

IMAGING

Evaluation of Living Renal Donors: Accuracy of Three-dimensional 16-section CT

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Purpose: To retrospectively assess the sensitivity and specificity of three-dimensional (3D) 16-section computed tomography (CT) in the evaluation of vessels, pelvicalyceal system, and ureters in living renal donors, with surgical findings as the reference standard.

Materials and methods: This was a HIPAA-compliant study. Institutional review board approval was obtained for the review of subjects' medical records and data analysis, with waiver of informed consent. Forty-six renal donors (18 men, 28 women; mean age, 42 years) were examined with 16-section CT. Two blinded reviewers independently studied renal vascular and urographic anatomy of each donor CT scans by first using 3D images alone, then transverse images alone, and finally transverse and 3D data set. Image quality, degree of diagnostic confidence, and time used for review were recorded. Sensitivity and specificity were calculated.

Results: For 3D images, transverse images, and transverse in conjunction with 3D data sets, the respective sensitivity and specificity of CT in evaluation of accessory arteries by reviewer 1 were 100% and 100%, 89% and 100%, and 100% and 100%, and those by reviewer 2 were 89% and 97%, 89% and 100%, and 89% and 100%; the respective sensitivity and specificity in evaluation of venous anomalies by reviewer 1 were 100% and 98%, 100% and 98%, and 100% and 98%, and those by reviewer 2 were 100% and 98%, 100% and 95%, and 100% and 98%. For focused comprehensive assessment of renal donors with 3D scans alone, a reviewer on average (average of reviewers 1 and 2) used 2.4 minutes per scan, demonstrated full confidence in 93%, and rated the quality as excellent in 76%.

Conclusion: For focused assessment of renal vascular and urographic anatomy, review of 3D data set alone provides high sensitivity and specificity with regard to findings seen at surgery.

Editorial Comment

Recently, several studies have been shown that CT angiography (CTA) with multi-detector row technology (16-channel) has superior accuracy than conventional angiography and non-selective digital subtraction angiography for the evaluation of living renal donors. To obtain such high accuracy, the images must be obtained with 1 mm slice thickness reconstruction interval during arterial and venous phases. Using this protocol CTA will demonstrate with clarity almost all supernumerary renal arteries and veins, early branching of vessels and abnormalities of pelvicalyceal system and ureter. Thus, the overall accuracy of 16-channel- CTA for detection and classification of surgically relevant arterial and venous variants may reach 100%. However this protocol of investigation has important drawback since offers a huge number of axial images making their interpretation by the radiologist, a meticulous and time consuming process. The authors shows that in a series of 46 consecutive renal donors, who had surgical findings for comparison, review of 3D images alone obtained with 16-section CT was faster and adequate. The respective mean accuracy for evaluation of renal arterial, venous and urogram findings was 98%, 98% and 100% for 3D images alone. Three-dimensional images may also help the surgeons by offering them fewer and relevant images of donor anatomy, which can be displayed in the operating room during surgical procedure. As pointed out by the authors more studies will need to be performed to validate these results.

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Transition Zone Prostate Cancers: Features, Detection, Localization, and Staging at Endorectal MR Imaging

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Purpose: To retrospectively evaluate the accuracy of endorectal magnetic resonance (MR) imaging in the detection and local staging of transition zone prostate cancers, with pathologic analysis serving as the reference standard, and to assess MR imaging features of these cancers.

Materials and Methods: The institutional review board approved this HIPAA-compliant retrospective study and waived the informed consent requirement. An institutional database of 986 patients who underwent MR imaging before radical prostatectomy yielded 148 consecutive patients with at least one transition zone cancer at step-section pathologic analysis. An additional 46 patients without transition zone cancer were randomly selected as a control group. Two readers independently reviewed MR studies to identify patients with transition zone cancers and determine the location and local extent of these cancers. Imaging features that helped in the identification of transition zone cancers were recorded. Descriptive and kappa statistics, as well as receiver operating characteristic and multivariate logistic regression analyses, were used.

