

Catheter Induced Complete Heart Block in Tetralogy of Fallot

Katherine A Lindle and John P Breinholt*

Indiana University, Department of Pediatrics and Cardiology, Texas Children's Hospital, Houston, Texas, USA

Abstract

7 month old female with tetralogy of Fallot underwent pre-surgical cardiac catheterization and developed complete heart block. Persistence of heart block led to placement of a pacemaker. Induction of cardiac arrhythmias is a recognized complication of cardiac catheterization in children with congenital heart disease. Heart defects that alter the course of the conduction system, as in corrected transposition of the great arteries, have an increased risk of this procedural complication [1]. Complete atrioventricular block coincident with cardiac catheterization is rarely reported in children with tetralogy of Fallot. [2-4] we present a patient with tetralogy of Fallot who developed complete atrioventricular block during diagnostic catheterization prior to definitive surgical repair and her subsequent clinical course.

Keywords: Pediatric; Catheterization; Pacemaker; Tetralogy

Case Report

A seven month old female with tetralogy of Fallot was referred for cardiac catheterization for a preoperative hemodynamic evaluation and coronary artery angiography. She had done well clinically with normal oxygen saturations and normal growth and development. However, during the preceding month she had multiple cyanotic episodes. She was scheduled for cardiac catheterization on the day prior to surgical repair.

On the day of catheterization, her oxygen saturation was 89% on room air and breathing was unlabored. Her heart rate was 128 beats per minute, she was in sinus rhythm, and her cardiac exam was consistent with the diagnosis. Her physical exam was otherwise unremarkable. In the catheterization laboratory, she was placed under general anesthesia for the procedure. Her hemodynamic data was consistent with severe pulmonary stenosis with a right ventricle to main pulmonary artery pressure gradient of 67mmHg. Biventricular pressures were equal. While a balloon wedge catheter was across the pulmonary valve and within the right pulmonary artery, the patient developed complete heart block that returned to sinus rhythm after removal of the catheter. Upon reentering the right ventricle with a Berman angiographic catheter, the patient again developed complete heart block that did not resolve after catheter removal.

The subsequent day, the patient underwent repair of the ventricular septal defect with a gluteraldehyde-preserved pericardial patch, and reconstruction of the right ventricular outflow tract with a Gore-Tex monocusp patch. She tolerated the surgical procedure well, but remained in complete atrioventricular block. Atrial and ventricular pacing leads were placed, and she was atrioventricular sequentially (DDD) paced during the early post-operative period.

Five days after tetralogy repair, and six days of persistent atrioventricular block, the patient underwent placement of a Zephyr pacing generator (St. Jude Medical, St. Paul, MN) in the abdomen. The following day she transferred from the intensive care unit, and was discharged five days after pacemaker placement. On the day of discharge, the pacemaker was in DDD Mode with a lower rate of 100 and tracking rate of 180. She was atrial sensed with 100% ventricular pacing at 120 bpm.

She returned to pacemaker clinic four weeks after discharge. Pacemaker interrogation demonstrated that she was 39% ventricular paced including some likely pseudo-pacing. Her lower rate was

decreased to 80 bpm and her atrioventricular interval was lengthened (to 140 bpm) in order to minimize pacing. Her underlying rhythm was sinus during the clinic visit. At the subsequent clinic visit the percent pacing was 11% and the lower rate limit was decreased to 60 bpm. At the most recent follow up, 18 month post implant, the percent pacing was 2%.

Discussion

The development of complete atrioventricular block is an uncommon complication of cardiac catheterization, and is most commonly transient in nature. In an early study of over four thousand adult patients, seven developed transient, complete atrioventricular block during right heart catheterization [5]. The risk of inducing complete atrioventricular block in children with congenital heart disease has been reported as high as four percent [1]. While a known complication, in most reported cases the duration is less than one hour and no permanent pacing is necessary [6]. Previous reports emphasize that post-operative complete atrioventricular block typically resolves within the first 7-9 days of surgery without a statistically significant difference in morbidity [7-10].

