

SUPPLEMENTARY DATA

Surgical and catheter-based techniques

The mBTS procedure was performed via median sternotomy or thoracotomy, with or without cardiopulmonary bypass, with the mBTS clipped or not according to surgeon preference, and with PDA ligation added if necessary. A polytetrafluoroethylene (PTFE) graft, typically 3.0 to 4.0 mm in diameter depending on patient size and physiology (ie, the presence or absence of additional pulmonary blood flow), was anastomosed between the innominate or subclavian artery and the ipsilateral PA branch. When a central shunt was performed, a PTFE graft was anastomosed between the ascending aorta and the main PA via a median sternotomy. This technique was preferred in patients whose anatomy did not allow for a classic systemic-to-pulmonary shunt. The size of the graft was selected based on patient weight and hemodynamic status to optimize pulmonary blood flow while avoiding overcirculation. Shunt flow was evaluated intraoperatively by direct inspection and postoperatively by transthoracic echocardiography (TTE). Antiplatelet therapy with aspirin was initiated postoperatively in all patients.

DS was performed in the cardiac catheterization laboratory under general anesthesia and fluoroscopic guidance. Arterial access (femoral or axillary) was selected based on PDA anatomy, as assessed by preprocedural imaging using computed tomography (CT) and/or transthoracic echocardiography (TTE). The choice of access was primarily dictated by the origin and course of the PDA, with an axillary approach favored for PDAs arising from the undersurface of the aortic arch. Depending on individual anatomy, the PDA was inserted into either the main pulmonary artery or into a left proximal branch pulmonary artery. Premounted

drug-eluting coronary stents (X-science or Integrity) were advanced over a guidewire and deployed across the PDA to ensure complete coverage and adequate pulmonary perfusion. The choice of stent size and length was based on ductal morphology and length measured on fluoroscopy and in TTE. In some cases, 2 stents were required to ensure complete coverage of the PDA. All patients received systemic heparinization during the procedure. Following DS, intravenous unfractionated heparin was maintained for approximately 48 hours (target anti-Xa 0.3-0.5) before transition to dual antiplatelet therapy with aspirin and clopidogrel, which was continued until second-stage palliation. Following mBTS, postoperative anticoagulation and antiplatelet therapy were administered according to institutional surgical protocols, typically consisting of early anticoagulation followed by aspirin therapy.