3D CTA & MRA in the Evaluations of Total Pulmonary Venous Return (TAPVR)

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OBJECTIVE

• We present an interactive computer exhibit to describe the utility of cardiac CTA and MRA with 3D reconstruction in the preoperative evaluation of patients with TAPVR, as well as to help the user better understand the complex anatomy, variations, and associated findings of TAPVR.
DISCLOSURE

• We do not now have and have not within the past 12 months had a financial interest or other relationship with a commercial organization that may have an interest in the content of the educational activity.
ABSTRACT

- 10 patients with TAPVR underwent CTA and/or MRA imaging of the chest with 3D reconstructions using a commercially available workstation. Based on the Darling classification, 4 had supracardiac TAPVR while 2 had infracardiac TAPVR and 4 were mixed or complex types of TAPVR. Other associated findings included: Truncus arteriosus, cor triatriatum and hypoplastic left heart syndrome.
• 3D reconstructions were instrumental to the pediatric cardiothoracic surgeons for presurgical planning.
• 3D rotating color coded labeled models of the CTAs and MRAs will be presented to better illustrate the complex anatomy
• Three groups of models will be presented based on Darling classification: Supracardiac, Infracardiac and Mixed or complex types of TAPVR.
RESULTS

• The exhibit will help the learner be better equipped to identify the types of TAPVR as well as the variations and associated findings in these patients.
• The exhibit will help the viewer better understand the role of cardiac CTA and MRA in the evaluation of patients with TAPVR
INTRODUCTION

• TAPVR is a congenital disorder characterized by total mixing of systemic and pulmonary venous blood.

• TAPVR results from the abnormal embryogenesis where the initial communication between pulmonary portion of the foregut plexus and the cardinal and umbilical vitelline venous system persists.
Darling Classification

- Supracardiac (Type I) - 45-55%
- Cardiac (Type II) – 15-20%
- Infracardiac (Type III) - 15-20%
- Mixed or complex - 5-10%
Supracardiac (TAPVR-I)

- Four Pulmonary veins drain via a common vein into the right SVC, left SVC or their tributaries
- Usually the drainage is from the pulmonary veins into vertical vein and brachiocephalic vein and into the SVC.
Cardiac (TAPVR-II)

- Pulmonary veins drain directly to the right heart via the coronary sinus or directly into the right atrium
- Usually the coronary sinus is enlarged
Infracardiac (TAPVR-III)

- A common pulmonary vein travels down anterior to the esophagus through the diaphragm to connect to the portal venous system
- Usually the course of the connecting vein is tortuous resulting in high incidence outflow obstruction
CASE 1 - TAPVR type 1

BCV- brachiocephalic Vein; VV- vertical vein; SVC- superior vena cava
CASE 1: Description

- Supracardiac type total anomalous pulmonary venous return with majority of returning flow from the lungs ascending in the vertical vein due to cor triatriatum.
CASE 2-Supracardiac (TAPVR-I)
CASE 2

azygous arch inf mm (3D)

pulmonary conduit inf mm (3D)

SVC

Rt atrium inf mm (3D)

No VOI
CASE 2: Description

TAPVR type –I : Pulmonary venous drainage into a pulmonary conduit that drains into the azygous arch into SVC
CASE 2 – Supracardiac TAPVR
CASE 2
CASE 2
CASE 3 - Infracardiac (TAPVR- III)

Pulmonary veins
CASE 3: Description

- Cardiac MR: Infracardiac
- Pulmonary venous drainage into portal vein
CASE 4- Infracardiac TAPVR
Infracardiac (TAPVR - III)
CASE 4: Description

• Pulmonary veins draining into IVC
CASE 5-Complex TAPVR
CASE 5
CASE 5
CASE 5

Hypoplastic ascending aorta

Large PDA
CASE 5: Description

- Anomalous pulmonary venous drainage of RUL to an anomalous vein into SVC. Because there was no atrial septal defect all of the blood was shunted through the right upper lobe anomalous vein.
- Hypoplastic left heart syndrome
- Marked hypoplastic ascending aorta
- Large PDA
CASE 5
CASE 5

Intact Atrial Septum
CASE 6-Supracardiac (TAPVR-I)
CASE 6: Description

- Both right and left pulmonary veins drain into SVC.
- Transposition of great vessels
- Complete pulmonic atresia
CASE 6

SVC

Pulmonary veins
CASE 7- Supracardiac (TAPVR-I)

- SVC
- Innominate vein
- Pulmonary veins
CASE 7: Description

- TAPVR with separate connections bilaterally.
- Left pulmonary venous drainage into brachiocephalic vein.
- On the right pulmonary drainage is into SVC.
CASE 8-Complex TAPVR

- Vertical Vein
- Pulmonary veins
CASE 8

- SVC
- Brachiocephalic vein
- Vertical vein
- Pulmonary veins
CASE 8: Description

- TAPVR with left lung draining into vertical vein
- Right lower lobe drainage is into the Rt atrium
- Right upper lobe drainage into SVC
CASE 9 - Complex TAPVR

Volume Rendering No cut

DFOV 21.8 cm
FC43

RUL PV
SVC
RML PV
RLL PV
LLL PV
LA
RA
No VOI

W = 1000 L = 100
CASE 9: Description

- Right upper and middle pulmonary veins drain into SVC.
- RLL venous drainage is into Right atrium
- Left pulmonary veins empty into the left innominate vein.
- Massively dilated Right atrium
- ASD
CASE 9
Case 10 - Supracardiac (TAPVR-I)

- Vertical vein
- Brachiocephalic vein
- SVC
CASE 10: Description

- Supracardiac TAPVR with truncus arteriosus.
- Pulmonary veins drain into vertical vein, brachiocephalic and SVC
REFERENCES

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