Impaction of Cardiac Catheter in Coronary Vein

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The DIVERSE complications of cardiac catheterization have been the subject of numerous publications. The following case report describes a complication previously unreported as far as the authors are aware. Its occurrence appeared to be at least partially related to the presence of an uncommon venous abnormality. However, its successful management may provide some reassurance for other cardiologists unfortunate enough to be in a comparable predicament.

Case Report

A 2-year-old girl underwent right heart catheterization at University of Minnesota Hospitals on March 20, 1963. She was a mildly cyanotic child with a very active precordium. Auscultatory findings included a prominent apical first sound, an early systolic ejection click along the left sternal border, a grade I/IV systolic murmur along the lower left sternal border, a very narrowly split second sound that was very loud along the upper left sternal border, and a grade III/IV blowing decrescendo diastolic murmur along the left sternal border. Heart size was moderately increased on chest roentgenograms, with prominence of the main pulmonary artery segment, left atrium, and pulmonary vascular markings. The electrocardiogram showed an axis of −90 degrees, counterclockwise loop in the frontal plane, shifting atrial pacemaker, and marked right ventricular hypertrophy.

Right heart catheterization was performed by way of the right saphenous vein, through a direct incision over the vein in the groin. Aside from local lidocaine, no medications were given the patient. Initially, a no.-5 Lehman catheter was introduced into the vein, and was advanced without difficulty along the left border of the spine to the level of the diaphragm, where it passed obliquely to the right to the the region of the superior vena cava. At this point it became obvious that the patient had an anomalous inferior vena cava with azygos continuation.

Inasmuch as it had been possible in some previous cases with this anomaly to advance the catheter tip into the pulmonary artery, manipulation in this direction was continued.

The catheter tip was advanced into the right atrium and into the right ventricle, and from there into the aorta (fig. 1). Although the aorta was probed several times, the catheter could not be directed into the pulmonary artery. It was advanced into the left atrium on one occasion. The catheter was then replaced with a no.-6 N.I.H. 6-hole closed-tip angiography catheter. This too was advanced along the same anomalous course, but some difficulty was initially encountered in making the turn at the azygos-superior vena cava junction. The catheter tip was directed into the right atrium. The acute turn at the azygos-superior vena cava junction altered the normal “feel” of the catheter, compromising manipulatory efforts. After minimal manipulation, there was a sudden “tightening” of the catheter tip. Withdrawal could not be accomplished, and

Figure 1

Roentgenogram of chest. Anteroposterior view. Catheter has passed from left-sided inferior vena cava to azygos vein to right superior vena cava to right atrium to right ventricle and into aorta. Dotted line indicates portion of catheter course not visible because of motion.
CATHETER IN CORONARY VEIN

Figure 2
Roentgenogram of chest. Anteroposterior view. Catheter has passed from azygos vein to superior vena cava to right atrium, with tip in impacted position.

it was evident that impaction of the catheter tip in a small vessel had occurred. Blood could be easily withdrawn, pressures measured, and fluids injected, indicating that only a short terminal segment was impacted. The oxygen saturation was less than 30 per cent, suggesting that the tip was impacted in a small coronary vein connecting to the coronary sinus near its orifice. Roentgenograms in the anteroposterior (fig. 2) and lateral views substantiated this impression. The catheter tip was impinging on the posterior surface of the heart. Several times, whenever withdrawal was attempted, the heart rate increased and the T waves became inverted (fig. 3) within 5 seconds of the time that withdrawal tension was applied. Normal upright T waves gradually reappeared within 30 seconds of relaxation. Application of withdrawal tension resulted in tightening of the catheter loop at the azygos-superior vena cava junction, and the pulsations of the heart were conspicuously transmitted through the catheter.

After a period of 1 hour, it was decided that removal of the catheter would require thoracotomy. The patient was taken to the operating room and general anesthesia was started. Further attempts at catheter withdrawal were without success. Thoracotomy was then performed. The catheter could be palpated through the atrial wall, but resisted withdrawal. Under inflow stasis, the atrium was opened. The catheter was cut, and the distal segment was removed, but only after considerable tension was applied in order to dislodge the tip, which was tightly impacted in a small vessel connecting to the coronary sinus. The atrial incision was then closed, and the operation was completed. The proximal portion of the catheter was withdrawn through the saphenous vein incision. The patient tolerated the entire series of events very well, and was discharged 10 days later after an uneventful convalescence. Examination of the catheter following removal showed no cracks, defects, or adherent tissue.

The limited data obtained during cardiac

Figure 3
Electrocardiogram taken during catheterization procedure; lead II. A. No withdrawal tension being applied to catheter. B. Taken just after brief application of withdrawal tension. Note increased heart rate and inversion of T waves.

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catheterization indicated atrial and ventricular septal defects, with bidirectional shunting. These data, coupled with the clinical data, were considered to favor a diagnosis of complete atrioventricular canal. At the time of surgery, the great vessels were noted to be in normal position, with the pulmonary artery being large and tense, and with no evidence of anomalous pulmonary venous connections. The patient has shown no significant change in her clinical condition in the intervening 2 years, but the parents have been unwilling to proceed with further catheterization studies.

It appears likely that the unusual course of the catheter, due to the venous anomaly, hampered attempts at withdrawal by preventing the application of withdrawal tension in a relatively direct line. Moreover, during attempts at withdrawal, the catheter loop at the azygos-superior vena cava junction was pulled caudally, and this might well have produced an impacting action on the catheter tip rather than withdrawal tension. In other words, instead of the catheter sliding around the junction, the sharp-turn loop may have moved up and down as a unit. Initially, the interference with normal manipulatory "feel" may well have prevented the operator from recognizing the impacted position.

It would seem advisable to anticipate the possibility of this complication in patients catheterized by way of an anomalous inferior vena cava with azygos continuation. Moreover, it may well be more difficult to withdraw a catheter tip from a wedged pulmonary artery position in patients who have been catheterized by way of this anomalous vein. Cardiac catheterization is more difficult to carry out by this route, aside from this complication; so if this anomaly is suspected, an arm or axillary vein should be used.

Summary
A complication of right heart catheterization is described in which the tip of the catheter became impacted in a vein connecting to the coronary sinus, requiring thoracotomy and removal under direct vision. This occurred in a 2-year-old patient with an anomalous inferior vena cava with azygos continuation, and it is suggested that this anomalous course may well have contributed to the development of this complication.

References

Arteries, Veins, and the Movement of Blood

Alcmeon of Croton, the first Greek known to have practiced dissection, distinguished two types of vessels (phlebos) carrying blood, as early as the sixth century B.C. This member of the Pythagorean sect, primarily interested in the relationship between the brain and the sense organs, taught that, during sleep, blood retreated from one set of vessels. Having observed the vacuity of some vessels after death, he assumed that in similar fashion the same vessels became bloodless during sleep.

The separation of vessels into two types is found early in the Hippocratic Corpus (fifth century B.C.). At first the term "artery" was used to designate the trachea and bronchi, which transported pLEXUS to the heart. Since some of the vessels originating from the heart cavity were found more or less empty of blood after death, they too were soon called arteries; but they were also said to transport blood and to be connected with the veins.—Andre CourNand, M.D. Circulation of the Blood. Edited by Alfred P. Fishman, M.D., and Dickinson W. Richards, M.D. New York, Oxford University Press, 1964, p. 4.
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