

[ CASE REPORT ]

## Reflex Anuria Following Retrograde Pyelography: A Case Report and Literature Review

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### Abstract:

A case of acute kidney injury due to reflex anuria that was caused by retrograde pyelography and required temporary hemodialysis is reported. An 83-year-old Japanese woman presented with anuria 2 days after undergoing bilateral retrograde pyelography for the investigation of gross hematuria. Retrograde pyelography showed no apparent abnormality, such as malignancy or urolithiasis, but pyelorenal extravasation of contrast medium was remarkable. Her anuria improved promptly after hemodialysis, allowing her treatment to conclude with only one hemodialysis session, and a normal renal function was restored with no sequelae. The details of this case and a review of the relevant literature are presented.

**Key words:** reflex anuria, acute kidney injury, retrograde pyelography, hemodialysis

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### Introduction

Acute kidney injury (AKI) occasionally occurs after intravenous pyelography. However, AKI is extremely rare after “retrograde” pyelography. Reflux anuria (RA) is a condition that was defined as “cessation of urine output from both kidneys in response to irritation or trauma to one kidney or its ureter or severe painful stimuli to other pelvic organs” by Hull et al. in 1980 (1). In most cases, RA occurs following colicky pain due to urolithiasis (2, 3). However, a small number of reports suggest that retrograde pyelography can also cause RA.

A case of AKI due to RA that was caused by retrograde pyelography and required temporary hemodialysis treatment is reported.

### Case Report

An 83-year-old Japanese woman came to the Department of Nephrology and Hypertension complaining of anuria. She had been found to have chronic hepatitis B virus infection (so-called hepatitis B virus carrier) when she was 41 years

old. She underwent total hysterectomy for myoma uteri at 48 years of age and cholecystectomy for cholecystolithiasis at 65 years of age. She had been prescribed antihypertensive and anti-osteoporotic medications by a rural clinician for more than 10 years. She had no history of any allergy to food or medication.

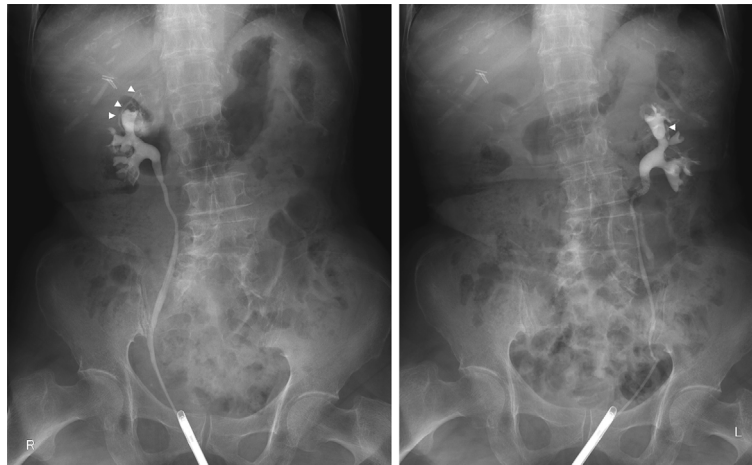
Two days prior to the consultation, she had undergone bilateral retrograde pyelography at our hospital for the investigation of gross hematuria. Retrograde pyelography using iopamidol (Iopamiron<sup>®</sup> inj.; Bayer Yakuin, Osaka, Japan) as the contrast medium showed no apparent abnormality, such as malignancy or urolithiasis, but pyelorenal extravasation of contrast medium was remarkable (Fig. 1). In the middle of the pyelography procedure, she suddenly complained of sharp back pain, and she was admitted to the urological department of our hospital for close observation.

The patient's clinical course and laboratory data before and after admission are shown in Fig. 2. On admission, her temperature was 37.2°C, blood pressure was 135/50 mmHg, and heart rate was 55 beats per minute. Although her renal function had been normal before pyelography (serum creatinine 0.49 mg/dL, estimated glomerular filtration rate 88.0 mL/min/1.73 m<sup>2</sup>, serum urea nitrogen 14 mg/dL), her serum

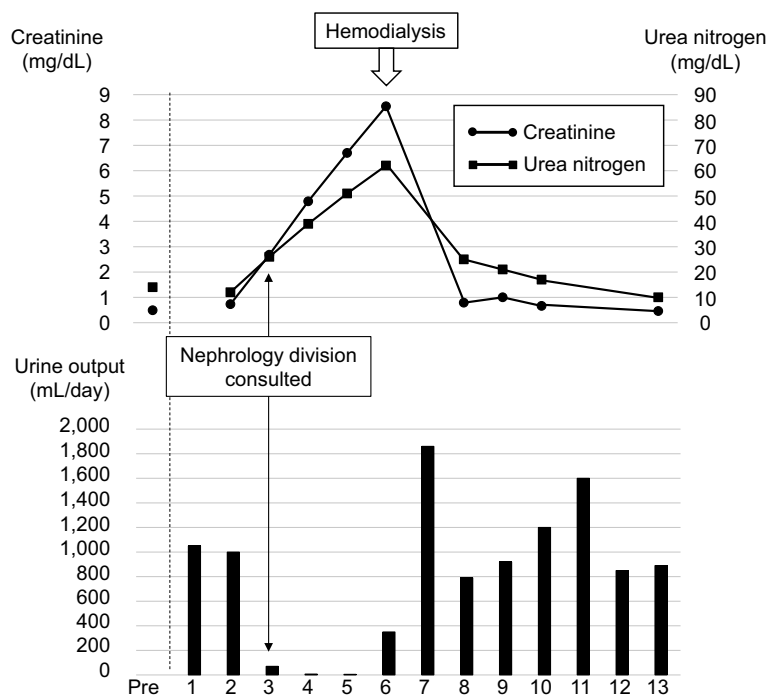
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**Figure 1.** Retrograde pyelography. Bilateral extravasation of contrast medium is seen (arrows).



