

# Superior Sensitivity of Angiographic Detection of Arteriovenous Fistula after Biopsy in a Renal Allograft with CO<sub>2</sub> Compared with Iodinated Contrast Medium

Phillip M. Cheng, MD, and Richard J. Van Allan, MD

Arteriovenous (AV) fistulas are potential complications of renal transplant biopsy procedures. In the setting of renal transplant failure, angiography with CO<sub>2</sub> as a contrast agent is a useful adjunct to angiography with conventional contrast medium in the diagnosis and treatment of such fistulas with minimal nephrotoxicity. The present report describes a case of a renal transplant AV fistula seen after biopsy that could be detected angiographically only with CO<sub>2</sub> contrast medium.

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Abbreviation: AV = arteriovenous

PERCUTANEOUS renal biopsy may be complicated by arteriovenous (AV) fistula in as many as 18% of patients (1). Although most are asymptomatic, such fistulas may lead to hematuria and renal insufficiency. CO<sub>2</sub> has been demonstrated to be useful in minimizing nephrotoxicity in the angiographic diagnosis and treatment of renal transplant AV fistulas (2). However, the sensitivity of CO<sub>2</sub> relative to conventional iodinated contrast media for the detection of AV fistulas is uncertain. We report a case in which a renal transplant AV fistula was detectable initially after biopsy with CO<sub>2</sub> as the contrast agent, but not with isoosmolar iodinated contrast medium.

From the Department of Radiology, Cedars-Sinai Medical Center, 8700 Beverly Boulevard, M-335, Los Angeles, California 90048. Received May 10, 2006; revision requested August 15; final revision received August 29; and accepted October 2. Address correspondence to R.J.V.; E-mail: vanallen@cshs.org

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## CASE REPORT

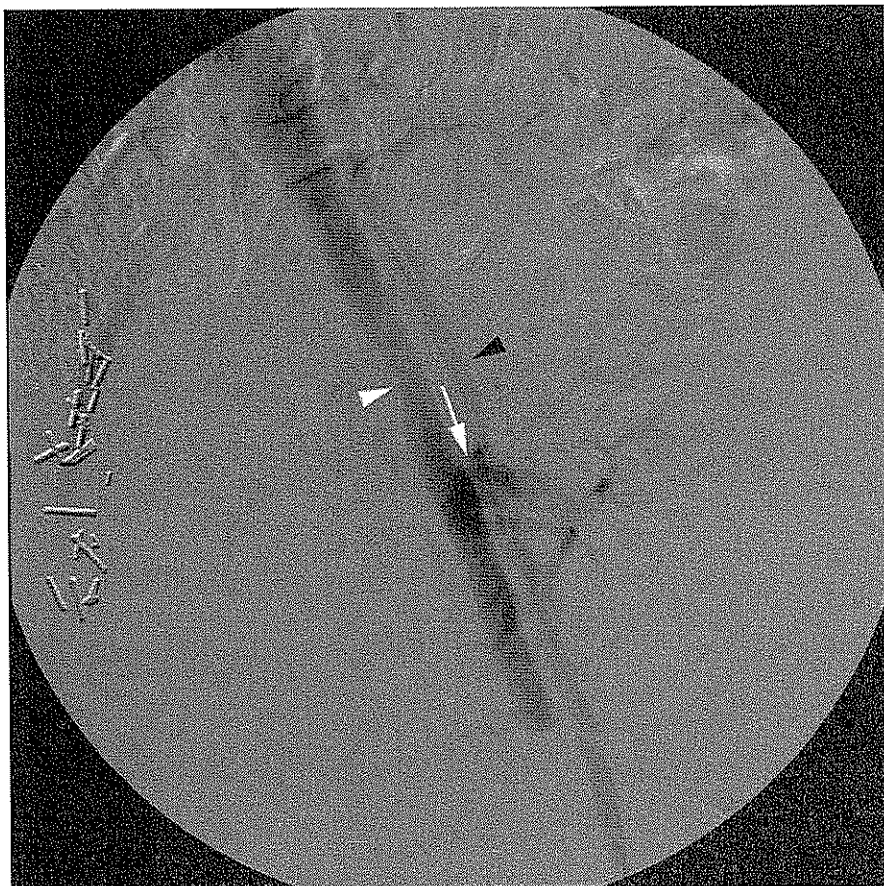
A 38-year-old woman with a history of end-stage renal disease secondary to type I diabetes underwent renal transplantation. Three months after the transplantation procedure, her serum creatinine levels were noted to fluctuate, and she was admitted for ultrasound-guided core biopsy of the renal allograft. After the biopsy, her creatinine level increased to 2.7 mg/dL, and she experienced gross hematuria.

