

Magnetic resonance imaging in abdominal trauma—More relevant than ever

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It is no surprise that computed tomography (CT) has become the workhorse of acute trauma imaging in most emergency departments around the world. While ultrasound and radiographs have utility in the initial screening for injuries, CT provides unparalleled spatial resolution and speed of image acquisition for an all-in-one solution for assessing the solid and hollow viscera of the abdomen. Additionally, access to CT has substantially improved over the last several years, and we can safely assume that every major trauma center today has at least one CT scanner in the department.

However, there are cases when CT itself is either not definitive or is not the optimal modality given its radiation exposure. While significantly lagging behind CT, access to magnetic resonance imaging (MRI) has also improved in the recent years. Being familiar with the trauma patterns and injuries only on CT is simply not sufficient for a radiologist dealing with traumas in the current times. Recognizing the need for further imaging with MRI and making appropriate recommendation in these cases is an important skill that today's emergency radiologist ought to have.

Usually, by the time MRI becomes relevant in a trauma setting, the trauma team is already involved in the case and initial imaging and clinical assessment has been performed. Hence, a multidisciplinary discussion is key to understanding the exact clinical question for performing an MRI.¹ Drs. Rajput and Mellnick² present a very timely review on this topic in current issue of CARJ. In their 2-part series, they have provided a comprehensive review of specific trauma scenarios when MRI plays a key role in diagnosing and guiding management, identified certain key points relevant to MRI protocols in trauma setting, and provided illustrative case examples of the relevant injuries on MRI. They have highlighted specific populations such as pediatric and pregnant women, where MRI can take a more central role in order to avoid ionizing radiation from CT.

In their first part, the authors highlight important protocol strategies relevant to an acute trauma patient, such as minimizing the number of sequences, utilizing free-breathing or respiratory-triggered imaging over breath-hold sequences, and utilizing novel sequences for faster image acquisition and artifact correction.² Particular focus in this part is given to the role of MRI in hepatobiliary and pancreatic injuries. These

injuries can have non-specific appearances at CT but dire consequences if gone undiagnosed. The significance of detecting pancreatic ductal injuries cannot be overstated. The high-contrast resolution of MRI with MRCP sequence can much clearly identify a main duct violation compared to CT.^{3,4} The authors also highlight and demonstrate the importance of detecting pancreatic injuries in children, which can be associated with non-accidental trauma.⁵

The addition of hepatobiliary contrast agent with delayed imaging is an additional tool exclusive to MRI for assessing the biliary tree and detecting biliary leaks. Identifying the site of biliary injury is very helpful for guiding endoscopic and operative interventions. The authors highlight key strategies for improving the performance of the MRI, for example, obtaining delayed imaging at 40 minutes after administration of a hepatobiliary agent to detect biliary leaks and obtaining the high-resolution MR cholangiopancreatic sequences prior to biliary excretion of the hepatobiliary contrast agent. Similarly, scenarios when the MRI may have limited utility are also highlighted, such as in patients with bilirubin of greater than 3 g/mL. Finally, the ability of MRI to differentiate the mimics of traumatic injuries such as pre-existing masses is also discussed.

In the second part of the series, the authors discuss trauma in pregnancy, and vascular and genitourinary injuries.⁶ Imaging trauma in pregnancy requires an added caution for the radiation dose, which renders MRI particularly relevant in this setting. Although CT still remains the primary modality of assessment for any serious intraabdominal traumatic injuries in a pregnant trauma patient, MRI plays a key role in the initial assessment of patients with low clinical suspicion of injuries, or cases where imaging follow-up of known injuries is required. The authors

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appropriately highlight the superior ability of MRI to assess for placental abruption, a calamitous injury that can result in both maternal and fetal morbidity and mortality.

Authors also discuss the role of MRI in the assessment of acute aortic injuries in trauma cases with contraindications to iodinated contrast, preventing appropriate assessment by CT. Even unenhanced MRI sequences can provide useful information on the integrity of major vessels. Finally, uses of MRI in the assessment of genitourinary trauma are discussed. Particularly, the ability of delayed phase examination in the assessment of ureteric injuries is highlighted. Penile injuries are another subset of injuries that are often suboptimally assessed with ultrasound and can benefit from superior contrast resolution of MRI, specifically for assessing the integrity of the tunica albuginea.

Cases that require MRI use in trauma setting are few and far in between. Such a review presented here is a great resource for every radiologist to get up to the speed so that next time a complex trauma patient rolls in through the ED doors, they are well-equipped to make the most of every imaging modality available at their disposal.

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