In this patient, complete atrioventricular block persisted six days prior to placement of a permanent pacemaker. At her four week hospital follow-up evaluation, she was noted to be in sinus rhythm 70% of the time. Eighteen months after pacemaker implant, she was in sinus rhythm 98% of the time. Complete heart block was induced during the time in which a catheter was in or coursing through the right ventricle. Sinus rhythm returned after an initial episode, followed by persistent heart block. Possible etiologies of this include changes in her electrical mapping secondary to the tetralogy of Fallot morphology or irritation of the electrical system by the catheter in an expected tetralogy of Fallot

***Corresponding author:** John P. Breinholt, Department of Pediatrics Cardiology, Indiana University School of Medicine, 702 Barnhill Dr., RR127, Indianapolis, Indiana 46202, USA, Tel: 317-274-8906; Fax: 317-274-4022; E-mail: jobreinh@iupui.edu

Received April 07, 2011; Accepted May 14, 2011; Published May 17, 2011

Citation: Lindle KA, Breinholt JP (2011) Catheter Induced Complete Heart Block in Tetralogy of Fallot. J Clin Exp Cardiol 2:135. doi:10.4172/2155-9880.1000135

Copyright: © 2011 Lindle KA, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

anatomy. Complete heart block was noted in adults during right heart catheterization that had preexisting bundle branch blocks or marked axis deviation, which were not present in this patient [10]. Additionally, in 15% of patients, the proximal His Bundle is on the right side of inter ventricular septum, creating the possibility that the His bundle was irritated with right-heart catheterization [11].

While previous studies have shown that most surgically-induced complete atrioventricular block resolves within the first 7-9 days, multiple studies have unsuccessfully attempted to determine the predictive factors that predispose these patients to either recovery or the need for a permanent pacemaker [8]. Morbidity and mortality of pacemaker implantation is small, but not inconsequential. Moreover, the time and financial investment of generator changes and lead replacements is not trivial.

Conclusion

This patient with tetralogy of Fallot unexpectedly developed complete atrioventricular block during diagnostic catheterization prior to definitive surgical repair. Her surgical and post-operative course was uneventful despite persistence of atrioventricular block that was ultimately treated with pacemaker placement. Over the following 18 months a significant decrease in ventricular pacing occurred, to only two percent. Although an eventual return to sinus rhythm occurred, a pacemaker was required in the interim. This case emphasizes the need for continued vigilance during catheterization of children with complex congenital heart disease, even if heart block is not a common occurrence.

References

1. Black I, Moore D, Cortes S, Lamber EC (1966) Atrioventricular block as a complication of cardiac catheterization in infants and children. *J Pediatr* 69: 364-371.
2. Gault JH, Ross J, Braunwald E (1966) Persistent atrioventricular dissociation with block and nodal rhythm after cardiac catheterization. *Am Heart J* 71: 690-694.3.
3. Freed MD, Rosenthal A (1973) Complete heart block after cardiac catheterization: a rare complication. *Pediatrics* 51: 935-938.
4. La Corte M, Dick M, Rosenthal A, Castaneda A (1975) Repair of tetralogy of Fallot after catheterization-induced complete heart block. *Chest* 68: 575-577.
5. Wennevold AI, Christiansen I, Linden (1965) Complications in 4,413 Catheterizations of the Right Side of the Heart. *Am Heart J* 69: 173-180.
6. Bruckheimer E, Berul CI, Kopf GS, Hill SL, Warner KA, et al. (2002) Late recovery of surgically-induced atrioventricular block in patients with congenital heart disease. *J Interv Card Electrophysiol* 6: 191-195.
7. Bonatti V, Agnetti A, Squarcia U (1998) Early and late postoperative complete heart block in pediatric patients submitted to open-heart surgery for congenital heart disease. *Pediatric Med Chir* 20: 181-186.
8. Weindling SN, Saul JP, Gamble WJ, Mayer JE, Wessel D, et al. (1998) Duration of complete atrioventricular block after congenital heart disease surgery. *Am J Cardiol* 82: 525-527.
9. Gross GJ, Chiu CC, Hamilton RM, Kirsh JA, Stephenson EA (2006) Natural history of postoperative heart block in congenital heart disease: implications for pacing intervention. *Heart Rhythm* 3: 601-604.
10. Gupta PK, Haft JI (1972) Complete heart block complicating cardiac catheterization. *Chest* 61: 185-187.
11. Massing GK, James TN (1976) Anatomical configuration of the His bundle and bundle branches in the human heart. *Circulation* 53: 609-621.