Ultrasonography for acute blunt renal trauma: does it help?

超聲波造影術是否有助診斷急性腎臟鈍傷？

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The role of ultrasonography in diagnosing blunt renal trauma is uncertain because it is much less sensitive in detecting parenchymal organ injuries. Indirect evidence such as perinephric haematoma may be easier to identify by ultrasonography and it is highly suggestive of underlying renal parenchymal injury. A patient with significant renal injuries diagnosed by bedside ultrasonography is reported and the role of ultrasonography in renal trauma is discussed. (*Hong Kong j.emerg.med.* 2006;13:57-60)

由於超聲波造影術對探測實質器官創傷的敏感度較低，故此在診斷腎臟鈍傷的角色仍未能確定。超聲波比較容易確認間接跡象如腎週血腫，這高度提示有潛在的腎臟實質創傷。現報告一名由臨床超聲波造影術診斷為有嚴重腎創傷的病者個案，並討論超聲波造影術於腎臟創傷中之角色。

Keywords: Abdominal injuries, emergencies, FAST, kidney, ultrasonography

關鍵詞：腹部創傷、急症、使用超聲波為創傷作焦點評估、腎臟、超聲波造影術

Case

A 28-year-old man presented to an emergency department (ED) with blunt abdominal trauma in November 2004. He was a motorcyclist who crashed with his right loin hitting against a lamp-post. On arrival, the patient's blood pressure was 147/89 mmHg and the pulse rate was 96 bpm. He was fully conscious. Other than complaining of right loin pain, he seemed completely stable. The physical examination showed tenderness over the right loin region. There was no external wound except minor abrasions over the left hand and right knee. The chest, cardiac and neurological examinations did not reveal any abnormality.

Focused assessment with sonography for trauma (FAST) was performed and did not show any intra-peritoneal or pericardial fluid. However, while scanning the right upper quadrant for the Morison's pouch, an enlarged right renal mass was seen (Figure 1). The whole renal mass measured more than 15 cm long and 8 cm wide. A huge anterior perinephric haematoma displaced the kidney posteriorly and a laceration was noted in the middle of the right kidney.

Urgent contrast computed tomogram (CT) abdomen was performed (Figure 2). It showed a deep laceration at the anterior aspect of the middle part of the right kidney which extended to the collecting system with a large perinephric haematoma. The right main renal artery and renal vein were still patent, and there was no urinary extravasation.

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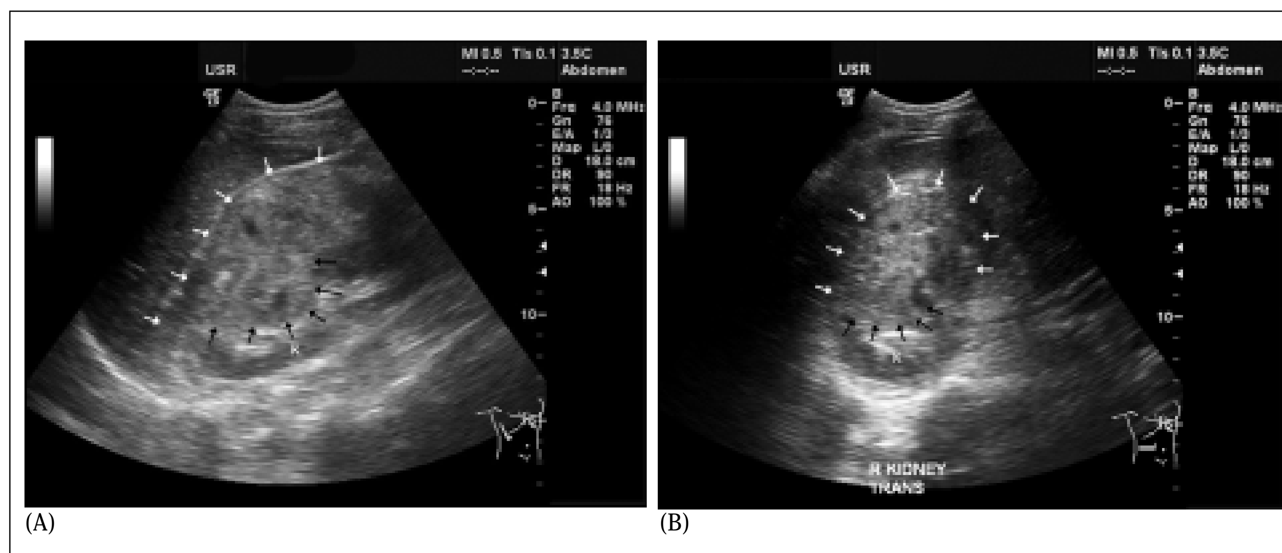

