Diagnostic and interventional MRI catheterisation: A 10-year single centre experience.

1) King’s College London, London, UK.
2) Evelina Children’s Hospital, Guy’s and St Thomas’ Foundation NHS Trust, London, UK.

Introduction: Hybrid fluoroscopic (X-Ray) and MR imaging-guided cardiac catheterisations (XMR) provide high definition anatomy and haemodynamics in a single combined procedure whilst minimizing radiation exposure. We report a 10-year, single institution experience of XMR catheterisation, while demonstrating the evolving applications of this approach in the diagnosis and management of congenital heart disease and evolution of solely MR-guided interventions.

Methods: Retrospective review of XMR and MR-guided catheterisations between Feb 2002 and Feb 2012 at a single institution. Data collated on patient demographics, XMR procedural data and findings, impact on patient management and outcomes. Procedural complications were noted. Institutional Ethics and UK regulatory authority approval were obtained.

Results: 221 studies were performed in 196 patients. Median age and weight was 4.5 years (range 4 days to 64.7 years) and 15.4 kg (range 2.3–106 kg), respectively. 201 were combined XMR catheterisations, 20 were solely MRI-guided cardiac catheterisations, of which 7 were part of the first-in-man clinical trial on MRI-guided cardiac interventions. 57 patients had a functionally univentricular heart, of whom 18 were post-Fontan procedure. 176 patients had pulmonary vascular resistance (PVR) studies. Median total PVR was 2.4wu.m$^2$(0.4-66). 65 had an elevated PVR > 3 wu.m$^2$ (median 4.6 wu.m$^2$;range: 3 - 66 wu.m$^2$). 54 patients had a pharmacological stress study to assess cardiac output and haemodynamic responses. 151 patients went on to have an intervention (medical, catheter or surgical) based on the XMR data, at a median interval of 46 days (range 0-763 days). Accurate PVR assessment led to risk stratification and fenestrated rather than complete closure of septal defects (n=8). 23 patients were assessed pre-liver transplant, with 12 put forward for liver transplantation. 4 of these had cardiac lesions requiring intervention and repeat XMR before being accepted for transplant. There were 2 immediate complications and 1 late complication, with no procedural deaths.

Conclusions: XMR catheterisations provide additional information on cardiac anatomy, physiology and haemodynamics to facilitate risk stratification and management planning for patients with suspicion of raised PVR and complex anatomy. Recent advances in interventional MRI have led to the performance of the first-in-man clinical trial on MR-guided percutaneous cardiac interventions.