# Coarctation of the Abdominal Aorta and Renal Artery Stenosis Related to an Umbilical Artery Catheter Placement in a Neonate

Raymond D. Adelman, MD*, and Rose Ellen Morrell, MD‡

**ABSTRACT. Umbilical artery catheters have been associated with thrombotic complications, such as partial or complete occlusion in the aorta, the renal arteries, and other blood vessels. There have been few reports of the long-term consequences of either symptomatic or asymptomatic thrombi. We report a patient, now 22 years of age, born with a normal aorta, who developed hypertension at the age of 2 months after use of an umbilical artery catheter. An intravenous pylegram and nuclear renal scan were compatible with occlusion of left renal artery and of the distal aorta. At 6 months of age, the patient presented with reduced femoral pulses. Angiography demonstrated an acquired coarctation of the abdominal aorta and renal artery stenosis. An abdominal ultrasound performed at 22 years of age revealed partial obstruction of the lower abdominal aorta and marked atrophy of the left kidney. This case underlines the importance of long-term follow-up studies of infants who have undergone umbilical artery catheterizations. *Pediatrics* 2000;106(3). URL: http://www.pediatrics.org/cgi/content/full/106/3/e36; *coarctation, renal artery stenosis, neonate, umbilical artery catheter, thrombosis.***

Umbilical artery catheters have been associated with thrombotic complications[1–3] such as partial or complete occlusion of the aorta,[4] the renal arteries, and other blood vessels. Although some patients are symptomatic with acute renal failure, hypertension, bowel infarction, or limb ischemia,[3,5] many patients experience silent thromboses.[1,3,4] There have been few reports of the long-term consequences of either symptomatic or asymptomatic thrombi[6–8]; most publications deal with the acute presentation and short-term follow-up. We report a patient, now 22 years of age, born with a normal aorta, who developed hypertension at 2 months of age after use of an indwelling umbilical artery catheter, and who presented at 6 months of age with reduced femoral pulses. Angiography revealed an acquired coarctation of the abdominal aorta and renal artery stenosis.

## CASE REPORT

AJ was one of a pair of twins born in 1976 at 26 weeks of gestation weighing 860 g. Apgar scores were 5 and 5 at 1 and 5 minutes of age, respectively. An umbilical artery catheter was placed with the tip at the level of T5. The patient subsequently developed Gram-positive sepsis, meningitis, and necrotizing enterocolitis that was managed medically. On day 5, a systolic murmur was diagnosed as patent ductus arteriosus. A flush aortogram was performed through the umbilical catheter, which revealed a normal abdominal aorta and normal renal arteries. On the same day, the patent ductus arteriosus was ligated.

The patient was noted at 2 months of age to be hypertensive with systolic blood pressures up to 125 mm Hg. Blood pressure measurements in 4 extremities revealed no differences between the upper and lower extremities. An intravenous pyelogram showed a large right kidney but nonvisualization of the left. A nuclear renal scan suggested faint visualization of the left kidney; no radioisotope was visualized in the distal aorta, compatible with an aortic thrombosis. The patient was treated with multiple antihypertensive medications including hydrochlorothiazide, hydralazine, and methyldopa, but no thrombolytic agents, and was discharged with adequate blood pressure control at 4 months of age. At 5 months of age, she was readmitted for hypertension and medications were readjusted. Femoral pulses were palpable. At 6 months of age, no femoral pulses were palpated. An aortogram revealed stenosis of the abdominal aorta from just below the origins of the renal arteries. The left kidney and left renal artery were hypoplastic. There was moderate collateral circulation (Fig 1). She was continued on antihypertensive medications and aspirin and dipyridamole were added. The patient took medications over the next 5 years. She was readmitted at 12 years of age. She had been off antihypertensive medications and had a blood pressure of 137/84 mm Hg. The patient is now 22 years old and over the last 10 years has remained intermittently hypertensive off all medications. No surgery or interventional angioplasty has been performed. An abdominal ultrasound performed in December 1999 revealed partial obstruction of the lower abdominal aorta and marked atrophy of the left kidney.

