In-Flight Management of a Supraventricular Tachycardia Using Telemedicine

Jessica J. Voerman; Mary E. Hoffe; Sam Surka; Paulo M. Alves

BACKGROUND: Supraventricular tachycardia (SVT) is a common presenting arrhythmia in the general population. Cases of SVT presenting during commercial air travel are always challenging as they might be confused with other conditions requiring different treatment strategies. We present a case of an in-flight SVT that was successfully managed using telemedicine support.

CASE REPORT: A 33-yr-old woman developed chest pain and dizziness while on an international commercial flight. Vital signs obtained on an on-board telemedicine device recorded an initial heart rate and blood pressure of 220 bpm and 128/78 mmHg, respectively. An electrocardiogram (ECG) was also obtained and transmitted to the ground-based medical support (GBMS) center where an SVT was diagnosed. Vagal maneuvers were recommended which resulted in a return to sinus rhythm and stabilization of the patient.

DISCUSSION: In parallel to the global increase in commercial air travel, it is expected that the incidence of in-flight arrhythmias will also increase, including SVTs. Vagal maneuvers are a safe, first-line option. While treating patients with a symptomatic tachyarrhythmia it is essential to diagnose the underlying arrhythmia, especially when initial maneuvers fail. Telemedicine, with transmission of vital signs and ECGs to GBMS centers, can enable diagnosis and guide management of in-flight SVTs, distinguishing them from other forms of cardiac arrhythmia. Undifferentiated chest pain and dizziness are common causes for flight diversions and, as such, could potentially be prevented in some instances by using telemedicine.

KEYWORDS: cardiac arrhythmia, commercial air travel, ground based medical support center, remote telemetry.

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Supraventricular tachycardias (SVTs), a type of narrow complex tachycardia, are commonly presenting arrhythmias in the general population. SVTs may present in previously healthy individuals, with women having been found to have a higher incidence than men.[10] Patients presenting with an SVT can be divided into two groups, those with cardiovascular disease and those without. In general, those without cardiovascular disease are more likely to be women, younger at presentation, have an earlier onset of symptoms and have faster heart rates.[10]

Telemedicine and the use of ground based medical support (GBMS) centers was pioneered to help seafarers on ships, with the first services recorded as early as 1920.[1] With air travel becoming increasingly more popular, similar services have been extended to airlines, assisting airline crew with in-flight medical events (IFMEs). MedAire Inc., a large company offering GBMS to commercial airlines, started offering this service in 1986 via radio connection.[9] Since then communication technology has improved greatly, with MedAire Inc. receiving its first transmission of a 12-lead electrocardiogram (ECG) from an onboard telemedicine device in 2003.[9] We present a case of an in-flight SVT that was successfully diagnosed and managed using telemedicine support.

CASE REPORT

A previously well 33-yr-old woman with no comorbidities developed palpitations, chest pain, and dizziness while on

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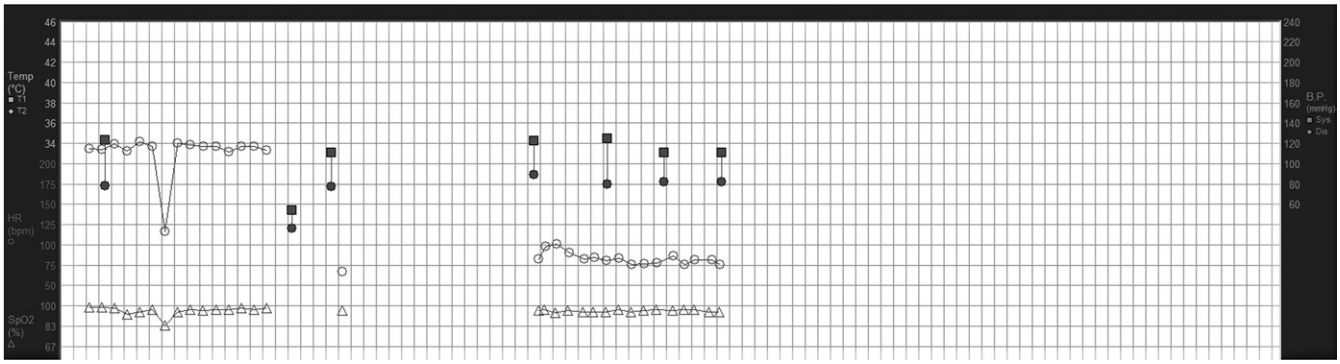

Fig. 1. Transmitted vital sign chart data from Tempus IC.

