

Assessment of donor kidney anatomy

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GUIDELINES

No recommendations possible based on Level I or II evidence

SUGGESTIONS FOR CLINICAL CARE

(Suggestions are based on Level III and IV evidence)

- At present, the optimal means of assessing living donor kidney anatomy is by using 16 slice (or better) computed tomography (CT) with contrast enhancement in a timed fashion (triphasic CT).
- No additional imaging is required except on the rare occasion that fibromuscular dysplasia is suspected.

IMPLEMENTATION AND AUDIT

No recommendation.

BACKGROUND

The imaging of kidneys prior to donor nephrectomy can be accomplished by several means, including: ultrasound (US); conventional angiography (CA); digital subtraction angiography (DSA); computed tomography (CT) and magnetic resonance imaging (MRI), each of which has inherent limitations, strengths and weaknesses.

A single modality to assess vasculature, renal parenchyma and urinary drainage is preferred.

The pre-nephrectomy anatomy which most anticipates complications during the transplant procedure is the presence or absence of variant arteries.

Numerous studies have assessed the sensitivity, specificity and accuracy of each imaging technique in relation to surgical anatomy.

The objective of this guideline is to outline the best means of assessing donor kidney anatomy prior to surgery.

SEARCH STRATEGY

Databases searched: MeSH terms and text words for kidney transplantation were combined with MeSH terms and text words for angiography, X-ray computed tomography and magnetic resonance angiography. The search was carried out in Medline (1966 – September Week 1, 2006). The Cochrane Renal Group Trials Register was also searched for

trials not indexed in Medline. The Register searches all major medical electronic databases, including Embase.

Date of searches: 19 September 2006.

Update search:

Databases searched: MeSH terms and text words for kidney transplantation were combined with MeSH terms and text words for living donor and combined with MeSH terms and text words for open and laparoscopic nephrectomy. The search was carried out in Medline (1966 – March Week 1, 2009). The Cochrane Renal Group Trials Register was also searched for trials not indexed in Medline.

Date of searches: 9 March 2009.

WHAT IS THE EVIDENCE?

Conventional Angiography

Six studies published from 1978 to 2000 compared operative findings with angiographic findings.^{1–6} The sensitivity in detecting accessory renal arteries ranged from 67%–100% (mean 86%). This method is useful for the detection of fibromuscular dysplasia.

Digital Subtraction Angiography

Seven studies published from 1985 to 2006 compared operative findings with digital subtraction angiography (DSA) findings.^{7–13} The sensitivity in detecting accessory renal arteries ranged from 60%–91% (mean 81%). This method is useful for the detection of fibromuscular dysplasia.

Computed Tomography

Twenty-nine studies published from 1995 to 2006 compared operative findings with CT angiographic findings.^{3,5,6,8,9,12–35} The sensitivity in detecting accessory renal arteries ranged from 40%–100% (mean 84%). In studies with more than 100 participants, the mean sensitivity was 86%. This technique detects early branching with a mean sensitivity of 81%, but may miss fibromuscular dysplasia (incidence uncertain). Sixteen-slice machines are considered to be superior to 4-slice machines.

Tombul *et al.* (2008) assessed 3-D computed tomography in 60 consecutive living kidney donors from 2002–2007.³⁶ Preoperative MDCT angiography detected 64 of the 67 renal arteries seen preoperatively in 60 renal units. Two undetected arteries had diameters less than 3 mm. The sensitivity of MDCT angiography was 95% for arteries and 93% for veins. The positive predictive value was 100% for arteries and veins. MDCT angiography was found to be less invasive and enabled rapid and accurate preoperative assessment of vascular anatomy in living kidney donors.

Magnetic Resonance Imaging

Thirteen studies published from 1997 to 2006 compared operative findings with MRI angiographic findings.^{10,14,18,19,32,37–43} The sensitivity in detecting accessory renal arteries ranged from 20%–100% (mean 80%). In studies with more than 100 participants, the mean sensitivity was 54%. This technique detects early branching with a mean sensitivity of 69%. It may miss fibromuscular dysplasia (incidence uncertain). Magnetic resonance angiography (MRA) source data is better than maximum intensity projection (MIP) data, which is better than virtual reality (VR) and shaded surface display (SSD) data.

Kok *et al.* (2008) evaluated the outcomes of vascular imaging and the clinical consequences of multiple arteries and veins.⁴⁴ Vascular anatomy at operation was compared with vascular anatomy as imaged by MRI or subtraction angiography. MRI failed to predict arterial anatomy in 23/220 compared with 3/101 after angiography. The authors concluded that both MRI and angiography provided suboptimal information on renal vascular anatomy.

Neville *et al.* (2008) prospectively compared MRA with selective renal angiography in patients from 53 renal units.⁴⁵ Selective renal angiography provided a sensitivity and specificity of 86% and 95%, respectively, and positive predictive value and negative predictive value of 75% and 97%, respectively. MRA had a sensitivity and specificity of 64% and 88%, respectively, and positive predictive value and negative predictive value of 58% and 90%, respectively. It was concluded that MRA could not replace standard renal angiography as the reference standard.

Monroy-Cuadros *et al.* (2008) retrospectively analysed the reliability of MRA compared with intra-operative findings in 66 patients.⁴⁶ In 8 cases, an accessory renal artery was found intra-operatively, 2 of which were incorrectly diagnosed as normal by MRA. The negative predictive value of MRA was 97%.

SUMMARY OF THE EVIDENCE

CT evaluation is at least as good as CA and DSA in depicting detailed vascular anatomy of donor kidneys. Sixteen-slice CT machines may be superior to CA and DSA.

MRI may be slightly inferior to CT evaluation.

Both CT and MRI provide additional information about the renal parenchyma and urinary drainage of the kidneys. Both are less expensive to use than CA or DSA.

WHAT DO THE OTHER GUIDELINES SAY?

Kidney Disease Outcomes Quality Initiative: No recommendation.

UK Renal Association: No recommendation.

Canadian Society of Nephrology: No recommendation.

European Best Practice Guidelines: The European Guidelines (ERA-EDTA) state that the requirements include ultrasound and conventional angiography with intravenous pyelography being optional. This guideline was written in 2000.

International Guidelines: No recommendation.

SUGGESTIONS FOR FUTURE RESEARCH

Imaging modalities, especially MRI, are advancing rapidly in technological terms. This guideline is very likely to be out of date within 3 years and should be reviewed at the latest by 2011.

CONFLICT OF INTEREST

Stephen Munn has no relevant financial affiliations that would cause a conflict of interest according to the conflict of interest statement set down by CARI.

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