Stenting of the Right Ventricular Outflow Tract

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Introduction

The approach to patients with a narrow right ventricular outflow tract (RVOT) and reduced pulmonary blood flow, as classically seen in Tetralogy of Fallot, is mostly surgical - either by creating a systemic-to-pulmonary artery shunt or by undertaking complete repair.

Creation of a systemic-to–pulmonary artery shunt however remains high risk surgery in particular in infants with younger age and lower weight, or associated lesions, such as atrioventricular septal defect, or co-existing syndromes (mortality around 10%). Neonatal complete repair remains rare in the UK (CCAD data).

Previously transcatheter techniques, including balloon valvuloplasty and stenting, to address a very narrow right ventricular outflow tract have been described, without having gained widespread acceptance.

This report describes the single-centre experience with stenting of the RVOT in a series of 47 patients who were judged to be at high risk for initial surgical palliation or complete repair.

Methods

Retrospective case note review and data analysis of patients undergoing RVOT stenting at a single tertiary centre over a 7 year period.

Patients

Between 2005-2012, 47 selected patients underwent cardiac catheterization with a view to stent a very narrow RVOT to improve pulmonary blood flow.

Management of all individual patients was discussed in a multi-disciplinary team meeting. Surgical intervention (creation of a systemic-to-pulmonary artery shunt, outflow tract patch or complete repair) was considered in all. If surgery was deemed high risk, patients were considered for stent implantation into the right ventricular outflow tract.

In 3 patients the procedure was abandoned due to unfavorable anatomy.

Median age at stent implantation was 63 (range 5-406) days.

Median weight was 3.9 kg (1.7-12.2 kg), with 15 patients weighing less than 3 kg, including 7 weighing less than 2.5 kg.

Clinical parameters, associated lesions and co-morbidities are summarized in the table below.

Clinical factors		*n*
	Weight < 3 kg	15
	Saturations < 72%	21
	recent spell	20
	Prostaglandin infusion	5
	Severe syndrome	10
	Recent necrotising enterocolitis	3
	Recent RSV bronchioloitis	4
	Tracheostomy	1
Anatomical factors		
	hypoplastic pulmonary arteries	16
	MAPCAs	5
	AVSD	7
	Tricuspid atresia	1
	Isomerism	2
	DORV	9
	Left SVC to left atrium	4

Technique:

- General anaesthesia
- 50-100 IU / kg Heparin
- 4F Flexor sheath / 4 RJ in < 3kg
- 6F RJ guide/ 4RJ in > 3kg
- 0.014" Choice PT or Thruway wire to RPA
- test injections 30 RAO/20 cc + 60 LAO (or Lat)

Stents:

- Coronary (Boston Liberte) 4 – 5mm < 5 kg
- Vascular (Cook Formula) > 5 kg

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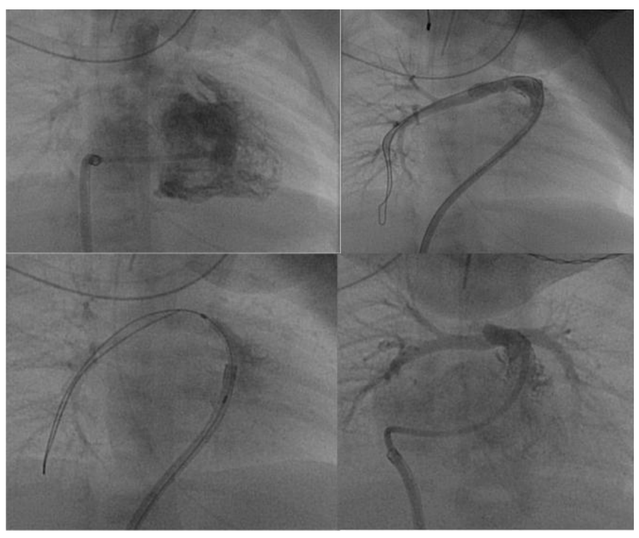


Angio sequence of RVOT stenting in a 2.8 kg child with complete AVSD and severe Fallot

Results

Forty-four patients underwent stent implantation with one procedural death (2.3 %). Premounted coronary stents (Boston Liberte) were used in 31 pts. Cook Formula 414 stents were used in 8 patients.

Median procedure time was 58 (24-260) and fluoroscopy time 16 (5.5-73) minutes.

Saturations increased from 71% (52-83%) to 90% (81-100%) [p<0.001].

One patient required emergency surgery and two needed a systemic-pulmonary artery shunt within 2 weeks post procedure (6.9%).

Subsequently 10 further catheter interventions were carried out (balloon in 4, further stent in 6).

Twenty-one patients underwent delayed surgery (complete repair in 18, palliative in 3) at a median of 258 (10-758) days post stenting.

Z-scores for pulmonary artery sizes increased significantly. LPA size increased from -1 (-3 to 0) to 0 (-3 to +1). RPA size increased from -1.5 (-3 to 0) to 0 (-2 to +1) [p<0.01].

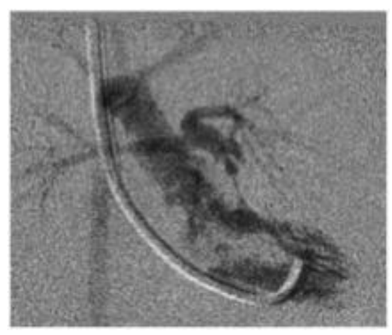
Nineteen patients remain well palliated after 201 (14-512) days.

There were no late deaths. There were no stent fractures.

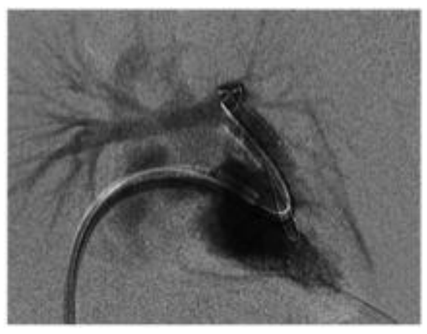
Conclusion

Stenting of the RVOT is an effective treatment option in the initial management of selected patients with very reduced pulmonary blood flow.

It should be considered treatment of choice in selected complex patients and very low weight neonates and infants.



Initial angio in 1.7 kg patient with severe Fallot



Repeat angio after RVOT stent prior to complete repair