duty operating as a flight attendant aboard an international commercial flight. Vital signs obtained on an onboard commercially available telemedicine device, the Tempus IC, recorded an initial heart rate and blood pressure of 220 bpm and 128/78 mmHg, respectively (**Fig. 1**). An ECG (**Fig. 2**) was obtained via the Tempus device and was transmitted in real time via satellite to the GBMS center where an SVT was accurately diagnosed by an emergency physician. The ECG also demonstrated wide spread ST segment depression in the antero-lateral leads. Given the symptom of chest pain, this could indicate a more emergent situation. Vagal maneuvers of ice placement on the face and blowing into an empty 10-mL syringe for 15 s continuously were immediately recommended. An intravenous (IV) line was also placed by a medical volunteer on board and an aspirin tablet (300 mg) was given as per the chest pain protocol. The patient responded to the treatment with subsequent resolution of her symptoms. A second ECG (**Fig. 3**) was obtained that confirmed a return to sinus rhythm.

DISCUSSION

Air travel is becoming increasingly more popular, with the International Air Transport Association (IATA) reporting total numbers of passengers in 2016 as 2.6 billion, of which 1.1 billion were traveling internationally.[8] In parallel to the global increase in commercial air travel, it is likely that the incidence of in-flight arrhythmias will also increase, including SVTs. It is widely understood in aviation physiology that being in flight is mentally, emotionally, and physically taxing on the human body.[5] The aviation environment itself has reduced atmospheric pressure, with cabins generally pressurized to between 6000 and 8000 ft, with reduced oxygen availability and a resultant relative hypoxic hypoxia.[5] Other added stressors of air travel include physical stressors such as increased noise and vibration, decreased temperatures, and the emotional stressors associated with the preboarding stages of travel.[5] Passengers are also at risk of motion sickness, circadian dysrhythmia disruption (jet lag), and complications such as deep vein thrombosis from increased

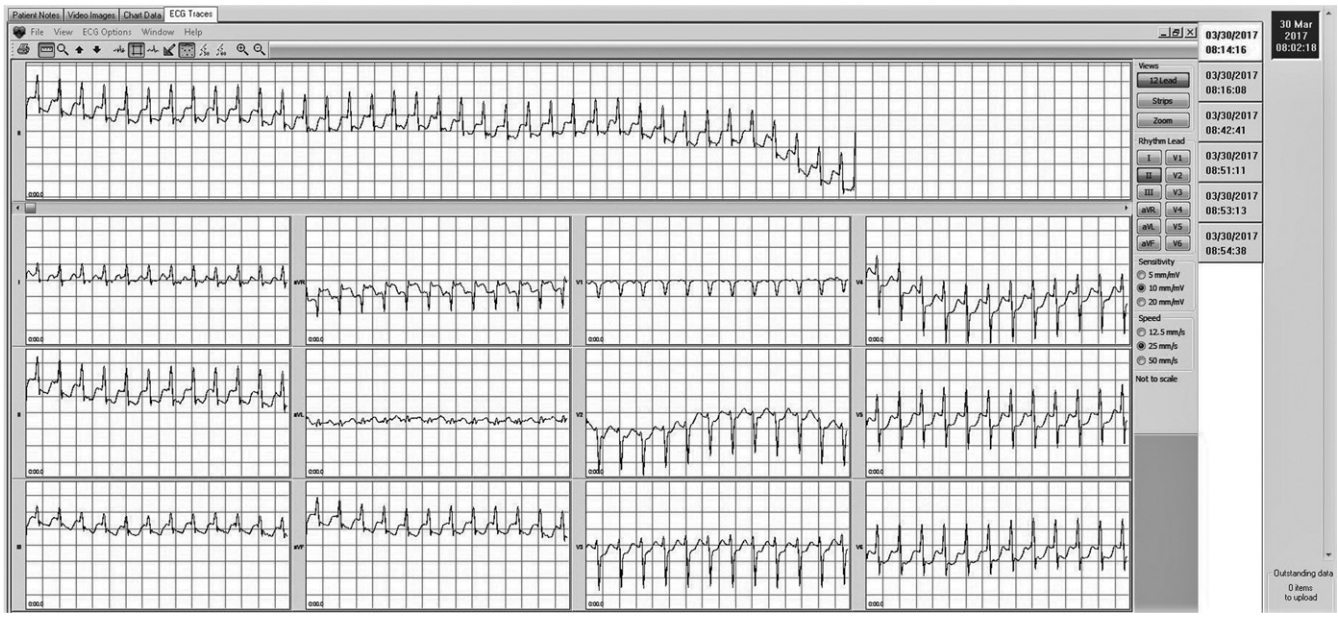

Fig. 2. Transmitted ECG pre-vagal maneuvers.