Figure 1. Sonographic scans of the right kidney (K) showing a huge perinephric haematoma (white arrows) extending from an anterior renal laceration (black arrows). A. Longitudinal scan; B. Transverse scan.

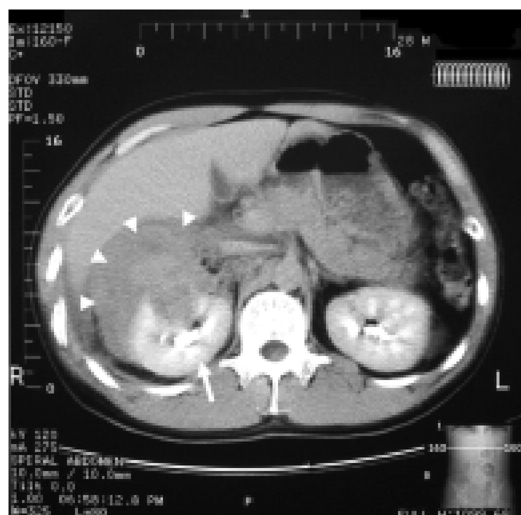

Figure 2. CT abdomen with intravenous contrast. The lacerated right kidney (white arrow) and the perinephric haematoma (white arrowheads) are well identified. Findings are compatible with the ultrasonography.

The patient was initially managed conservatively in the surgical ward. However, he had a significant drop in haemoglobin from 15.0 g/dL to 12.2 g/dL on day 2 and then to 8.3 g/dL on day 3. CT abdomen was repeated, showing a significant increase in size of the right perinephric haematoma. There was also a perisplenic collection, and splenic rupture was suspected. Exploratory laparotomy was thus performed. A 3-cm transverse laceration was found over the interpolar region of the right kidney with a large perinephric haematoma confined by the Gerota's fascia. No major hilar injury was found. There was a minor tear of the splenic capsule and 1 L of haemoperitoneum was detected. The kidney was repaired and bleeding from the splenic capsule was stopped by packing. The patient recovered uneventfully and was discharged on post-operative day 7.

Discussion

Ultrasonography has been widely used in ED for the investigation of blunt abdominal trauma. In the past, FAST stood for 'Focused Abdominal Sonography for Trauma' and it was mainly used to detect intra-peritoneal free fluid. Nowadays, FAST is redefined as 'Focused Assessment with Sonography for Trauma' and is not limited to the detection of intra-peritoneal blood but also pericardial collection and haemothorax. However, ultrasonography has been shown to be much less sensitive in detecting parenchymal organ injuries as compared to detecting free fluid.[1,2] In patients with blunt abdominal trauma, renal injuries are an infrequent cause of intra-peritoneal free fluid.[1-3] As the kidney is a retroperitoneal structure, unless significant

trauma occurs to the kidney, it is unlikely that intra-peritoneal free fluid would result.

Ultrasonography has several advantages over other diagnostic imaging modalities in renal trauma. It provides detailed renal anatomic information that can be performed at the bedside without moving the patient to an unmonitored environment. It can also provide information about other organ systems when the emergency physician suspects alternative diagnoses. Moreover, it is non-invasive and does not expose the patient to radiation or require the administration of intravenous contrast, which can be nephrotoxic and can cause serious allergic reactions. However, there are limitations in renal ultrasonography. It is more operator-dependent than any other investigation modalities, and it cannot provide detailed assessment of renal function in contrast to CT or intravenous urography (IVU).

