Case Report

Transhepatic Access for Atrioseptostomy in a Neonate

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We report the case of a neonate with total transposition of the great arteries who underwent Rashkind atrioseptostomy through transhepatic access due to congenital interruption of the inferior vena cava. The technical aspects of the procedure are discussed.

Introduction

Preoperative mortality in newborns with total transposition of the great arteries (TGA) is mainly due to absent or restrictive atrial septal defects (ASD). In the management of these neonates there is special emphasis on the use of prostaglandins to promote patency of the ductus arteriosus and perform atrioseptostomy using a balloon catheter (Rashkind procedure)[1]. Atrioseptostomy allows the survival of several patients with complex congenital heart diseases and it is one of the few indications of urgent catheterization in neonates[2].

However, the traditional percutaneous venous accesses may not be available for performing this procedure, mainly due to their previous use in the ICU, successive heart catheterizations and/or previous surgeries, or also due to congenital interruption of the inferior vena cava (IVC). The need of new diagnostic catheterizations and interventions in these patients has led to the development of new access routes to the right heart, such as the transhepatic access. Since there are few records in the literature on the use of this technique in newborns[3], in this article we report the case of a neonate with TGA and interruption of IVC, in whom the transhepatic access was employed to enable atrioseptostomy.

Case Report

A male neonate, on the 6th day of life, with an echocardiographic diagnosis of TGA and a small ASD (4 mm) and normal interventricular septum. Patient was referred to our service under mechanical ventilation and infusion of prostaglandin E1 (Prostin®) at 0.02 μg/kg/min. He progressed with an infectious condition requiring broad-spectrum antibiotic therapy and inotropic support. In the clinical course, the patient maintained low systemic arterial saturation (below 65%); a new echocardiogram characterized a restrictive flow through the ASD and atrioseptostomy was indicated.

Femoral vein puncture and insertion of a 6F-pediatric sheath were performed at the Intervention Cardiology Laboratory under general anesthesia. Absence of the IVC hepatic segment and continuity of azygos vein into the superior vena cava was identified. Access via umbilical vein was not possible since it had already been used for insertion of a central venous catheter in the first days of hospitalization. Since this was a critically ill neonate with low systemic arterial saturation and no clinical conditions for a surgical procedure at that moment, we decided to try the transhepatic puncture of the supra hepatic vein.

After asepsis of the right hypochondrium region, a puncture with a 22F spinal anesthesia needle with a mandril was performed. The landmarks used were the liver mean portion according to fluoroscopy, mid-axillary line and angiography performed in right atrium (RA) to visualize the main supra hepatic veins. The needle was directed posteriorly and superiorly to the spine and just a few centimeters away from its right border. After removal of the stylet, the needle was slowly drawn back under continuous aspiration. Occasionally, small injections of non-ionic contrast (Hexabrix®) were given. Six puncture attempts were performed by directing the needle anteriorly until a rapid contrast flow above the right atrium was observed. Then we inserted a coronary angioplasty guidewire (0.014") and a 6F-sheath was positioned on this guidewire after progressive dilation using the Seldinger technique. This sheath was later changed to another 7F-sheath for the passage of balloon catheters and its distal end was positioned in the lower part of the right atrium (Figure 1). As of this moment, the procedure was guided by transthoracic echocardiography. A rigid 0.035" guidewire was positioned in the left inferior pulmonary vein and Power-flex (Cordis) 7x20mm, 9x20mm and 12x20mm balloons were inserted for successive static atrioseptostomies (Figure 2) which were performed with no events. To complete the procedure, atrioseptostomy using a Rashkind 6F balloon was performed according to the conventional technique. At the end of the procedure there was no interatrial pressure gradient and systemic arterial saturation was maintained close to 80%. Echocardiography showed an increase in the ASD from 3.5 to 6.5 mm with a non-restrictive bidirectional flow.

Balloon catheters were removed; a 5F Judkins catheter for right coronary artery was inserted. The catheter was drawn back along with the introducer until it was located in the liver parenchyma; this position was confirmed by a small injection of contrast. At this site, two Gianturco (38x5x5 and 38x4x3) coils were inserted for hepatic hemostasis. An occlusive dressing was maintained in that site for 24 hours.

After the procedure, the neonate evolved in stable

Key words

Transhepatic access, atrioseptostomy, transposition of the great arteries.

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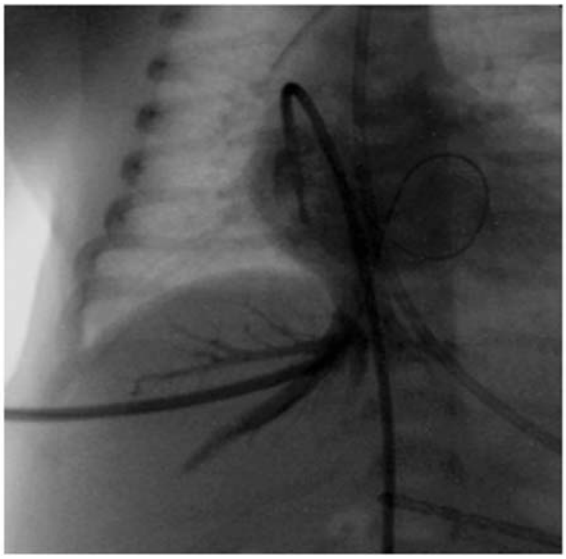

Fig. 1 - *Angiography through a 7F sheath, located on the supra hepatic vein, close to the right atrium outlet. The angiographic catheter is observed in the RA through the azygos system (absence of the hepatic portion of the inferior vena cava).*