**Figure 2.** Urine output, serum creatinine, and serum urea nitrogen levels during hospitalization.

creatinine level was somewhat higher afterwards (0.73 mg/dL), and she appeared to be at risk for AKI (4). On day 3, she became anuric (70 mL/day) despite hydration (1,000 mL/day) and intravenous furosemide treatment; therefore, acute kidney failure was diagnosed (4), and our division was consulted.

On the day of consultation, her serum creatinine was 2.68 mg/dL, fractional excretion of sodium was 2.9%, and fractional excretion of urea was 30.9%. She still complained of mild sharp back pain, but it had almost disappeared by the next day. However, on days 4 and 5, her anuria continued (7 mL/day and 5 mL/day, respectively). On day 6, her serum creatinine rose further to 8.54 mg/dL, and hemodialysis (HD) was performed. After the HD session, she passed 350 mL/12 hours of urine. On day 7, her urine output recovered to a high-normal level (1,860 mL/day), and on day 13, her

serum creatinine recovered to the pre-retrograde pyelography level (0.46 mg/dL). She was discharged from our hospital on day 21.

## Discussion

RA was defined by Hull et al. in 1980 as the “cessation of urine output from both kidneys in response to irritation or trauma to one kidney or its ureter or severe painful stimuli to other pelvic organs” (1). RA is an uncommon cause for AKI. This definition excludes physical occlusions of the bilateral ureters, intrinsic renal disease, and a decreased renal blood flow due to causes such as hypotension, dehydration, or sepsis.

In the present case, an elderly woman developed RA two days after undergoing retrograde pyelography and subse-

**Table. Clinical Courses of Previously Reported Cases of Reflex Anuria Following Retrograde Pyelography.**

Case	Age (y)/ Sex	Presentation	Duration of anuria	Urine output in diuretic phase	Recovery following RP	Dialysis Treatment	Reference
1	29/M	Severe bilateral flank pain	3 days	N/A	8 days	N/A	[5]
2	38/M	Bilateral renal angle pain	About 3 days	N/A	8 days	(-)	[6]
3	26/M	Generalized convulsion, fever	5 days	6,000 mL/18 h	10 days	(-)	[7]
4	44/M	Flank and suprapubic pain, hematuria, fever, pulmonary edema	5 days	N/A	15 days	(-)	
5	35/M	none	N/A	N/A	N/A	(-)	
6	35/M	Bilateral flank pain	72 hours	N/A	15 days	(-)	[8]
7	50/M	N/A	24 hours	N/A	4 days	(-)	[9]
8	47/M	Suprapubic cramping pain, nausea, vomiting	7 days	2,500 mL/day	About 1 month	(+)	[10]
9	49/M	Fever, chills, right abdominal pain	30 hours	N/A	N/A	(-)	[11]
10	26/M	Anorexia, nausea, vomiting, bilateral flank pain	N/A	N/A	N/A	(-)	
11	61/M	Bilateral flank pain	N/A	N/A	N/A	(-)	
12	41/M	Severe bilateral flank pain	92 hours	6,000 mL/day	9 days	(-)	[12]
13	5/F	Abdominal pain, vomiting	N/A	N/A	N/A	N/A	[13]
14	69/M	Bilateral flank pain	3 days	5,830 mL/day	8 days	(+)	[14]
15	69/M	Bilateral flank pain	48 hours	5,170 mL/day	8 days	(-)	[15]
16	83/F	Severe lumbar backache, nausea, vomiting	4 days	1,800 mL/day	9 days	(+)	Current case

RP: retrograde pyelography, N/A: not available

quently received hemodialysis treatment. Her anuria improved promptly after hemodialysis, allowing her treatment to conclude with only one hemodialysis session, and a normal renal function was restored with no sequelae.

Table summarizes the clinical characteristics described in case reports of patients who developed AKI after retrograde pyelography (5-15). Common symptoms include severe flank pain. The present patient also had persistent bilateral lumbar backache and lower abdominal pain. Ranging from approximately 3 to 7 days, the duration of anuria was no more than 5 days in most cases, with a mean of 3.4 days. The time to the restoration of the baseline renal function was typically around 10 days, with a mean of 11.3 days. The previous cases included many whose renal function was restored without requiring dialysis treatment but also many that were reported before dialysis became widely available, thus providing no binding guidance. Therefore, treatment options including hemodialysis should be considered in cases such as the present one, where the patient had persistent anuria and advanced fluid retention, or in cases where electrolytes or the acid-base equilibrium is substantially out of balance.

