	C
Thin-cut CT scans of the pelvis should be performed if there is clinical suspicion of fracture or symptoms persist after no evidence of fracture is seen on initial radiographic findings.	C
Riders should be kept to toe-touch weightbearing for 3 to 4 weeks, followed by a gradual progression to weightbearing as tolerated. Return to training on a stationary trainer for those with radiographic evidence of early callous formation without displacement of the fracture fragments. Riders can be allowed to return to training on the road after radiographic evidence of bony healing. A phased return to full competition should not be initiated until full bony healing around 8 to 12 weeks is evident.	C

For information about the SORT evidence rating system, see <http://www.aafp.org/afpsort.xml> and Ebell MH, Siwek J, Weiss BD, et al. Strength of Recommendation Taxonomy (SORT): a patient-centered approach to grading evidence in the medical literature. *Am Fam Physician*. 2004;69:549-557.

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