Letters to the Editor

Paraspinal Fat Pad Changes as a Valuable Indicator of Posterior Ligamentous Complex Injury in Upper Cervical Spine Trauma

From
Miso Kim, MD, Seunghun Lee, MD, and Yoonah Song, MD
Department of Radiology, Hanyang University Hospital, 17 Haengdang-dong, Sungdong-gu, Seoul 133-792, Korea
e-mail: *radsh@hanyang.ac.kr*

Editor:

We read with great interest the article by Dr Molière and colleagues in the March 2017 issue of *Radiology* (1) and congratulate the authors on their great work. In this study, they suggested that paraspinal fat pad (PFP) changes on computed tomographic (CT) scans are significantly associated with posterior ligamentous complex (PLC) injury in patients with cervical spine trauma.

We would like to comment on some issues and ask a question about the article.

First, they stated that "the disappearance of the fatty appearance of the PFP without obvious fractures should raise the possibility of PLC injury" and showed figure 2a and 2b (1). However, we think there is bone marrow edema in the C7 anteroinferior vertebral body and a suspicious fracture line in the C7 vertebral body of the 47-year-old man. Is it really possible that PLC is injured without fracture of the cervical spine? Ligamentous injuries without fracture of the cervical spine are rare (2). Chiu et al (3) evaluated 14577 patients who experienced blunt trauma. There was an overall incidence of ligamentous injury without evidence of fracture of 0.6% (3).

Second, Dr Molière and colleagues said that "purely discoligamentous injuries…can be unstable…" (1). Therefore, they tried to evaluate PLC by using PFP. But, is it clinically significant? Stability of the spine can be predicted by the failure of two contiguous columns (4). Also, when using the numerical Subaxial Cervical Spine Injury Classification (SLIC) score, purely discoligamentous injury cannot have a score of 4 or higher (5). Distraction injuries are defined as any injury that results in distraction across the fracture, intervertebral disk, or posterior elements (6). Therefore, purely discoligamentous injury is insufficient to generate spinal instability.

In conclusion, it is difficult for the PLC to be injured without fracture. Moreover, when there is purely discoligamentous complex injury, it cannot have a score of 4 or higher with SLIC. This means purely discoligamentous complex injury is insufficient to generate spine instability.

Disclosures of Conflicts of Interest: M.K. disclosed no relevant relationships. **S.L.** disclosed no relevant relationships. **Y.S.** disclosed no relevant relationships.

References

1. Molière S, Zaragori-Benedetti C, Ehlinger M, Le Minor JM, Kremer S, Bierry G. Evaluation of paraspinal fat pad as an indicator of posterior ligamentous complex injury in cervical spine trauma. Radiology 2016;282(3):790–797.
2. Bernstein MP, Baxter AB. Cervical spine trauma: pearls and pitfalls. 2012 ARRS categorical course syllabus. Vancouver, British Columbia: ARRS, 21–25.
3. Chiu WC, Haan JM, Cushing BM, Kramer ME, Scalea TM. Ligamentous injuries of the cervical spine in unreliable blunt trauma patients: incidence, evaluation, and outcome. J Trauma. 2001;50(3):457–463, discussion 464.
4. Munera F. Imaging evaluation of adult spinal injuries: emphasis on multidetector CT in cervical spine trauma. Radiology 2012;263(3):645–660.
5. Vaccaro AR, Hulbert RJ, Patel AA, et al. The subaxial cervical spine injury classification system: a novel approach to recognize the importance of morphology, neurology, and integrity of the disco-ligamentous complex. Spine (Phila Pa 1976) 2007;32(21):2365–2374.

6. Phillips F, Khan SN. Treatment of complex cervical spine disorders. Orthop Clin North Am 2012;43(1):xiii.

Response

From
Guillaume Bierry, MD, PhD, and Sébastien Molière, MD
Department of Radiology, University Hospital of Strasbourg, 1 avenue Molière, F-67098 Strasbourg, France
e-mail: *guillaume.bierry@chru-strasbourg.fr*

We thank Dr Kim and colleagues for their interest in and thoughtful comments on our work.

They are completely right in identifying bone edema in the C7 vertebral body on figure 2, but it was, in this patient, pre-existing and to a previously known degenerative disk disease.