Compared with the limited number of past cases, the present case has three characteristics that are of great interest. First, it is the second reported case in a female patient and the first reported case of an adult woman. The reasons for the sex bias are unknown. Khan et al. reported that they collected cases of patients who developed RA after unilateral ureteral calculus, and all 20 were men (16). While no reasons were provided, the possibility that progesterone-induced vasodilation plays a role in women was mentioned. The patient in the present case also experienced symptoms

such as cold sweats, nausea, and vomiting, in addition to bilateral lumbar backache and lower abdominal pain, and those symptoms also persisted, suggesting that the patient was subjected to quite powerful stress. As a result, the progesterone-induced vasodilation was offset, thus potentially allowing such a disorder to develop even in an adult woman. RA accompanied by nausea and vomiting may tend to become protracted and severe.

Second, the typical diuretic phase was absent from the process of recovery from renal failure in the present case. As a result, the correction of the body fluid volume or weight took some time. The anuria in this patient persisted for 4 days, during which her weight increased from baseline by approximately 5 kg, and she developed cardiomegaly and pulmonary congestion. Even after the anuria improved, her urine output remained no higher than 2,000 mL/day, and her weight decreased gradually, eventually returning to the baseline level 3 weeks later. As indicated in Table, very few reports mentioned the diuretic phase, but many indicated a urine output of  $\geq 5,000$  mL/day during the diuretic phase (7, 12, 14, 15). Even in reported cases where the cause is something other than retrograde pyelography, the diuretic phase was seen in the process of recovery from RA-induced AKI (17, 18). The computed tomography (CT) scan of the present patient on the day of RA onset showed subcutaneous edema and ascites, which had not been present before her hospital admission. A possible explanation is that the severe stress induced an increase in vascular permeability, allowing body fluid to leak from blood vessels into subcutaneous tissues and the abdominal cavity, resulting in a reduced urine output during the diuretic phase. Moreover, the CT scan taken three days after the patient recovered from

anuria showed not only an increasing amount of ascites but also the presence of pleural effusion for the first time. The fact that the correction of body fluid volume and weight took time suggested that the body fluid that had moved into the third space was gradually resorbed into the blood vessels thereafter. Indeed, the CT scan obtained two months after her discharge showed that the pleural effusion and ascites had nearly disappeared.

Third, the present patient was the oldest reported to date among patients who developed RA after retrograde pyelography. As shown in Table, all patients in the previous case reports were no older than 64 years of age, but those in a limited number of cases reported in the past 20 years were all elderly,  $\geq 65$  years of age. This may be attributable to both improvements in how retrograde pyelography is performed, including the use of thinner ureteral catheters and less harmful contrast media, and increases in the number of elderly patients undergoing retrograde pyelography as the population ages.

While the details remain unclear, two mechanisms may trigger RA after retrograde pyelography (19, 20). One is the neurovascular reflex, wherein the stress exerted on one kidney causes reflex spasm of the intrarenal arterioles or ureters of both kidneys, resulting in a reduced renal blood flow and/or hydronephrosis. The other is mechanical obstruction, wherein the backflow of contrast material from the renal pelvis to the tubules creates a pressure overload, which induces inflammation and edema in the renal interstitium, resulting in contrast medium-induced mechanical occlusions in the kidneys and decreases in renal blood flow. The patient in the present case had mild bilateral hydronephrosis as confirmed by the CT scan on the day of RA onset, suggesting that she had bilateral ureteral spasm. Nevertheless, the fact that anuria persisted thereafter without worsening of hydronephrosis suggested that bilateral intrarenal arteriolar spasm occurred at the same time and that the anuria was attributable directly to decreases in the glomerular filtration rate due to a reduced renal blood flow.

Of note, while the anuria improved several hours after hemodialysis, its causal relationship was unknown. As shown in Table, most cases in previous reports were not treated with hemodialysis. Nevertheless, the anuria improved within seven days (no more than five days in most cases). These facts indicated that RA following retrograde pyelography was curable without further treatment. However, in the present case, the urine output was markedly increased shortly after hemodialysis, suggesting that the elimination of uremic toxins and contrast medium might contribute to the recovery from RA. Epstein et al. reported that hemodialysis was performed to treat RA after retrograde pyelography, in which anuria had persisted for seven days and then improved promptly, as in the present case (10). Performing hemodialysis earlier to treat RA may shorten the duration of anuria.

We reported the case of an elderly woman who developed anuria two days after retrograde pyelography and required

hemodialysis. While retrograde pyelography and other stimuli to the kidneys or surrounding organs rarely induce anuria in the pathological condition of RA, clinicians should keep such a possibility in mind. Clinical characteristics of RA vary from one patient to the other. Most patients recover spontaneously after several days, but prolonged anuria warrants consideration of hemodialysis as one of the treatment options.

**The authors state that they have no Conflict of Interest (COI).**

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