



Trauma and reconstruction

## Vicarious excretion of intravenous contrast masquerading as a nephroenteric fistula in a patient with a grade IV renal injury

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## ARTICLE INFO

## Keywords:

Fistula  
Renal trauma  
Vicarious contrast excretion

## ABSTRACT

We describe a case of a patient who suffered a grade IV renal injury who demonstrated vicarious excretion of intravenous contrast into the bowel masquerading as a nephroenteric fistula. Despite concerning imaging features, given the patient's lack of clinical symptoms of a nephroenteric fistula, negative oral activated charcoal test, and our understanding of the pharmacokinetics of intravenous contrast, our suspicion for nephroenteric fistula was low. This case highlights the importance of carefully considering the mechanism of injury when developing a differential diagnosis of potential sequela after trauma and understanding the pharmacokinetics of intravenous contrast in the trauma setting.

## Introduction

The preferred imaging modality to assess the kidneys after blunt and/or penetrating trauma is a computed tomography (CT) scan of the abdomen and pelvis with intravenous contrast with immediate and delayed phases. Follow-up CT imaging 48–72 hours after initial imaging is recommended in patients with high-grade renal injury (American Association for the Surgery of Trauma [AAST] grades IV–V), given the increased risk for complications such as hemorrhage, urinoma, and fistula formation.<sup>1</sup> We present the case of a patient with an AAST grade IV renal injury who demonstrated vicarious excretion of intravenous contrast into the bowel masquerading as a nephroenteric fistula.

## Case presentation

A 68-year-old female with a history of nephrolithiasis and an 8 cm right lower pole calyceal diverticulum was transferred to our center with severe abdominal pain after falling over a rock while running. A CT urogram (imaging with non-contrast, and immediate and delayed contrast phases), which was performed after intravenous injection of 125 mL of Iohexol 350 mg/mL, demonstrated a large amount of urinary extravasation from the right lower pole renal pelvis.

The patient was taken to the operating room for cystourethroscopy, right retrograde pyelogram, and placement of a right-sided double-J stent. Real-time fluoroscopic interpretation of the retrograde pyelogram confirmed urinary extravasation from the right lower pole, as the

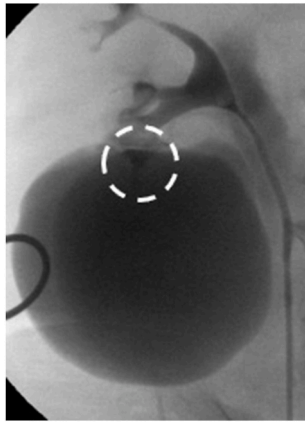
borders of the right lower pole calyceal diverticulum were intact (Fig. 1). Follow-up CT urogram, which was performed 48-h after double-J stent placement using intravenous injection of 125 mL of Iohexol 350 mg/mL, demonstrated no active urinary extravasation and a decrease in the size of the peri-nephric urine collection. Although the patient never received any oral contrast, the patient was incidentally noted to have a large amount of contrast in the right and transverse colon suggestive of a nephroenteric fistula (Fig. 2). There was no evidence of contrast in the gastrointestinal tract on prior CT urogram and retrograde pyelogram.

However, given the patient's mechanism of blunt trauma and lack of clinical symptoms, our suspicion for a nephroenteric fistula was low. Additionally, we performed an oral activated charcoal test prior to discharge that was negative for a fistulous connection between the urinary and enteric systems. Given the patient's clinical picture, we suspected that the contrast noted in the right and transverse colon on CT urogram was secondary to vicarious contrast excretion after administration of intravenous contrast rather than a nephroenteric fistula. CT urogram performed 3 weeks after injury confirmed resolution of the urinary leak and absence of a nephroenteric fistula, and the double-J stent was removed.

