Ventricular dysrhythmias during spaceflight were first noted on flights during the Apollo era. 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 in-flight 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, even during extravehicular activity. In addition, a previous study reported no increase in dysrhythmias during long-duration flights. 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 tachyarrhythmia during spaceflight.
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, multiformal 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. 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.


FIGURE 1. Nonsustained episode of VT recorded on 2-channel Holter (modified leads V1 and V5). 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.