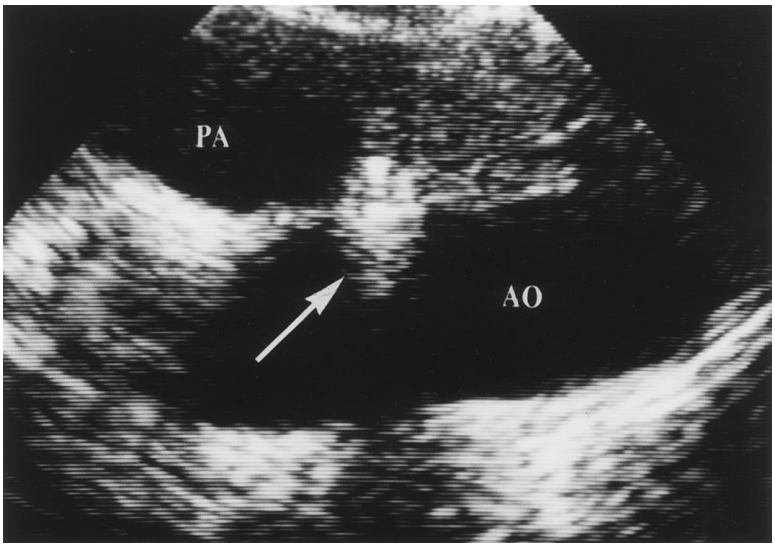

FIGURE 3. Parasternal long-axis echocardiographic image at follow-up in patient 2. The coil is seen protruding into the ascending aorta (AO) lumen *(arrow)* and also into the main pulmonary artery (PA). There was no flow through the graft by color or pulsed Doppler interrogation.

transvenous rather than transarterial device delivery, may also be used to optimize success and minimize complications.[2,5]

This report demonstrates the feasibility of percutaneous coil occlusion of ascending aorta to pulmonary artery interposition grafts. The technique was safe and effective with medium-term follow-up in 2 patients.

1. Culham JAG, Izukawa T, Burns JE. Embolization of a Blalock-Taussig shunt in a child. *Am J Radiol* 1981;137:413–415.
2. Perry SB, Radtke W, Fellows KE, Keane JF, Lock JE. Coil embolization to occlude aortopulmonary collateral vessels and shunts in patients with congenital heart disease. *J Am Coll Cardiol* 1989;13:100–108.
3. DeSouza NM, Reidy JF. Embolization with detachable balloons—applications outside the head. *Clin Radiol* 1992;46:170–175.
4. Gewillig M, Van der Hauwert L, Daenen W. Transcatheter occlusion of high flow Blalock-Taussig shunts with a detachable balloon. *Am J Cardiol* 1990;65:1518–1519.
5. Burrows PA, Edwards TC, Benson LN. Transcatheter occlusion of Blalock-Taussig shunts: technical options. *J Vasc Interven Radiol* 1993;4:673–680.
6. Beekman RH, Shim D, Lloyd TR. Embolization therapy in pediatric cardiology. *J Interven Cardiol* 1995;8:543–556.
7. Sharma S, Kothari SS, Krishnakumar R, Saxena A, Sharma R, Taneja K, Rajani M, Venugopal P. Systemic-to-pulmonary artery collateral vessels and surgical shunts in patients with cyanotic congenital heart disease: perioperative treatment by transcatheter embolization. *Am J Radiol* 1995;164: 1505–1510.
8. Rothman A, Lucas VW, Sklansky MS, Cocalis MW, Kashani IA. Percutaneous coil occlusion of patent ductus arteriosus. *J Pediatr* 1997;130:447–454.
9. Verma R, Lock BG, Perry SB, Moore P, Keane JF, Lock JE. Intraaortic spring coil loops: early and late results. *J Am Coll Cardiol* 1995; 25:1416–1419.

An Episode of Ventricular Tachycardia During Long-Duration Spaceflight

Janice M. Fritsch-Yelle, MS, Urs A. Leuenberger, MD, Dominick S. D'Aunno, MD, Alfred C. Rossum, MD, Troy E. Brown, PhD, Margie L. Wood, BS, Mark E. Josephson, MD, and Ary L. Goldberger, MD

Ventricular dysrhythmias during spaceflight were first noted on flights during the Apollo era.[1] Since then, the possibility that serious cardiac rhythm disturbances might occur during spaceflight has been an ongoing concern. As a result, there has been an ongoing effort by NASA to document and categorize inflight rhythm disturbances. Systematic evaluations of 24-hour Holter recordings performed before, during, and after spaceflight have documented no increase in cardiac dysrhythmias during short-duration flights (<14 days) aboard the Space Shuttle,[2] even during extravehicular activity.[3] In addition, a previous study reported no increase in dysrhythmias during long-duration flights.[4] However, there are recent anecdotal reports from the Russian MIR space station of inflight cardiac dysrhythmias that adversely impacted mission objectives. This has again raised the concern that cardiac rhythm disturbances may become an issue during the long inflight tours of duty planned for space station and interplanetary missions. As part of the effort to understand the effects of long-duration spaceflight on cardiac conduction, astronauts and cosmonauts assigned to tours of duty aboard MIR wear Holter monitors for 24-hour periods before and during their flights. The purpose of this report is to describe an episode of ventricular tachycardia (VT) recorded during 1 of those periods. This is the first documented episode of a ventricular tachyarrhyhthmia during spaceflight.

