ment of new coronary events. Data from the present study show that paroxysmal supraventricular tachycardia detected during 24-hour ambulatory electrocardiography is not a risk factor for the development of new coronary events in elderly patients with heart disease.

Atrial fibrillation has been documented in numerous studies to be a risk factor for the development of thromboembolic stroke. We previously reported in 976 elderly patients that the incidence of new thromboembolic stroke at 39-month mean follow-up was 4.1 times higher in elderly patients with atrial fibrillation than in elderly patients with sinus rhythm.[5]

The Framingham Study reported that the incidence of deaths from cardiovascular causes was 43% in men with atrial fibrillation and 21% in men with sinus rhythm (risk ratio = 2.0), and 41% in women with atrial fibrillation and 15% in women with sinus rhythm (risk ratio = 2.7).[1] At 34-month mean follow-up of 118 patients with global T-wave inversion, Walder and Spodick[6] demonstrated that the mortality rate was 58% in 12 patients with atrial fibrillation detected by electrocardiograms, and 35% in 106 patients with sinus rhythm (p = 0.005). Data from this study show that atrial fibrillation is an independent predictor of new coronary events in elderly patients with heart disease. The time to onset of new coronary events was also significantly shorter in patients with atrial fibrillation than in patients with sinus rhythm or supraventricular tachycardia. After controlling for other prognostic variables, patients with atrial fibrillation and heart disease had a 2.2 times higher probability of developing new coronary events than those with heart disease without atrial fibrillation.

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A Cost-Effectiveness Strategy for Transtelephonic Arrhythmia Monitoring

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Transtelephonic arrhythmia monitoring (TTM) is an effective tool for detecting arrhythmias associated with infrequent symptoms. Other uses include the evaluation of variant angina and follow-up of patients with postmyocardial infarction and pacemakers.[1–5] However, no clear data have been provided as to the optimal duration of TTM or its cost-effectiveness. Reiffel et al[6] found that 95% of patients making symptomatic calls or making a call in which an arrhythmia was documented did so within 5 weeks; most patients (70%) made their first symptomatic call within 1 week. The cost-effectiveness of the 5-week TTM was not addressed. Our current study was designed to evaluate the clinical usefulness of TTM and from that database to derive a strategy for its cost-effective use.

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Records from 48 consecutive patients (45 men and 3 women, median age 64 years) referred for TTM (Instromedic, Hillsboro, Oregon) to the Department of Veterans Affairs Medical Center in Miami from 1990 to 1993 were reviewed. Ambulatory electrocardiograms (ECGs) (Ambulatory ECG, Marquette, Milwaukee, Wisconsin) recorded in the same patient within a month of TTM were also reviewed. At initial evaluation, a baseline ECG was recorded and each patient was instructed to wear the monitor for 30 days. Patients were to transmit an ECG and call in to report their symptoms when they occurred. ECGs were interpreted by experienced technicians and reviewed by a physician.

Indications for TTM were divided into 2 groups: patients referred for primarily central nervous system symptoms (including presyncope, syncope, vertigo, and dizziness) and patients referred for primarily cardiac symptoms (including palpitations, skipped beats, and racing heart). TTM was considered useful when it was a diagnostic study (i.e., when an explanatory arrhythmia occurred during symptoms) or a pertinent negative study (i.e., when symptoms occurred without an explanatory arrhythmia). A second comparison group of ambulatory ECGs (n = 43) matched for age, sex, and indication were also reviewed.

Cost analyses were based on $550 per ambulatory ECG and $660 for 1 month of TTM. The cost per useful study was calculated as the number of total studies divided by the number of useful studies multiplied by the cost of the monitoring method.[7] Costs per useful TTM and ambulatory ECGs in the paired and group comparison categories were calculated. Chi-square analysis was used to compare the number of useful tests in the central nervous system versus cardiac group and the number of diagnostic versus pertinent negative studies.

Of the 48 consecutive patients with TTM, 5 had an inadequate database. Of the remaining 43 patients, 4

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tinent negative studies were 3.5 times more common than diagnostic studies ($p < 0.025$). Of the 31 patients who had recent ambulatory ECGs, 5 (16%) had useful studies (3 were diagnostic and 2 were pertinent negative) for a cost per useful study of $3,410. A matched group of 43 ambulatory ECGs showed no diagnostic and 3 pertinent negative studies (7%) (cost $7,883 per useful study).

When diagnostic yield was examined by indication group, no diagnostic and 10 pertinent negative studies were found in the 32 patients referred for central nervous system symptoms (cost = $2,112 per useful study). In the 11 patients referred for cardiac symptoms, 4 had diagnostic studies and 4 had pertinent negative studies. The cost per useful study in the cardiac group was $908. Useful studies were significantly more likely to be found in the cardiac symptom (73%) than in the central nervous system symptom (31%) group ($p < 0.05$). Furthermore, 4 of 4 diagnostic and 7 of 14 pertinent negative studies were noted in ≤7 days. If monitoring had been performed only in the cardiac symptom group and for only 1 week, 4 of 4 diagnostic and 2 of 4 pertinent negative studies would have been detected for a prorated cost of $303 per useful study or $453 per diagnostic study.

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TTM was more cost-effective than ambulatory ECG when used to evaluate intermittent symptoms suggestive of an arrhythmia. TTM was twice as effective as paired comparison ambulatory ECG studies (cost per useful study $1,577 for TTM vs $3,410 for paired ambulatory ECG study) and 5 times as effective as matched ambulatory ECG studies ($7,883 per useful study). After clinical indications were separated into primarily central nervous system and cardiac symptoms, a significantly higher diagnostic yield was evident in the cardiac symptom group (73% vs 31%; $p < 0.05$). Linzer et al[8] suggested that cardiac loop electrocardiographic recording is an important diagnostic test in patients with syncope unexplained by ambulatory ECG. Ambulatory electrocardiography is the most frequently used diagnostic test for syncope despite its being nondiagnostic in >90% of cases.[8] This study suggests that these limitations extend in this population to TTM as well.

All 4 diagnostic TTM studies were due to supraventricular tachycardias with palpitations, racing heart, and known supraventricular arrhythmia being the clinical indication for the monitoring. Kopp and Wilber[9] suggested that cardiac loop electrocardiographic recording is more cost effective than ambulatory ECG.[8] The usefulness of TTM in patients with primarily cardiac symptoms was also supported by our results in which 8 of 11 (or 73%) of these patients had useful studies. There was a large number of pertinent negative results with TTM (in this study 3.5 times as many pertinent negative as diagnostic studies, $p < 0.025$); overall this is considered helpful in that it serves to reassure the patient that the symptoms are noncardiac in origin and may aid in further management. However, the cost per pertinent negative study was $2,027.

The high diagnostic yield in the cardiac group and the high yield of diagnostic studies in ≤7 days suggested a strategy for TTM use in our population. Using TTM in this patient population for only cardiac symptoms and for only 1 week would have identified all diagnostic studies, increased TTM availability, and decreased cost to $453 per diagnostic study or $303 per useful study. Our population was predominantly elderly men with a high prevalence of cerebral vascular disease. Analyses should be performed in a variety of patient groups and appropriate strategies derived.

In conclusion, TTM appears more effective than ambulatory ECG for the detection of arrhythmias associated with intermittent central nervous system or cardiac symptoms. Limiting TTM to patients with primarily cardiac symptoms and to a 1-week time period would have optimized cost-effectiveness in this group of patients.

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