Dr Kim and colleagues raise questions regarding spinal stability in purely discoligamentous injuries. The frequency of PLC injuries without obvious fracture is probably higher than that reported by Chiu et al (1) (0.6%), as those authors considered pure ligamentous cervical spine injury as a cervical spine having abnormal anatomic alignment, dislocation, subluxation, or listhesis, without fracture. It has been well demonstrated that PLC and disk injuries can be demonstrated on magnetic resonance images, even without abnormal alignment on radiographs, and the frequency of such occult discoligamentous injuries can be as high as 44% (2,3).

Purely discoligamentous injuries can undoubtedly be unstable (4). Vaccaro et al (5) clearly stated that, in distraction injuries, the "pattern most commonly involves ligamentous disruption propagating through the disk space or through the facet joints, such as that seen in facet subluxation or dislocation (without fracture and translation or rotation)". Therefore, following SLIC criteria, a purely discoligamentous injury, associated with a facet dislocation but no fracture, can reach a score clearly above 4.

So, even if PLC injuries are frequently associated with fractures, pure ligamentous and discoligamentous injuries in cervical spine trauma are not rare and can undoubtedly lead to catastrophic secondary instability.

Disclosures of Conflicts of Interest: G.B. disclosed no relevant relationships. **S.M.** disclosed no relevant relationships.

References

1. Chiu WC, Haan JM, Cushing BM, Kramer ME, Scalea TM. Ligamentous injuries of the cervical spine in unreliable blunt trauma patients: incidence, evaluation, and outcome. J Trauma 2001;50(3):457–463.
2. Ackland HM, Cameron PA, Varma DK, et al. Cervical spine magnetic resonance imaging in alert, neurologically intact trauma patients with persistent midline tenderness and negative computed tomography results. Ann Emerg Med 2011;58(6):521–530.
3. Mayer M, Zenner J, Auffarth A, et al. Hidden discoligamentous instability in cervical spine injuries: can quantitative motion analysis improve detection? Eur Spine J 2013;22(10):2219–2227.
4. Herkowitz HN, Rothman RH. Subacute instability of the cervical spine. Spine 1984;9(4):348–357.
5. Vaccaro AR, Hulbert RJ, Patel AA, et al. The subaxial cervical spine injury classification system: a novel approach to recognize the importance of morphology, neurology, and integrity of the disco-ligamentous complex. Spine (Phila Pa 1976) 2007;32(21):2365–2374.

Impact of Measurement Time on Clinical Workflow in Different Manual Methods of Region of Interest Positioning for ADC Quantification

From
Adriano M. Priola, MD, and Sandro M. Priola, MD
Department of Diagnostic Imaging, San Luigi Gonzaga Hospital, University of Torino, Regione Gonzole 10, 10043, Orbassano, Torino, Italy
e-mail: *adriano.priola@inwind.it*

Editor:

In the February 2017 issue of *Radiology*, Dr Blazic and colleagues (1) reported on reproducibility and reliability in assessing complete tumor response after combined chemotherapy and radiation therapy (CRT) with three different manual methods of region of interest (ROI) positioning for apparent diffusion coefficient (ADC) measurements in rectal cancer. They concluded that the single-section method would be preferred over the measurement of the whole-tumor volume (WTV) in clinical practice due to its "efficient" and "quick" approach, despite the latter having higher reproducibility and better diagnostic performance, by using the percentage ADC change in the assessment of complete tumor response. However, the authors did not provide the measurement time required for each method. The measurement time of different freehand methods of ROI positioning has high clinical relevance because the goal is to provide an effective ADC measurement without impacting the clinical workflow. Nevertheless, in the assessment of the variability of ADC measurements, few studies compared the measurement time between different methods (2–4). In a recent study on diffusion-weighted imaging of pleural abnormalities (4), although we found the best intra- and interobserver agreement in WTV analysis, it was a time-consuming method in diffuse large pleural tumors, requiring up to 6 minutes for complete ADC mapping. In ADC mapping of rectal cancer, the difference in measurement time between the WTV analysis and other methods could be lower due to the lower amount of tissue to be sampled, as shown in the representative cases reported by Dr Blazic and colleagues (1). A short additional time could make preferable the WTV analysis in these patients due to a negligible impact on clinical workflow, with the advantage of higher reproducibility and best diagnostic performance of ADC measurements.

Last, although the use of a bicompartmental model would be preferable for distinguishing perfusion at low *b* values and true diffusion, it should be added that ADC measurements obtained by authors may be overestimated because of perfusion effects deriving from the use of a *b* value of less than 200 sec/mm^2 in ADC maps (4–7). Moreover, the multiple exponential fit with a large range of *b* values, resulting