From the National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Texas; The Milton S. Hershey Medical Center and The Pennsylvania State University, Hershey, Pennsylvania; the Department of Internal Medicine, University of Texas Medical Branch, Galveston, Texas; Kelsey Seybold Clinic, Johnson Space Center, Houston, Texas; KRUG Life Sciences, Houston, Texas; and Cardiovascular Division, Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, Massachusetts. This study was supported by grants NAS9-97005 and NAG5-6350 from the National Aeronautics and Space Administration, Houston, Texas. Ms. Fritsch-Yelle's address is: Life Sciences Research Laboratories, SD3, Johnson Space Center, Houston, Texas 77058. Manuscript received November 6, 1997; revised manuscript received and accepted January 15, 1998.

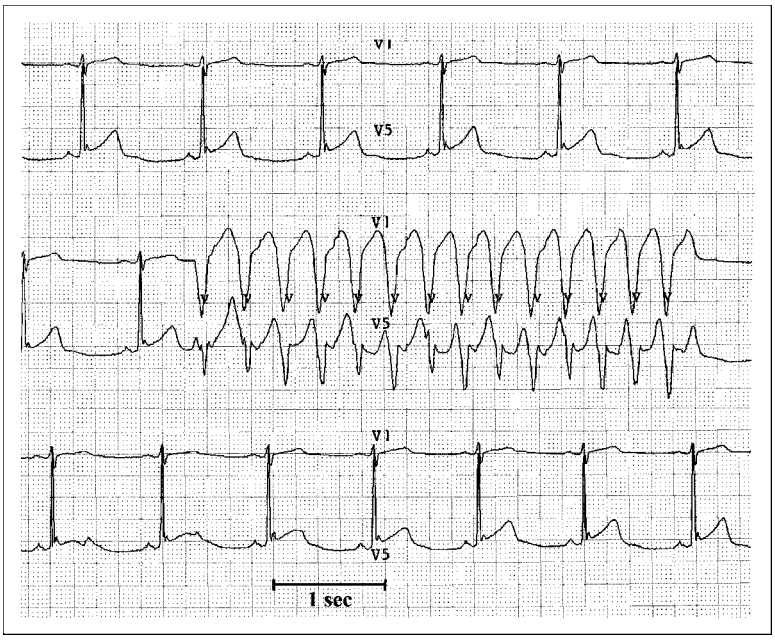

FIGURE 1. Nonsustained episode of VT recorded on 2-channel Holter (modified leads V_1 and V_5). The 3 panels are continuous. Note initiation of event with a late-diastolic premature ventricular complex (V) , as well as electrical alternans during the episode and transient, nonspecific ST-T changes afterward.

• • •

The subject was a Caucasian male with no known history of cardiovascular disease. He wore a Holter monitor for two 24-hour periods before and five 24-hour periods during a 4-month stay on the MIR space station and the American Shuttle. During Holter monitoring on this individual before flight, ventricular couplets, multiform premature complexes, and one 5-beat run of supraventricular tachycardia were noted, but he demonstrated no episodes of ventricular tachyarrhythmias. However, during the second month of his mission, an isolated episode of nonsustained VT during one 24-hour period of Holter monitoring was recorded (Figure 1). The 14-beat VT episode (maximum rate about 215 beats/min) occurred at about 6:05 A.M. It began with a late-diastolic premature ventricular complex (PVC) and was associated with electrical alternans, a nonspecific finding.[5] The morphology of the ventricular beats during the VT episode was different from those of the fixed-coupled PVCs noted before this event. Transient, nonspecific ST-T changes were noted following the episode. No clinical correlation was found between this episode and in-flight performance, and there was no impact to the mission. The subject was asymptomatic.

• • •

The mechanism of this episode of VT is not known. The record appears more consistent with triggered activity initiated by a delayed after-depolarization, or perhaps with increased automaticity rather than reentry. No evidence of ischemia or QT prolongation was noted. Speculatively, provocative factors might involve electrolyte fluxes (calcium, potassium), autonomic alterations, or perturbations associated with change in ventricular mass or volume. Although such nonsustained episodes of VT may be seen in normal individuals and may have no prognostic importance, further systematic studies are needed to exclude potentially serious electrical instability during long-term spaceflight.

We describe an incident of nonsustained VT recorded from a crew member in his second month aboard the MIR space station. Although this subject did not report symptoms, this event increases the concern that serious cardiac dysrhythmias may be a limiting factor during long-duration spaceflight.

1. Douglas, WR. Current status of space medicine and exobiology. *Aviat Space Environ Med* 1978;49: 902–904.
2. Fritsch-Yelle JM, Charles JB, Jones MM, Wood ML. Microgravity decreases heart rate and arterial pressure in humans. *J Appl Physiol* 1996;80:910–914.
3. Rossum AC, Wood ML, Bishop SL, Deblock H, Charles JB. Evaluation of cardiac rhythm disturbances during extravehicular activity. *Am J Cardiol* 1997;79:1153–1155.
4. Goldberger AL, Bungo MW, Baevsky RM, Bennett BS, Rigney DR, Mietus J, Nikulina GA, Charles JB. Heart rate dynamics during long-term spaceflight:report on MIR cosmonauts. *Am Heart J* 1994; 128:202–204.
5. Kremers MS, Miller JM, Josephson ME. Electrical alternans in wide complex tachycardias. *Am J Cardiol* 1985;56:305–308.