Transjugular Retrograde Cannulation of the Portal Vein via Patent Ductus Venosus: Alternative Access for Endovascular Hepatic Interventions

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ABSTRACT

The use of the patent ductus venosus via a transjugular approach to access the portal system for endovascular treatment of hepatic vascular anomalies in three infants is reported. Two patients had an arterioportal fistula, and one had a rapidly involuting congenital hemangioma. All patients underwent arteriography followed by embolization of the vascular anomalies without complications. This alternative route is technically simpler and likely safer than transarterial and transhepatic approaches.

ABBREVIATIONS

PDV = patent ductus venosus

The ductus venosus is a fetal communication between the portal and systemic veins, which usually closes in the first postnatal week. Persistent patent ductus venosus (PDV) is a rare anomaly resulting in portosystemic shunting and may be associated with hepatic vascular anomalies (1). Reports have been published regarding percutaneous embolization of such anomalies by directly closing the PDV (2–6). This report describes use of the PDV as a conduit to access the portal vein for embolization of hepatic vascular anomalies without occluding the PDV.

CASE REPORTS

Our institution does not require institutional review board approval for the publication of retrospective case reports. However, in keeping with the ethical conduct of studies, the principles of the Declaration of Helsinki were followed.

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Technically successful endovascular interventions for hepatic vascular anomalies were performed via the PDV in three infants. All the interventions were performed under general anesthesia. The anomalies included two arterioportal fistulas and one hepatic rapidly involuting congenital hemangioma.

Patient 1

A 6-week-old girl with trisomy 21 presented with congestive heart failure and failure to thrive. Echocardiography showed a patent ductus arteriosus and a patent foramen ovale. Ultrasonography revealed a complex arterioportal shunt with a PDV. Angiography demonstrated a fistula between the left inferior phrenic artery and vein (**Fig 1a**) with anomalous drainage into the left portal vein. Transarterial cannulation of the phrenic artery was challenging because of the small caliber of this vessel and its origin close to the mesenteric arteries. The PDV was accessed via a transjugular approach using a 4-F vertebral catheter, which was further advanced retrogradely into the portal vein (**Fig 1b**). The catheter was used for selective cannulation of the left phrenic vein, which drains the phrenic arteriovenous fistula into the left portal vein (**Fig 1c**). Venography delineated the anatomy of the shunt with reflux of contrast material into the inferior phrenic artery and aorta. The left phrenic vein was successfully occluded using pushable 0.035-inch coils (Nester; Cook, Inc, Bloomington, Indiana) (**Fig 1d**). Follow-up ultrasound

