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# Achilles Tendon Ruptures in Young Female Basketball Players: A Case Series

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## Abstract

Achilles tendon ruptures are a common entity in middle-aged male athletes. There have been limited reports of these injuries in female athletes in general and no reports that we are aware of teenage female athletes with complete tears that required surgical intervention. We present a case series of three female basketball players treated at the same institution by the same surgeon under the age of 20 over a 9-month period with complete Achilles tendon ruptures that underwent surgery. Clinicians should be aware of this pathology when seeing female athletes with calf pain.

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The pursuit of athletic endeavors has resulted in an increased prevalence of Achilles tendon injuries. Reported ruptures have increased from 2.1 out of 100,000 person-years in 1979 to 21.5 out of 100,000 person-years in 2011.<sup>1</sup> This is a condition with a reported male to female ratio ranging from 5:1 to 6:1.<sup>2</sup> The average age in multiple studies has been found to be in the fourth and fifth decades of life, with recent trends showing an increased age at which these injuries occur.<sup>1-3</sup>

The reasons for increased tear rate with age are multifactorial. The Achilles tendon has a tenuous blood supply at the midsubstance of the tendon.<sup>4</sup> This blood supply is worsened with age and disuse, and the response to microinjury of the tendon is less robust. In addition, morphological changes with aging have shown decreased cell density and a decrease in collagen fibril diameter and density.<sup>5</sup> With increased physical training, the ten-

don diameter increases, and with disuse, it atrophies. The combination of poor bloody supply and tendon plasticity may play a role in tendon ruptures in patients who abruptly increase their physical activity without appropriate conditioning.<sup>6</sup> Repetitive loading, especially in an undertrained athlete, can be postulated to lead to tendinosis and eventual rupture at the midsubstance of the tendon during an eccentric load.

Although atypical tendon ruptures can be caused by corticosteroid or antibiotic use,<sup>7</sup> we could not find any reports in the literature of complete Achilles tendon ruptures in female patients under the age of 20 years due to athletic trauma. We present a case series of three female basketball players treated at the same institution by the same surgeon under the age of 20 over a 9-month period who sustained complete Achilles tendon ruptures that underwent surgery.

Figure 1



**A–C**, T2-weighted, fat-suppressed sagittal ankle MRIs demonstrating Achilles tendon rupture approximately 2 cm above the insertion of the Achilles tendon. **A**, Corresponds to case #1, **(B)** to case #2, and **(C)** case #3.

## Cases

### Case 1

A 17-year-old female basketball player presented to the clinic 2 weeks after the onset of calf pain in the posterior aspect of her left lower leg, approximately 2 cm above the insertion of the Achilles, while playing basketball during an attempted jump. She was diagnosed with a left ankle sprain and made non-weight bearing by her primary care physician. She noted no antecedent pain, history of performance-enhancing drugs, antibiotic use, or previous injuries. On physical examination, a palpable gap was noted in the region of the Achilles tendon. The patient was unable to plantarflex and had a positive Thompson test. An MRI demonstrated a complete rupture of her Achilles tendon (Figure 1, A). Intraoperatively, degenerative tissue was identified. The repair was performed using a #2 nonabsorbable suture placed in a running locking

fashion in the proximal tendon stump and a second #2 nonabsorbable suture placed in a similar fashion in the distal stump. The ends of the sutures were then tied together to re-approximate the resting plantar flexion of the nonoperative leg. The repair was then augmented at the point of actual tendon apposition using an interrupted 2-0 Vicryl suture. An accelerated rehabilitation program as described by Willits et al.<sup>8</sup> was used. At 6 months, the patient had full plantar flexion strength, no pain, and returned to play. At 5 years after her surgery, the patient had successfully competed in collegiate basketball at the NCAA Division II level.

### Case 2

A 19-year-old female basketball player presented to the clinic 3 weeks after the onset of moderate calf pain in the posterior aspect of her left lower leg, approximately 2 cm above the insertion of the Achilles, while playing basketball. She noted 1 to 2 weeks of intermittent calf pain

before this episode while running. She was diagnosed with a left ankle sprain and placed in a walking boot by her athletic trainer. She noted no history of performance-enhancing drugs, antibiotic use, or previous injuries. On physical examination, a palpable gap was noted in the region of the Achilles tendon. The patient was unable to plantarflex and had a positive Thompson test. An MRI was ordered, which demonstrated a complete rupture of her Achilles tendon (Figure 1, B). Intraoperatively, degenerative tissue was identified. The repair was performed as noted in case #1 (no fibrin clot) with the same rehabilitation protocol. At 6 months, the patient had full plantar flexion strength, no pain, and returned to play. At 4.5 years after her surgery, she had successfully competed in collegiate basketball at the NCAA Division III level.