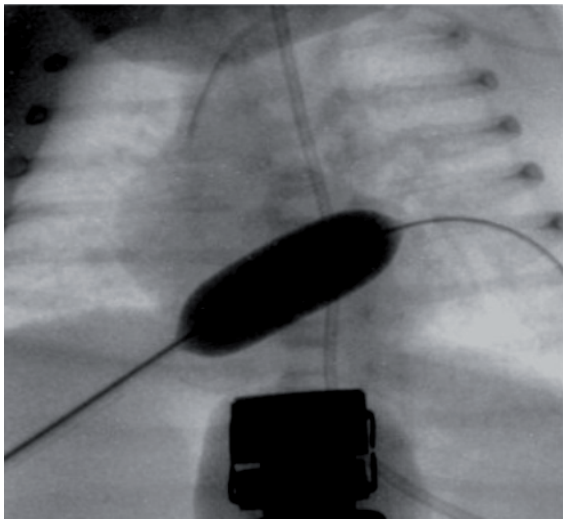

Fig. 2 - *Balloon-catheter positioned on the interatrial septum, for static atrioseptoplasty.*

conditions at the ICU, maintained satisfactory arterial saturation; we waited until the end of the antibiotic therapy before undertaking corrective surgery. Abdominal ultrasound performed on the next day did not show any signs of intraparenchymatous liver hematoma, venous thrombosis or intracavitary hemorrhage. Post-procedural chest X-ray did not demontrate pleural effusion or pneumothorax. Liver enzymes and blood counts after the procedure and on the next day were also within normal limits.

Discussion

Restrictive ASD is one of the major causes of mortality in neonates with TGA[1-2]. Atrioseptostomy with a balloon catheter is a safe and effective procedure in these patients. It is usually performed in an emergency setting, and can be monitored by fluoroscopy or bedside transthoracic echocardiography[4]. The access routes most commonly used for this procedure are the femoral and umbilical veins. The main techniques include atrioseptostomy with a balloon catheter, atrioseptostomy with a Park blade and atrioseptostomy involving the static dilation of ASD with angioplasty balloon catheters[2].

The greatest advantage of the umbilical access in neonates is that it spares other vessels for future procedures. The umbilical vein remains pervious in the first 24 hours of life, but rarely after three or four days. In this patient, the umbilical vein could not be used because of previous catheterization for drug administration. Although the internal jugular vein may be used for catheterization in infants, there is no report on the use of this access for atrial septostomies, probably due to the difficulty to cross the ASD with this route when using a conventional Rashkind balloon with no terminal hole; the same explanation is valid for the subclavian vein.

Recently, both diagnostic and therapeutic catheterizations have been performed by means of a transhepatic puncture in children who do not have conventional venous access[3,5-8]. However, there are few reports on such procedures in neonates with congenital absence of the hepatic portion of the IVC. Shim et al[7] showed that the transhepatic route is safe and effective for catheterization in children, including two neonates with critical pulmonary stenosis, in whom the transhepatic access promoted better positioning of the catheter at the right ventricle outlet. The same authors also speculate that this route promotes better access for percutaneous closure of the ASD of the oval fossa due to the more perpendicular positioning of the sheath in relation to the interatrial septum. By the way, one of the advantages described with this route is that it allows the use of high profile sheaths even in young children without vascular damage.

A 22-G Chiba needle was used in most of the procedures reported. It was recently shown that it is possible to perform the puncture in a simple way through the Seldinger technique and the use of equipment normally used in the catheterization laboratory, such as a 20-Gauge puncture needle (Cook Inc., Bloomingham, Indiana)[5]. The ideal puncture site can be identified by fluoroscopy[3,7] or with the use of abdominal ultrasound[5]. The landmark most commonly used is the mid-axillary line in the mid-hepatic portion between the diaphragm and the hepatic lower border identified by fluoroscopy. Previous angiographies can also be used as reference. The technique described is similar to that used in this case[3,7-8]. McLeod et al[5] reported that the use of ultrasound is useful and promotes satisfactory orientation for cannulation of hepatic veins, thus reducing the duration of fluoroscopy and exposure to radiation, but they speculated that the need of ultrasound decreases as the experience gained by the operator increases. Success rates in hepatic puncture range between 93% and 100% in the series evaluated[3,5,7].

Complications are rare and they occur in less than 5%

of the more traditional transhepatic procedures, such as percutaneous transhepatic cholangiography and access to the portal venous system. In 1998, Eremberg et al[9] reported two cases of significant intraperitoneal hemorrhage and determined a complication rate of 4.6% for heart catheterization. The main complications of the technique are hemothorax or pneumothorax, hemoperitoneum, pulmonary embolism and peritonitis. Other potential complications include intestinal or gallbladder perforation, thrombosis of hepatic veins or portal system veins, hemobilia and liver function abnormalities. Therefore, after the procedure it is necessary to carry out careful monitoring of vital signs and laboratory markers, along with abdominal ultrasonography[10].

Hepatic hemostasis after the end of catheterization can be attained with occlusion of the intrahepatic path with coils or gelfoam. Kaye et al[10] advocate the use of such devices in the entire path to prevent intraperitoneal bleeding. Another precaution is to avoid embolization of hepatic veins, assuring that the catheter is in the liver parenchyma by means of small contrast injections. Hemostasis can also be assured without the use of any devices and by manual compression on the right hypochondrium; there is no report of significant bleeding after interventions with this method[5].

In conclusion, transhepatic puncture in this case report enabled the performance of atrioseptostomy in a neonate with TGA and interruption of the IVC. It showed to be safe and effective for this purpose.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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