The patient was brought to the angiography suite and sedated with general anesthesia. Thirty milliliters of CO<sub>2</sub> were initially hand-injected via a 5-F Kumpe catheter (Cook, Bloomington, IN) in the left common iliac artery, which demonstrated rapid (<1 sec) shunting of CO<sub>2</sub> from the kidney into the common iliac vein (Fig 1). Selective CO<sub>2</sub> arteriography by hand injection performed via a 5-F Cobra 1 catheter (Cook) from the origin of the transplant renal artery again demonstrated rapid shunting (Fig 2).

However, selective digital subtraction arteriography of the transplant renal artery with 9 mL of Visipaque 320 (Amersham, Princeton,

NJ) at a rate of 3 mL/sec demonstrated no AV fistula (Fig 3). Selective catheterization of a segmental branch in the lower pole of the transplant kidney was performed with a Renegade 3-F Hi-Flo catheter (Boston Scientific, Watertown, MA), and arteriography with iodinated contrast medium was repeated, which revealed a tiny pseudoaneurysm from an interlobar branch. Subselective arteriography of this interlobar branch (2 mL at a rate of 0.5 mL/sec) finally revealed the AV fistula (Fig 4) previously demonstrated only with CO<sub>2</sub>.

Successful embolization of the fistula was performed with Gelfoam (Upjohn, Kalamazoo, MI) and confirmed with conventional (Fig 5) and CO<sub>2</sub> arteriography (Fig 6). No further episodes of gross hematuria were reported during the patient's hospitalization. Three months later, a left iliac arteriogram with CO<sub>2</sub> contrast medium and a transplant renal arteriogram with iodinated contrast medium were performed as part of an evaluation for transplant renal artery stenosis; no AV communication was demonstrated.



**Figure 1.** Injection of CO<sub>2</sub> from the left common iliac artery (black arrowhead) results in rapid shunting of CO<sub>2</sub> from the transplant kidney into the common iliac vein (white arrowhead). The transplant renal artery is visualized (white arrow).

## DISCUSSION

CO<sub>2</sub> acts as a negative contrast agent, with its low density in a blood vessel demonstrated by digital subtraction angiography. Advantages cited in comparison with conventional iodinated contrast agents include a lack of nephrotoxicity and allergic reactions. However, the sensitivity of CO<sub>2</sub> relative to iodinated contrast agents for particular angiographic diagnostic tasks has not been well documented. A small series by Textor et al (3) in 1997 suggested that the use of CO<sub>2</sub> may allow detection of some subtle active gastrointestinal bleeding better than iodinated contrast medium, but this finding was not borne out in a larger series (4).

It has been reported that for the detection of AV shunting in hepatic and renal tumors, CO<sub>2</sub> may be superior to iodinated contrast medium (5,6). This may be related to the low viscosity of CO<sub>2</sub> relative to iodinated contrast media, typically approximately 0.25% (7). In our case, the viscosity advantage of CO<sub>2</sub> was magnified because our iodinated contrast agent was Visipaque 320, a relatively viscous agent (11.8 cps at 37°C) chosen because of its iso-osmolarity to serum and related reduced nephrotoxicity. By contrast, the impact of the vasodilatory properties of CO<sub>2</sub> on the detection of vascular abnormalities is unclear.

This is the first case in our experi-

ence in which we detected a renal transplant AV fistula with CO<sub>2</sub> angiography. It had already been our practice to obtain renal transplant arteriograms with CO<sub>2</sub> and as little iodinated contrast medium as possible, especially in the setting of renal insufficiency. However, this case has motivated us to make extra efforts to localize renal bleeding with the use of CO<sub>2</sub> contrast medium when no bleeding source is seen with iodinated contrast agent injections.

In summary, we present a case of renal transplant AV fistula after biopsy that was readily detected with CO<sub>2</sub> contrast medium in a nonselective injection, but not with iodinated contrast medium until a superselective injection was performed. Further studies are needed to more clearly establish the relative sensitivity of CO<sub>2</sub> and iodinated contrast medium in the detection of AV fistulas in this setting.

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**a.** **b.**  
Figure 2. Injection of CO<sub>2</sub> from the transplant renal artery (white arrow) shows rapid shunting of CO<sub>2</sub> from the transplant kidney into the common iliac vein (white arrowhead). Reflux of CO<sub>2</sub> is seen into the left common iliac artery (black arrowhead). Images were obtained less than 0.5 seconds apart.