### Case 3

A 17-year-old female basketball player presented to the clinic 8 weeks

after the onset of calf pain in the posterior aspect of her left lower leg, approximately 2 cm above the insertion of the Achilles, while playing basketball. She was diagnosed with a left ankle sprain and an Achilles tendon strain by another provider and was treated conservatively. After 6 weeks of conservative treatment, she returned to basketball and felt a pop in her posterior leg while playing. She noted no history of performance-enhancing drugs, antibiotic use, or previous injuries. On physical examination, a palpable gap was noted in the region of the Achilles tendon. The patient was unable to plantarflex and had a positive Thompson test. An MRI was ordered, which demonstrated a complete rupture of her Achilles tendon (Figure 1, C). Intraoperatively, degenerative tissue was identified. The repair was performed in the same fashion as noted in case #1 (with a fibrin clot) with the same rehabilitation protocol. At 6 months, the patient had full plantar flexion strength, no pain, and returned to play. At 4.5 years after her surgery, she had successfully competed in collegiate basketball at the NCAA Division II level.

## Discussion

This case report is the first to highlight a unique population of young women who may be at risk for Achilles rupture due to their athletic activity. Epidemiologic studies from Europe, Canada, and the United States consistently show middle-aged men as the largest demographic group with this injury.<sup>9-11</sup> The reported mean age for acute tendon rupture is 37 to 43.5 years and it is 3 to 5 times more common in men.<sup>9,11,12</sup> Worldwide, athletic activity is associated with higher rates of Achilles tendon disorders and rupture.<sup>10,12</sup> Among patients with rupture in the United States, more than half of all injuries

occur from basketball and racquet sports.<sup>12</sup> A recent retrospective analysis from New Zealand found an equal number of male (54%) and female (46%) athletes in their cohort of 363 patients with Achilles tendon rupture—the authors attributed this unusual finding to the high incidence of netball in New Zealand, which is played widely and almost exclusively by women at a competitive level.<sup>9</sup>

Achilles rupture may be less common in women for a variety of reasons. Bryant et al.<sup>13</sup> have suggested the chronic effect of estrogen exposure in women leads to less Achilles tendon strain. Female sex hormones have an inhibitory effect on muscle fiber diameter, possibly providing protection against risk of tendon rupture.<sup>14</sup> Decreased muscle mass would be less likely to generate a force of contraction that exceeds the maximal tensile strength of the Achilles tendon. It is possible that the young female athletes in our series had diminished circulating estrogen due to their high level of athletic activity and thus did not have these protective effects against injury.<sup>15</sup>

The diagnosis of Achilles rupture was delayed 2 to 8 weeks for all patients in our cohort. This may have been due to their unusual demographic, or because their symptoms at the time of injury were often atypical. Delay in diagnosis of rupture is common for the Achilles tendon, with correct diagnosis missed at the time of initial evaluation in up to 25% of cases.<sup>16</sup> Raiken et al<sup>10</sup> found diagnostic delay to be three times more likely in patients 55 years or older, who—as with our patients—were beyond the usual age range of presentation.

Studies have shown that 33% of patients with Achilles rupture had prodromal symptoms.<sup>12</sup> Similarly, two of our patients experienced antecedent calf pain. All three, intraoperatively, were found to have degenerative tissue and scar forma-

tion, suggesting a chronic nature to their pathology. This is similar to previous studies on pathologic findings in the ruptured Achilles tendon and the role of previous degenerative change.<sup>17-19</sup> Silbernagel et al<sup>20</sup> reported poorer patient-reported outcomes for women who underwent Achilles repair surgery compared with men. However, in that study, patients were on average 40 years old and only followed up for 1 year. In our case series, all three athletes were able to return to play after 6 months and played collegiate basketball.

In conclusion, we present three cases of Achilles ruptures in female patients younger than 20 years old. We urge providers to consider Achilles pathology when faced with a young female athlete with calf pain, particularly in the context of high-risk sporting activity.

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