## DISCUSSION

The use of umbilical artery catheters has been associated with numerous reports of catheter-associated thrombi.[1–3] The reported incidence of thrombi has ranged from 5% to 30% depending on the method of detection and such clinical variables as duration of catheterization, catheter type, and use of infusate heparin. Catheter position may be an additional risk factor with high catheter placement, as seen in this infant, associated with more significant thrombotic events.[1–4,9,10] Some thrombi are symptomatic with limb ischemia, hypertension, renal failure, and bowel ischemia[3]; however, angiographic, ultrasound, and postmortem data indicate that many thrombi are silent. Goetzman et al[1] identified thrombi by angiography performed at the time of catheter withdrawal; only 13% of patients with thrombi had been clinically diagnosed. Seibert et al[4] studied 81 neonates by serial ultrasonography. Twenty-six percent of patients developed aortic thrombi (most of which were large) yet 29% of these were asymptomatic, with an additional 24% manifesting only hematuria (diagnosed by Dipstix, Bayer

From *Phoenix Children's Hospital, Phoenix, Arizona; and ‡Oakland Children's Hospital, Oakland, California.
Received for publication Jan 3, 2000; accepted Apr 5, 2000.
Address correspondence to Raymond D. Adelman, MD, 909 E Brill St, Phoenix, Arizona 85006-2896. E-mail: radelman@phxchildrens.com

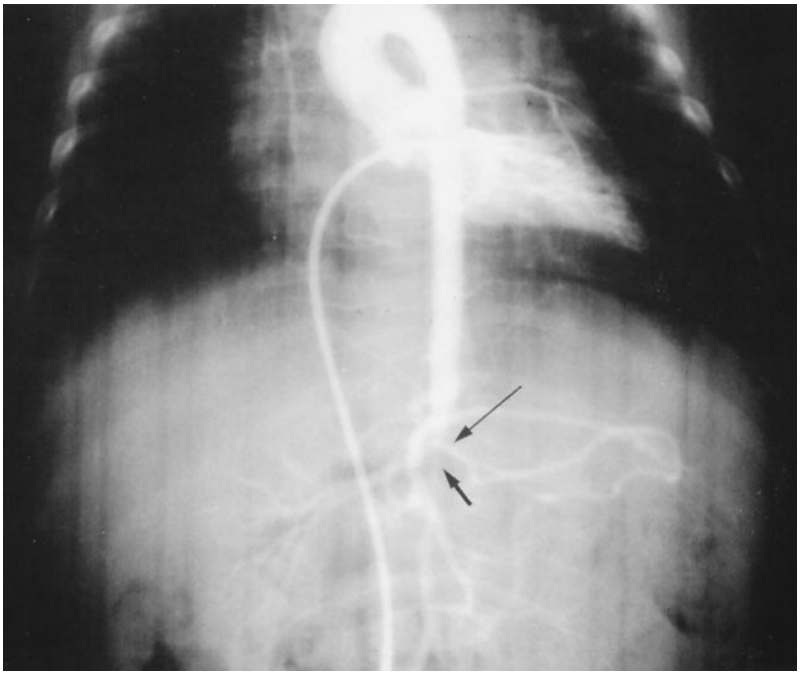

**Fig 1.** Aortogram performed at 6 months of age demonstrating stenosis of the abdominal aorta below the origins of the renal arteries (short arrow) and left renal artery stenosis (long arrow).

Elkhart, IN). Hence, as many as one half or more of catheter-associated thrombi are asymptomatic.

Long-term studies of patients with thrombi have been few.[6–8,11] For a mean of 15 months, Malin[6] followed 3 patients with aortic thrombosis and renal artery occlusion associated with umbilical artery catheterization. At follow-up, all infants had unilateral renal abnormalities documented by ultrasonogram or renogram. Although not specifically addressed, none were reported to have signs or symptoms of coarctation. Adelman[7] reported 12 neonates who were followed for 5.75 years for hypertension attributable to renal artery or aortic thrombosis. Blood pressure was normal for all infants after discontinuation of antihypertensive therapy and creatinine clearance was normal for 9 of 10 survivors. However, 8 of 11 patients studied had abnormal renal morphology or function. Six patients had ischemic-appearing radionuclide scans, including 3 with normal renal morphology by intravenous pyelogram or ultrasound. No patients had clinical findings of coarctation. Caplan et al[8] studied 15 patients with aortic thrombosis and renovascular hypertension for a mean of 26 months. Three patients had small or absent kidneys unilaterally by ultrasonogram, whereas 6 patients had absent or no flow unilaterally by renogram. However, no patient was reported with significant differences between blood pressure readings in upper and lower extremities. Seibert et al[11] reported no aortic abnormalities in 10 neonates with aortic thromboses studied by ultrasonography at 36 to 42 months of age. Thus, although there are some reports of long-term sequelae of indwelling umbilical artery catheters, our report is the first case of an acquired coarctation of the abdominal aorta and renal artery stenosis secondary to a thrombus, which occurred during neonatal umbilical artery catheterization.