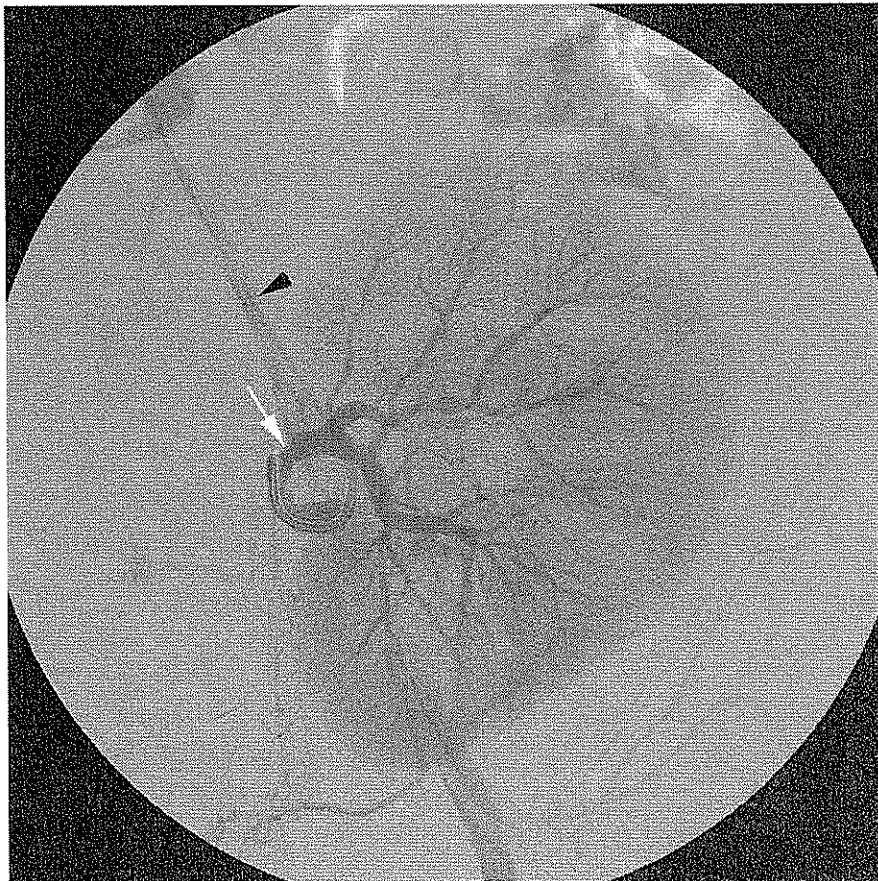


Figure 3. Injection of iodinated contrast medium from the transplant renal artery (white arrowhead) does not demonstrate a fistula. Reflux of contrast medium is seen into the left common iliac artery (black arrowhead).