Results: For identification of patients with transition zone cancers, sensitivity and specificity were 75% and 87%, respectively, for reader 1 and 80% and 78%, respectively, for reader 2. Interreader agreement was fair. For detection of the location of transition zone cancer, the area under the receiver operating characteristic curve was 0.75 for reader 1 and 0.73 for reader 2. Interreader agreement was fair. The readers' accuracy in detecting transition zone cancer foci increased significantly ($P=.001$) as tumor volume increased. In the detection of extraprostatic extension of transition zone cancers, sensitivity and specificity were 56% and 94%, respectively, for reader 1 and 28% and 93%, respectively, for reader 2. Homogeneous low T2 signal intensity ($P=.001$ for reader 1, $P<.001$ for reader 2) and lenticular shape ($P=.017$ for reader 1) were significantly associated with the presence of transition zone cancer.

Conclusion: MR imaging can be used to detect, localize, and stage transition zone prostate cancers.

Editorial Comment

Recently some reports have been shown the role of MR imaging in the assessment of transition zone (TZ) cancers. MR features observed in transition zone cancer are presence of nodule with ill-defined margins (lack of capsule) showing homogeneous hypo intensity on T2 weighted images. In this retrospective study, the authors added two other important features that helped in the identification of TZ cancers: lenticular shape of the lesion and invasion of the anterior fibromuscular stroma. Although none of these findings is pathognomonic for transition zone cancer the authors found that the combination of these features allows the identification of these cancers with specificity ranging from 78 to 87%. The authors observed that, tumor volume was an important factor in the detection of TZ cancers. The accuracy of TZ cancer detection at MR imaging was related to the transition zone cancer volume, with higher accuracy for cancers with larger volumes. The accuracy was significantly higher for tumor volume greater than or equal 0.77 mL. This may not be relevant if we consider that patients with TZ cancers have higher tumor volumes than patients with peripheral zone cancers. Although based on small series, another important and original observation of the current study is that local staging of transition zone cancers is possible with MR imaging and that extraprostatic extension occurs at a larger mean tumor volume in TZ cancers than in peripheral zone cancers. As we have mentioned in the March – April 2006 issue of this journal, other MR imaging techniques such as diffusion-weighted images, contrast material-enhanced MR imaging and MR spectroscopic imaging can also be used

for evaluation of TZ cancers. In our experience, the findings on conventional MR imaging should be associated with these other imaging techniques.

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UROGENITAL TRAUMA

American Association for the Surgery of Trauma Organ Injury Scale for kidney Injuries Predicts Nephrectomy, Dialysis, and Death in Patients with Blunt Injury and Nephrectomy for Penetrating Injuries

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Background: Despite broad clinical use of the American Association of the Surgery of Trauma (AAST) injury scale for kidney, it has only been found to predict the need for renal surgery in single institution series. We sought to validate this scheme for morbidity and mortality in a national cohort of patients with renal injury.

Methods: A retrospective cohort design was used to determine the association between increasing AAST scores and nephrectomy, dialysis, and mortality. The cohort included all patients with a renal injury in the National Trauma Data Bank (NTDB) from 1994 and 2003. Univariate and multivariate prediction models were used for analysis of data.

Results: At the time of review, a total of 742,774 patient records were registered in the NTDB. Renal injury occurred in 8465 patients (1.2%). Increasing injury grade was associated with a greater nephrectomy (RR 12-127), dialysis (RR 1.3-4.7), and mortality (RR 1.3-1.9) rate for blunt kidney injury. For penetrating injury, nephrectomy was the only outcome that was associated with higher grades of renal injury with a RR of 7.7 to 31 for grades III to V injuries.

Conclusion: The AAST injury scale for kidney predicts for morbidity in blunt and penetrating renal injury and for mortality in blunt injury. Thus, we continue to support its use as a clinical and research tool.

Editorial Comment

Thee injury scales developed for kidney trauma were primarily based on the consensus of experts in urologic trauma, and not by evidence based medicine. First reported back in 1989, the AAST injury scales provide a valuable tool to classify injuries, in order to perform clinical research, and to decide on management. (1) The above retrospective review is another in a long line of papers seeking to validate that the AAST scale of degree of kidney injury is an accurate predictor of morbidity and mortality from blunt renal trauma. Since the more severe the mechanism of injury, the higher the likelihood for increased AAST renal injury grade, it is intuitive that the kidney and associated injuries result in higher rates of nephrectomy and mortality.

The National Trauma Data Bank - NTDB - www.facs.org/trauma/ntdb.html - the largest aggregation of trauma registry data ever assembled., managed by the American College of Surgeons, is a national data base of