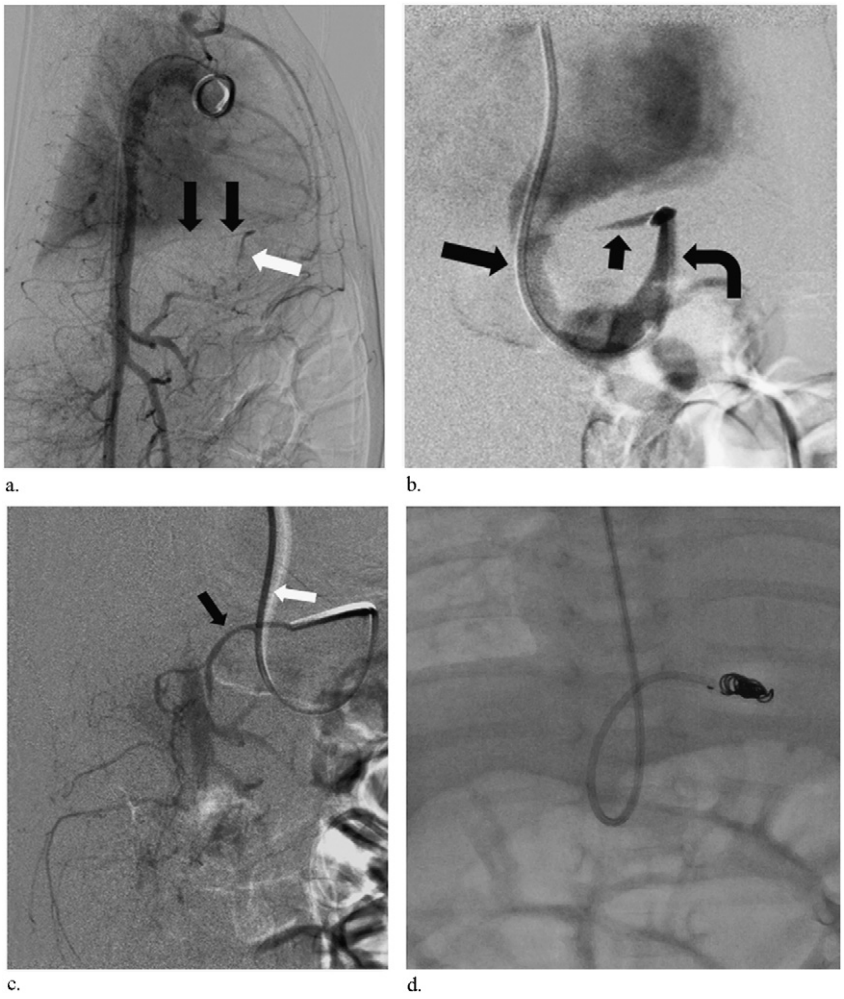

Figure 1. Patient 1 with simple arterioportal shunt. **(a)** Lateral aortogram shows an enlarged inferior phrenic artery (white arrow) draining into a phrenic vein (black arrows). **(b)** The tip of the catheter was advanced via the PDV (long arrow) into the left portal vein (curved arrow). There is retrograde flow of contrast material into the phrenic vein (short arrow). **(c)** The catheter (white arrow) was advanced further via the venous side of the fistula. The level of the PDV is marked with the white arrow. There is reflux of contrast material into the inferior phrenic artery (black arrow) and the aorta. **(d)** Final frontal image after coil embolization of the fistula.

examinations over the next 3 months confirmed complete occlusion of both the fistula and the PDV.

Patient 2

A 3-month-old girl with trisomy 21 was referred to our institution for the management of a large arterioportal malformation. The infant also had a complex congenital heart disease (atrial septal defect, ventricular septal defect, and patent ductus arteriosus), high-output heart failure, pulmonary hypertension, and ascites. Surgical ligation of capsular hepatic arterial feeders at an outside institution resulted in no significant reduction of the shunt. Angiography demonstrated an extensive network of small arterial feeding branches from dilated hepatic, superior mesenteric, gastroduodenal, inferior phrenic, and internal mammary arteries (**Fig 2a**). This network terminated into a huge aneurysmal segment of the intrahepatic portal vein (**Fig 2b**). The anteriorly located portal aneurysm communicated with the portal vein through a long, wide neck. There was a PDV. Transarterial embolization of the distal segments of the main hepatic and gastroduodenal arteries supplying the shunt was performed. Nevertheless, the residual shunt was substantial. Because of the presence of numerous arterial feeders, an endovenous approach for embolization of the portal aneurysm was performed via a transjugular approach and through the PDV (**Fig 2c**). The portal venous pressure was elevated (22 mm Hg). The neck of the portal aneurysm was occluded with an AMPLATZER septal occlusion device (AGA Medical, Plymouth, Minnesota). Percutaneous transhepatic access to the aneurysm was obtained using sonographic guidance. Embolization of the portal aneurysm distal to the septal occlusion device was performed with 0.035-inch Nester coils (**Fig 2d**). The procedure resulted in marked reduction of the shunt. The patient died after a cardiac operation.

Patient 3

A full-term3-day-old girl presented with hepatosplenomegaly and cardiomegaly. Bilirubin, hepatic transaminases,