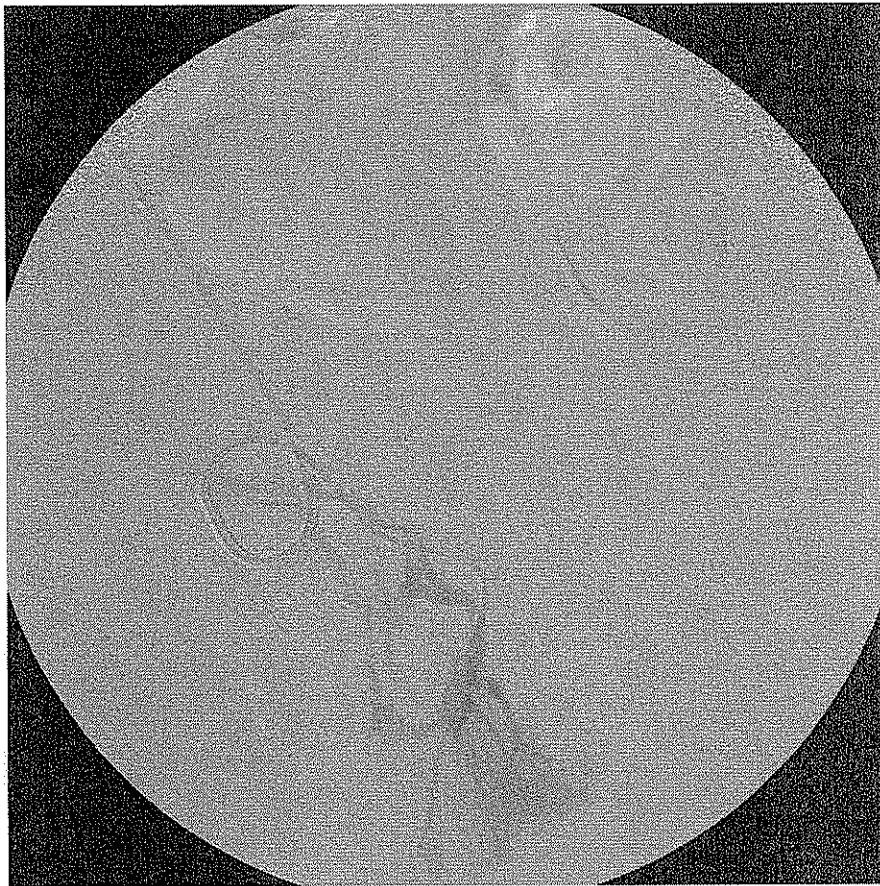
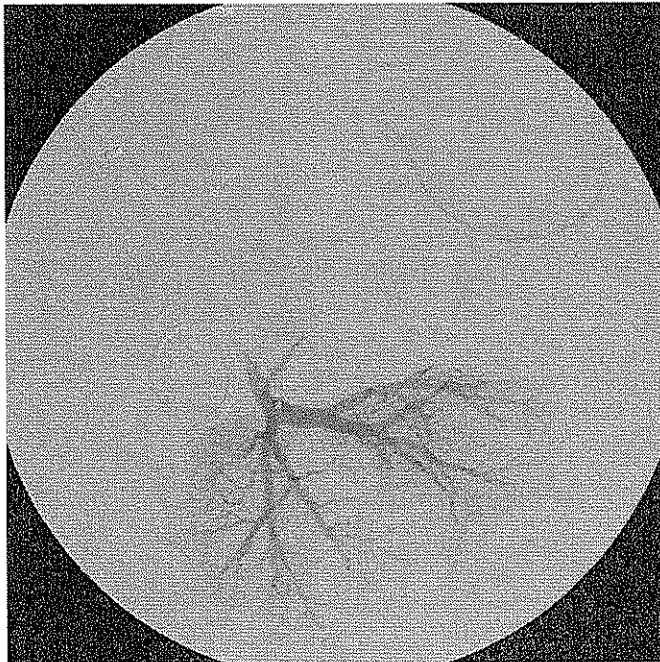
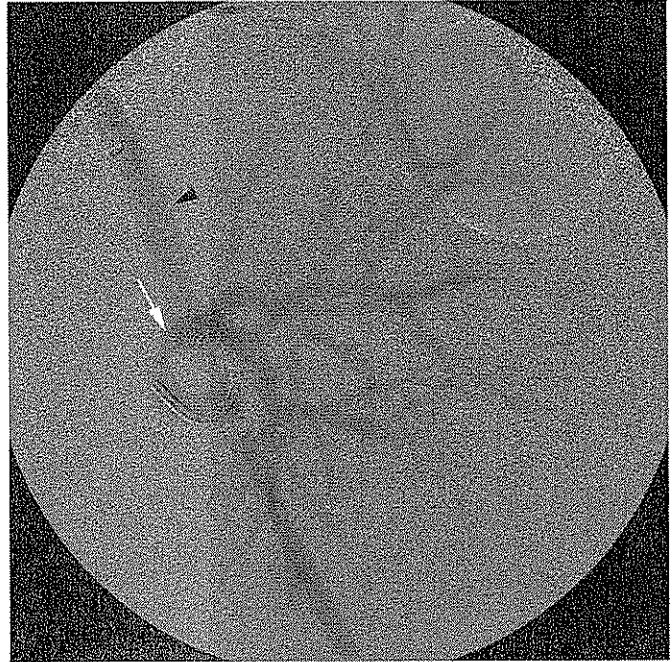


Figure 4. Selective injection of a subsegmental branch demonstrates the AV fistula.



5.



6.

Figures 5, 6. (5) Injection of iodinated contrast medium after successful Gelfoam embolization confirms elimination of shunting. (6) Injection of CO<sub>2</sub> from the transplant renal artery (white arrowhead) after successful Gelfoam embolization confirms elimination of shunting (compare with Fig 2). Reflux of CO<sub>2</sub> is seen into the left common iliac artery (black arrowhead).