

# Notable Findings of a Preparticipation Examination in an 18-Year-Old Volleyball Player: A Case Report

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## Abstract

The preparticipation examination (PPE) is commonly performed to screen for potentially detrimental health conditions in competitive athletes to help decrease rates of morbidity and mortality associated with participation in sports. However, the significant clinical impact of PPE in the United States has yet to be determined. We describe an 18-year-old female athlete who presented with dizziness and a right-sided limp at 8 days after initial injury. Findings of PPE examination indicated that she had unknowingly sustained a concussion during a volleyball match and continued to play, which resulted in injury to the right foot. Despite abnormal findings of magnetic resonance imaging, the symptoms of concussion completely resolved at 3 weeks after initial injury. A modified return-to-play protocol and cast boot for 6 weeks were used, with progressive return to full physical activity. Athletes and coaches should be aware of any possible symptoms of concussion in preventing subsequent injuries during sports-related activities.

## Introduction

Preparticipation examination (PPE) is a standard screening procedure to evaluate the health status of high school-aged and college-aged athletes before training and competition. A total of 49 of 50 states have incorporated legal mandates for yearly screening for interscholastic athletes.<sup>1</sup> One goal of PPE is to identify potentially life-threatening conditions, so that appropriate interventions can be made to reduce rates of morbidity and mortality associated with participation in sports. Additionally, findings of PPE can help evaluate history of injury and other pertinent patient characteristics, which may prevent reoccurrence or future complications of injuries. However, further research is required to identify the significant clinical impact of PPE in the United States.<sup>2,3</sup>

Most athlete-patients who undergo PPE are healthy, without medical comorbidities and injuries. We describe a young volleyball player who presented with an injury to her right foot resulting from an unidentified concussion.

## Case Report

An 18-year-old female volleyball player presented to the training room at The University of New Mexico for a PPE. She arrived limping and unable to fully bear weight on her right foot, with expressed difficulty in arriving owing to headaches and dizziness caused by a head injury during a volleyball match 8 days earlier. Further discussion with the patient revealed that she had sustained a concussion after being hit in the head with a ball. The patient was not aware of the concussion and had continued to play, which resulted in injury to her right foot in plantar-flexion and abduction-type motions. She noted swelling and difficulty in weight bearing, but did not recall a specific “pop.”

The patient filled out the third edition of the Sport Concussion Assessment Tool (SCAT3), which is a standardized checklist that describes 22 different symptoms of concussion and includes a severity scale between 0 and 6 (Figure 1). Results of the SCAT3 indicated 22 symptoms and a total severity score of 84 at 8 days after initial injury.

At the PPE, findings of a complete neurological examination were normal except in the balance test, which was not performed owing to foot pain. With the exception of a mild limp, the results of physical examination were normal. The right foot of the patient did not appear to have signs of swelling or bruising, despite tenderness to palpation over the medial tarsometatarsal joint and pain during flexion and abduction of the foot.

Radiographs of each foot showed slight widening at the Lisfranc joint on the injured side (Figures 2A and 2B), and the patient was given crutches. Results of magnetic resonance imaging (MRI) indicated a nondisplaced stress fracture of the proximal second metatarsal and marrow contusion of the base of the second metatarsal at its articulation with the lateral cuneiform.

Because a research study was underway on athletes with concussions, a structural MRI of her brain was obtained and an abnormal finding within the right anterior temporal lobe was noted. A follow-up T2-weighted MRI using contrast agents revealed an oval area of hyperintensity in

## SYMPTOM EVALUATION

### 3 How do you feel?

"You should score yourself on the following symptoms, based on how you feel now".

	None	Mild	Moderate	Severe			
Headache	0	1	2	3	4	5	6
"Pressure in head"	0	1	2	3	4	5	6
Neck Pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2	3	4	5	6
Sensitivity to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling like "in a fog"	0	1	2	3	4	5	6
"Don't feel right"	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Fatigue or low energy	0	1	2	3	4	5	6
Confusion	0	1	2	3	4	5	6
Drowsiness	0	1	2	3	4	5	6
Trouble falling asleep	0	1	2	3	4	5	6
More emotional	0	1	2	3	4	5	6
Irritability	0	1	2	3	4	5	6
Sadness	0	1	2	3	4	5	6
Nervous or Anxious	0	1	2	3	4	5	6

Total number of symptoms (Maximum possible 22)

Symptom severity score (Maximum possible 132)

Do the symptoms get worse with physical activity?  Yes  No

Do the symptoms get worse with mental activity?  Yes  No

Self rated  Self rated and clinician monitored

Clinician interview  Self rated with parent input

**Overall rating:** If you know the athlete well prior to the injury, how different is the athlete acting compared to his/her usual self.