Coarctation of the abdominal aorta is very unusual in the pediatric population.[12] Because we had angiographically documented a normal aorta in this patient at the time of catheter insertion, we can reasonably presume that the coarctation months later at the site of a thrombus was causally related to the thrombus and/or to vessel wall injury, with subsequent scarring and constriction. Tomizawa et al[13] demonstrated endothelial cell detachment and internal elastic membrane destruction in animals undergoing acute aortic catheterization. Tyson et al,[14] in an autopsy study of infants who had umbilical artery catheters, demonstrated fatty deposits in the intima and media, proliferation of medial smooth muscle cells, and fibrosis. The paucity of long-term studies of patients with catheter-associated thromboses makes determination of the types and incidences of sequelae difficult to assess. However, long-term consequences do occur. We recently reported an 18-year-old[15] who was found to have an asymptomatic aortic aneurysm at the site of a neonatal catheter-associated aortic thrombus that had clinically resolved in infancy.

## CONCLUSION

A patient presented with severe hypertension attributable to coarctation of the abdominal aorta and renal artery stenosis after apparent resolution of an umbilical artery catheter-associated thrombosis. This case underlines the importance of long-term follow-up studies of infants who have undergone umbilical artery catheterizations to assess the type and magnitude of various sequelae and to provide important clinical and prognostic information for physicians and families.

## REFERENCES

1. Goetzman BW, Stadalnik RC, Bogren HG, et al. Thrombotic complications of umbilical artery catheters: a clinical and radiographic study. *Pediatrics*. 1975;56:374–379

2. Jackson JC, Truog WE, Watchko JF, et al. Efficacy of thrombo-resistant umbilical artery catheters in reducing aortic thrombosis and related complications. *J Pediatr*. 1987;110:102–105
3. Adelman RD. The hypertensive neonate. *Clin Perinatol*. 1988;15:567–585
4. Seibert JJ, Taylor BJ, Williamson SL, et al. Sonographic detection of neonatal umbilical artery thrombosis: clinical correlation. *AJR Am J Roentgenol*. 1987;148:965–968
5. Singh HP, Hurley RM, Myers TF. Neonatal hypertension: incidence and risk factors. *Am J Hypertens*. 1992;5:51–55
6. Malin SW, Baumgart S, Rosenberg HK, et al. Nonsurgical management of obstructive aortic thrombosis complicated by renovascular hypertension in the neonate. *J Pediatr*. 1985;106:630–634
7. Adelman RD. Long-term follow-up of neonatal renovascular hypertension. *Pediatr Nephrol*. 1987;1:36–41
8. Caplan MS, Cohn RA, Langman CB, et al. Favorable outcome of neonatal aortic thrombosis and renovascular hypertension. *J Pediatr*. 1989; 115:291–295
9. Berger C, Durand C, Francoise M, Gouyon JB. Ultrasonographic survey of the effect of umbilical arterial catheterization in newborn infants. *Arch Pediatr*. 1994;1:998–1003
10. Adelman RD, Karlowicz MG. What is appropriate work-up and treatment for an infant with an umbilical artery catheter-related thrombosis? *Semin Nephrol*. 1998;18:362–364
11. Seibert JJ, Northington FJ, Miers JF, et al. Aortic thrombosis after umbilical artery catheterization in neonates: prevalence of complications on long-term follow-up. *AJR Am J Roentgenol*. 1991;156:567–569
12. Rudolph AM, Hoffman JIE, Rudolph CD. *Rudolph's Pediatrics*. 20th ed. Stamford, CA: Appleton and Lange; 1996:1484
13. Tomizawa Y, Okoshi T, Nishida H, et al. Aortic wall injury and thrombogenesis in catheterization: experimental study. *Kokyu To Junkan*. 1989; 37:1113–1117
14. Tyson JE, deSa DJ, Moore S. Thromboatheromatous complications of umbilical arterial catheterization in the newborn period: clinicopathological study. *Arch Dis Child*. 1976;51:744–754
15. Adelman RD. Abdominal aortic aneurysm 18 years after apparent resolution of an umbilical catheter-associated aortic thrombosis. *J Pediatr*. 1998;132:874–875

# Coarctation of the Abdominal Aorta and Renal Artery Stenosis Related to an Umbilical Artery Catheter Placement in a Neonate

Raymond D. Adelman and Rose Ellen Morrell

*Pediatrics* 2000;106;e36
DOI: 10.1542/peds.106.3.e36

PEDIATRICS®
OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

# Coarctation of the Abdominal Aorta and Renal Artery Stenosis Related to an Umbilical Artery Catheter Placement in a Neonate

Raymond D. Adelman and Rose Ellen Morrell

*Pediatrics* 2000;106;e36
DOI: 10.1542/peds.106.3.e36