NEW HORIZONS

Three-Dimentional CT Angiography : Renal Applications

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The applications for three-dimentional CT Angiography (CTA) are expanding with continued improvements in spiral CT technology, computer technology and increased experience with CT angiography. Fast data acquisition allows scanning during arterial phase of intravenous contrast enhancement. Data are acquired continuously with spiral CT imaging, producing a volume of CT data without gaps or breaks in information. The volumetric CT dataset is obtained while the patient suspends respiration and respiratory misregistration artifacts are minimized or eliminated. With these benefits, volumetric CT datasets are ideal for the application of post-processing techniques for the production of 3D-CT angiograms. A non-invasive examination, 3D-CTA can avoid complications that can occur with classic angiography including arterial injury, pain, hematoma and pseudo-aneurysm formation.

RENAL APPLICATIONS

Renal Artery Stenosis

Renovascular hypertension, a potentially curable cause of hypertension, accounts for less than 5% of adult patients with hypertension (1). Early diagnosis and treatment of patients with renovasular hypertension are necessary to prevent sequelae of long standing hypertension and renal dysfunction. Because of the low incidence of reno-vascular hypertension, a non-invasive screening examination has been sought. Now a days 3D-CTA is being studied for non-invasive evaluation for hemodynamically significant stenosis. Rubin found 3D-CTA to have 92% senstivity and 83% specificity for the detection of hemodynamically significant (>70%) stenosis using maximum intensity projection (MIP) techniques (1). Kattee *et. al.* found 96% sensitivity and specificity for the detection of stenosis graded between 51% and 99% using 3D-CTA and DSA (2). They also found that 3D-CTA was 100% sensitive and specific for detecting renal artery occlusion.

CT angiography allows the visualization of renal arteries in multiple planes and projections so that the renal arteries can be observed in their entirety and stenosis quantified. Nephrographic asymmetry have been found to be 85-98% sensitive and 50-53% specific for presence of significant renal artery stenosis (3). Nephrographic asymmetries include globe decrease in renal size or a regional dimunition in size if any accessory, or branch vessel is affected by stenosis. 3D-CTA conducted by us in reno-vascular hypertension revealed renal artery stenosis with decrease in kidney size (Fig. 1).

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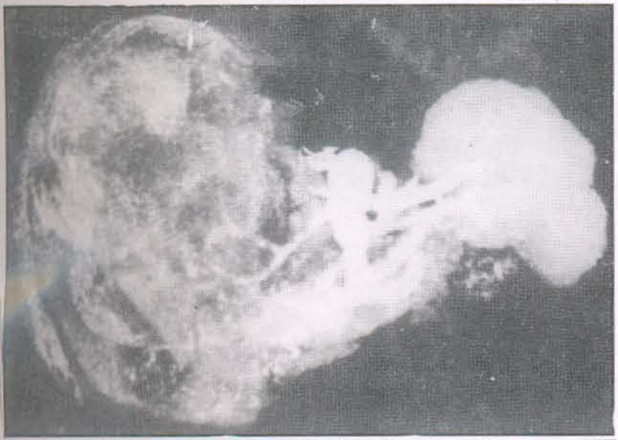

Fig. 1. CT renal angiogram in a case of renal vasculature hypertension showing Rt. renal artery stenosis. Rt. kidney is small in size.

Renal Donor candidates

Living related renal donation is a major treatment for patients with end stage renal disease. Patient and graft survival rates showed improved survival results with live related donation compared with cadaveric donation. 3D-CTA has been investigated as a non-invasive pre-operative method for evaluation of renal donor candidates. 3D-CTA provided better renal arterial and venous anatomy compared with classic angiography.

Rubin *et. al.* showed 3D-CTA to be 100% accurate for identification of accessory renal arteries and that 3D-CTA was useful for identifying perihilar branching patterns (4). Platt *et. al.* evaluated 154 patients with 3D-CTA and classic angiography before donor nephrectomy and found 3D-CTA to be as accurate as classic angiography for predicting renal donor anatomy (5).

Renal masses

CT angiography can be used pre operatively to evaluate patients with known or suspected renal masses. The use of dual phase 3D-CTA is helpful for determining the location and size of renal masses. The extent of venous invasion can be determined accurately pre operatively by 3D-CTA. The ability of 3D-CTA to show renal mass in multiple planes and orientations assists the surgeons in planning the possibility of performing nephron – sparing surgery (6). Similar observations were noted while doing 3D-CTA in renal masses at our centre (Fig. 2).

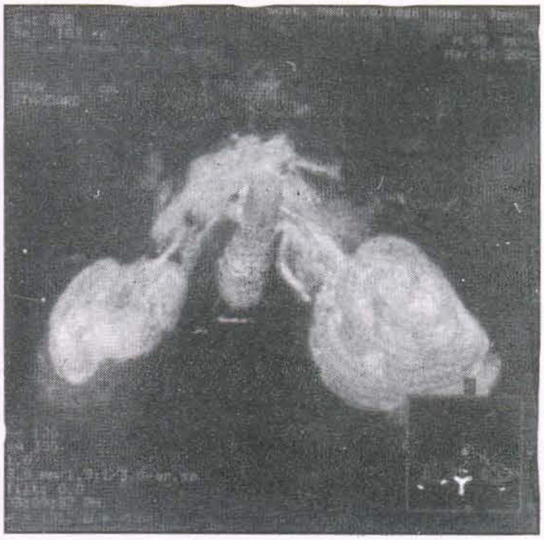

Fig. 2. CT renal angiogram in a case of hypernephroma showing extent of renal mass and the vascular supply of the mass.

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