## Discussion

We present a case of vicarious contrast excretion after administration of intravenous contrast masquerading as a nephroenteric fistula in the setting of a Grade IV renal injury after blunt trauma. In general,

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**Fig. 1.** Urinary extravasation from right lower pole calyx and superimposed lower pole calyceal diverticulum. Circle denotes area of urinary extravasation.

intravenous contrast is excreted by the kidneys via glomerular filtration and/or tubular secretion. It is for this reason that a CT urogram is the preferred imaging study to evaluate the upper tracts after blunt and/or penetrating trauma. Vicarious contrast excretion after administration of intravenous contrast refers to contrast excretion from a non-renal source such as the liver and small bowel. When contrast is excreted via the liver and/or small bowel, it may lead to unexpected opacification of the gall bladder, small bowel, and/or large bowel.<sup>2,3</sup>

Vicarious contrast excretion is thought to occur when plasma proteins such as albumin bind to intravenous contrast media, which results in increased hepatocyte and enterocyte excretion of contrast. However, as modern contrast media demonstrates minimal affinity for protein binding, it is typical for less than 1% of intravenously administered contrast to be excreted through vicarious pathways. Nevertheless, in the setting of acute and/or chronic renal injury (ie. trauma, urinary obstruction), there may be increased plasma protein binding to contrast media due to a decrease in renal blood flow and prolonged recirculation of contrast material, which may ultimately increase the likelihood of vicarious contrast excretion.<sup>2</sup> Additionally, administration of a high contrast load and hemorrhagic shock may further potentiate the likelihood of this phenomenon.

Vicarious contrast excretion is a relatively rare phenomenon that was first reported in the urologic literature by Barry Jr. and Forbis Jr. in 1968.<sup>3</sup> Since then, it has been reported in a handful of case reports in the urologic trauma literature. Kim et al. described vicarious contrast excretion in a 41-year-old who suffered a fall from a sixth-floor scaffolding.<sup>4</sup> The left kidney was not visualized on initial intravenous

urography. The patient was emergently taken to the operating room for left nephrectomy and splenectomy after sudden hemorrhagic shock and cardiac arrest. A cystogram performed at the end of the procedure showed opacification of the small and large bowel.<sup>4</sup> Kist et al. described vicarious contrast excretion in a 21-year-old man who suffered a blow to the right flank with a baseball bat.<sup>5</sup> The patient's admission CT with intravenous contrast demonstrated a fractured kidney. Follow up CT with intravenous contrast obtained 18 hours after admission demonstrated an enlarging perinephric hematoma and significant opacification of the gallbladder.<sup>5</sup>

In our case, a patient with an AAST grade IV renal injury demonstrated vicarious excretion of intravenous contrast into the bowel, which masqueraded as a nephroenteric fistula. This case highlights the importance of carefully considering the mechanism of injury when developing a differential diagnosis of potential sequela after trauma and understanding the pharmacokinetics of intravenous contrast in the trauma setting.

### Conclusion

Although vicarious contrast excretion after administration of intravenous contrast is relatively rare, it is critical for urologists to understand this phenomenon and their clinical implications, especially in the trauma setting.

### Funding

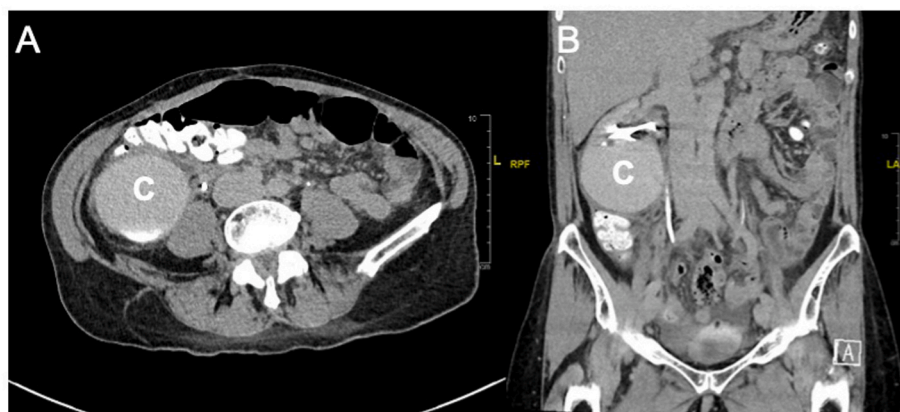
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

### Declaration of competing interest

Diboro Kanabolo, Rishi Sekar, Alexander Skokan, Judith Hagedorn, and Ziho Lee have no conflicts of interest or financial ties to disclose.

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**Fig. 2.** a: Axial, 10-min delayed contrast phase demonstrating vicarious intravenous contrast excretion into the large bowel. “C” denotes lower pole calyceal diverticulum. b: Coronal, 10-min delayed contrast phase demonstrating vicarious intravenous contrast excretion into the large bowel. “C” denotes lower pole calyceal diverticulum.

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