Could 3D-printed models improve pre and per-operative management of anomalous origin of coronary artery?

Batteux C. (1), Pléchaud J.F (1), Belli E. (1), Zoghbi J. (1), Van Aerschot I. (1), Bouzguenda I. (2)
Hôpital Privé Jacques Cartier, Massy, France (1); Hôpital Privé La Louvière, Lille, France (2)

Introduction: Anomalous Origin of Coronary Artery (AOCA) is the second most frequent cardiovascular etiology of sudden death during exercise among children and its pre- and per-operative management remain discussed.

Methods: We retrospectively analysed patients who underwent surgery for AOCA in our hospital. We evaluated their 3D-printed models to describe their anatomy and predict the most efficient surgical gesture and its potential difficulties.

Results: between 2010 and 2017, 19 patients were operated on (Median age 15 years old, 37% asymptomatic). Preoperative functionnal or invasive tests (stress test, coronaryography) didn’t improve the management of AOCA. Coronary unroofing was the most frequent surgical gesture performed (n : 16 ; 84%), associated in 50% to a complementary gesture (pulmonary trunk translation, Lecompte’s manoeuvre, sino-tubular jonction’s resection). There were no postoperative adverse events except pericardial effusion (n : 7 ; 36%) and no mortality. Median follow-up was 27 months. All patients are now asymptomatic. Based on CT-scan, we modelled, 3D-printed (photo) and presented 17 patients to a pluridisciplinary group. Due to a bad CT-scan quality, 2 models weren’t 3D-printed. Referring to per-operative anatomy, our models improved the preoperative anatomy description in 47% of cases (n : 8). Main surgical gesture decided on 3D printed models was similar to surgical choice in 82% of cases (n : 14). Furthermore, complementary or alternative gesture to unroofing have been predicted in 7/11 cases (63%).

Conclusions: Unroofing in AOCA surgical management shows good and safe results but preoperative management remain variable. With 3D printed models, we showed a real benefit on 3D anatomy description, and a good matching in the prediction of associated/alternative gesture to coronary unroofing.

Photo: Anomalous Origin of Right Coronary Artery (from left sinus) : printed model