Please circle one response:

No different  Very different  Unsure  N/A

**Figure 1.** At 8 days after initial injury, results of the third edition of the Sport Concussion Assessment Tool indicated mild levels of 22 symptoms and a total severity score of 84.

the right frontal subcortical white matter, without presence of mass effect or abnormal enhancement (Figure 3). The abnormal finding was felt to be benign, consistent with signs of gliosis, and a result of previous trauma, infection, or inflammation, rather than the concussion. Less likely causes were found to be demyelinating process or neoplasm.

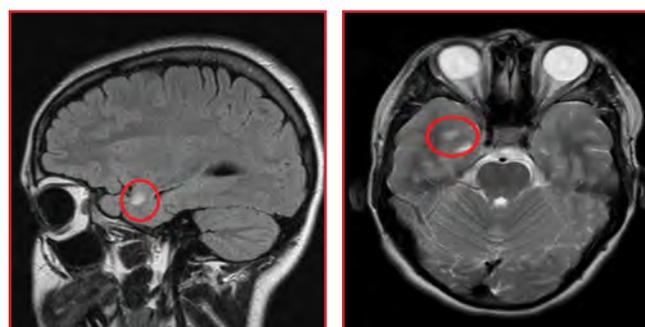
In treating the concussion, the patient was held out of classes to avoid worsening the symptoms. After the symptoms improved, she returned to classes and volleyball meetings. The symptoms completely resolved by 3 weeks after initial injury, and a modified Zurich protocol was used

owing to the foot injury. The protocol consisted of a five-step progression toward increasing activity in minimum 5-day period, ranging from light (eg, warm-up biking exercises) to non-impact full sports.<sup>4</sup> The patient was placed in a cast boot for 6 weeks and allowed to progressively return to full physical activity.

She was referred to a pediatric neuro-oncologist at The University of New Mexico for treating the lesion viewed on the brain MRI. A repeat MRI was recommended 6 months later. Because the patient was unable to present at 6 months, she has been scheduled to return after summer break, at which time conclusive results will be determined.



**Figure 2.** Radiographs of the (A) uninjured left foot and (B) injured right foot, showing slight widening at the Lisfranc joint (circled).



**Figure 3.** T2-weighted magnetic resonance imaging results of the brain using contrast agents, showing abnormal findings of an enhancement (circled) in the frontal subcortical white matter.

## Discussion

The National Collegiate Athletic Association has implemented changes in recent years to improve the awareness of concussions. The organization has a shared-responsibility policy, in which athletes must sign a statement

and agree to report signs of concussion to medical staff members.<sup>5</sup> In addition, athletes have received information on identifying symptoms of concussion. However, because our patient was not a collegiate-level athlete, she had not yet undergone this process.

In the current case, our patient was unaware of a concussion sustained during a volleyball match, and thus she continued to play and subsequently injured her foot. The foot injury required more time to heal than did the symptoms of concussion, which resulted in her inability to play competitive volleyball in the fall season.

Furthermore, although young athlete-patients are usually healthy at PPE, abnormal findings were found in the current case. Radiographs of both feet revealed a Lisfranc injury, whereas findings of MRI images indicated a stress fracture of the second metatarsal. Further MRI images revealed a brain lesion, yet it is unclear whether the observed lesion resulted from the concussion. A structural finding of an MRI would be rare and question the diagnosis of concussion. The lesion was likely caused by a previous injury or, less likely, demyelinating and neoplastic process. Findings of a follow-up MRI will help establish more definitive evaluation of the lesion.

Results of the current case highlighted several notable benefits of PPE: the need for athletes, their parents, coaches, and trainers to recognize symptoms of a concussion; the importance of increasing awareness of concussion signs at all ages and levels of sports-related activity; and possible abnormal findings revealed after imaging procedures during PPE. Although clinical significance of PPE has not been verified in the United States, the procedure may help in identifying possible conditions and subsequent preventative measures in treating seemingly healthy populations of younger athlete-patients.

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## Conflict of Interest

The authors report no conflicts of interest.

## Informed Consent

The patient was informed that the data concerning the case would be submitted for publication, and she provided verbal consent.

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