The sensitivities in using ultrasonography to detect abdominal parenchymal injuries are highly variable in different studies. Rothlin et al reported a sensitivity of 41.4% in detecting solid organ injuries in 312 patients.[2] The value was so low because they examined not only solid-organ injuries but also small-bowel and mesenteric injuries which had a particularly low detection rate. Goletti et al examined 250 patients for intra-peritoneal fluid and solid-organ injuries and reported 100% sensitivity in detecting renal injuries (3/3 patients).[4] McGahan et al analysed findings in 500 patients with abdominal trauma and found a sensitivity of 25% in detecting renal injuries (1/4 patients).[1] Kuligowska et al found a sensitivity of 50% (3/6 patients) in detecting renal injuries in 268 patients with abdominal trauma.[5] The sensitivity of ultrasonography in detecting renal injuries varied widely among these studies, probably because the numbers of injuries were too small. Moreover, the degrees of experience of the examiners were unspecified.

Concerning sonographic findings of renal injuries, bleeding into the retroperitoneal space may be identified as hypoechoic areas around the kidney. Focal areas of parenchymal haemorrhage and oedema may be seen as hypoechoic areas within the kidney. Renal fractures may be seen as a linear reproducible absence of echo. If the collecting system is injured, urine may leak out from the kidney and collect between the renal capsule and Gerota's fascia, creating an urinoma, which may be shown as an anechoic ring around a portion of the kidney.[6]

Due to the morphological complexity of the kidney, detection of renal parenchymal injuries is particularly difficult when compared with other solid organs. In the study by Sato et al[7] renal injuries accounted for 71.4% (10/14) of undetected solid organ injuries. Many renal parenchymal injuries were diagnosed indirectly by finding a perinephric haematoma or urinoma. Sato et al found the sensitivity in detecting perinephric haematoma was 83.8% while the direct detection rate of renal parenchymal injuries was as low as 53.3%, even by experienced sonographers.[7] The detection of superficial renal lacerations is particularly difficult because they are usually small. Even when renal lacerations are found by ultrasonography, it is difficult to determine whether they are superficial or deep (reaching the collecting system) because ultrasonography is unable to visualise the collecting system directly unless the system is distended. Missing superficial renal lacerations may not be clinically significant because most of them may be managed conservatively. In contrast, in renal vascular injury, interventions like laparotomy or transarterial embolisation are usually needed.[8] The detection rate of renal vascular injury by ultrasonography is extremely low. If the above condition is suspected, contrast-enhanced CT scanning is still the diagnostic imaging test of choice. New technological advances such as power or colour Doppler may provide an alternative diagnostic strategy to CT for the diagnosis of renal perfusion injuries; however, they deserve further studies.

Another important role for ultrasonography in renal trauma is in the management of patients with identified parenchymal injuries such as haematoma. These lesions often are well-visualised and can be evaluated periodically to monitor their resolution so that patients do not need to undergo further investigations with

radiation exposure risks. As in our case, if interval bedside ultrasonography could be used to monitor the expanding perinephric haematoma, intervention could probably be expedited and a second CT scan may possibly be saved.

In the investigation of renal trauma, contrast-enhanced CT scanning is still the diagnostic imaging test of choice because it provides information about renal function and vascular status, in addition to detailed anatomic data. However, it is not as easily available as ultrasonography. In the trauma setting, we employ FAST examination as a screening tool to look for intra-peritoneal free fluid. It can help to screen for renal trauma, but it should be noted that it is not designed to pick up renal injuries. Serious injuries can be missed in renal trauma patients if we rely on ultrasonography alone for diagnosis.[9]

Conclusion

Acute traumatic injuries of the kidney are often associated with significant splenic, hepatic, diaphragmatic or bowel trauma.[10] These concomitant injuries may result in the presence of intra-peritoneal free fluid. However, isolated renal injuries may not present with intra-peritoneal free fluid, while significant renal injuries may be missed by ultrasonography. When sonographic findings are negative or equivocal and clinical or laboratory evidence suggests significant renal injury, contrast-enhanced CT scan should be performed to locate any renal lesion.

Concerning our case, in which CT would probably be delayed if ultrasonography was not performed, it clearly shows that ultrasonography could expedite management in renal trauma. We suggest emergency physicians should look for evidence of renal trauma while performing FAST before the exact role of ultrasonography for renal trauma is determined by further studies.

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