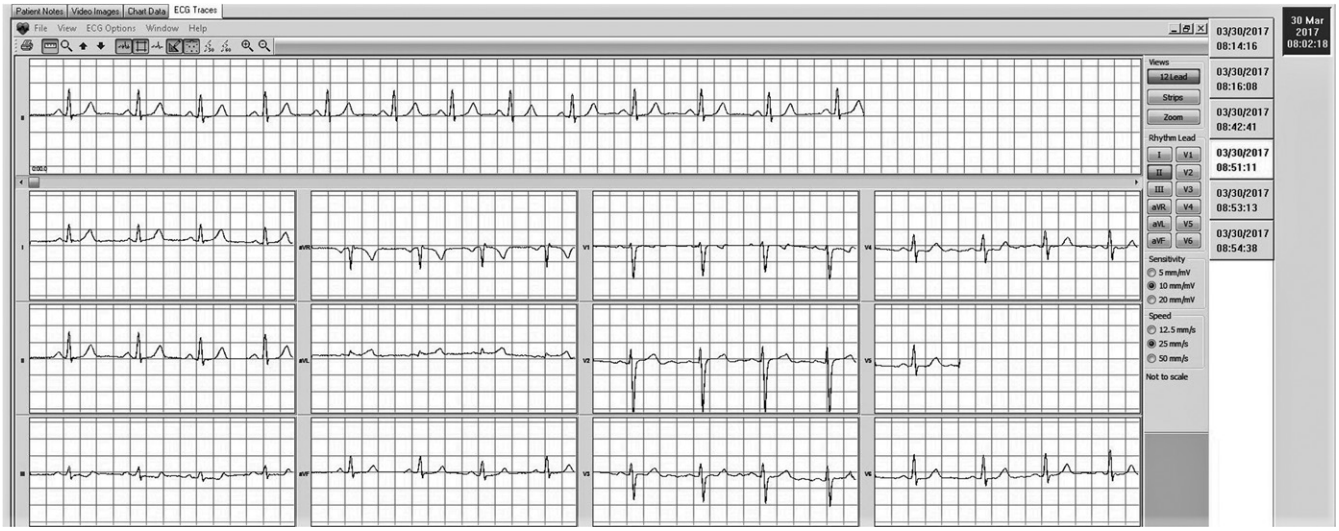

Fig. 3. Transmitted ECG post-vagal maneuvers.

immobility.[5] It is not impossible that those stressors, isolated or in concert, could trigger medical events in individuals with predisposing conditions.

The incidence of IFMEs ranges from 16 per 1 million to 23 per 1 million passengers.[6,11] Gastrointestinal, respiratory, neurological, and cardiac complaints were found to be the most common presentations of IFMEs.[11] When aircrew are faced with an ill or unstable passenger, a medical diversion of the flight could be considered to avoid morbidity or mortality. The rate of diversions due to medical reasons varies between 7.3% and 12.6%,[6,11] with undifferentiated chest pain and neurological complaints being among the most common causes for flight diversions.[7]

SVTs are usually benign in otherwise healthy individuals, but are potentially life threatening in those with ischemic heart disease and may necessitate flight diversion in such cases. Widespread ST depression was noted in this case report's initial ECG, but resolved with appropriate treatment. This ST depression during an SVT is well described in the literature, with one study reporting that 76% of SVT cases can have ST depression.[4] It does not indicate underlying myocardial ischemia or coronary artery disease, provided symptoms and ST changes revert to normal on return to sinus rhythm.[4]

Treatment of SVTs include a number of options, with vagal maneuvers recognized as an appropriate, noninvasive, first-line treatment option in hemodynamically stable patients. While a number of different vagal maneuvers exist, the Valsalva maneuver, as was advised in this case, can easily be done in the confined space of an aircraft as it is a technique that requires minimal resources.[12] Smith et al. describes three key aspects of successful cardioversion with the Valsalva maneuver: a supine position, an intrathoracic pressure of 40 mmHg, and sustaining this for 15 s.[12] One study found that blowing into a 10-mL syringe was effective in creating the required intrathoracic pressure.[13] The recently published REVERT trial discusses the benefit of a postural modification; this being the supine repositioning from the semirecumbent position and the addition of a passive leg raise after the sustained 15 s of 40-mmHg of intrathoracic pressure.[2] In this case report, even though successful cardioversion was achieved, future cases of in-flight SVT may benefit from this postural modification.

Telemedicine, with transmission of vital signs and ECGs to GBMS center-based emergency physicians, can enable diagnosis and guide management of in-flight SVTs, distinguishing them from other forms of cardiac arrhythmia. Telemedicine support is fast becoming an available option for aircrew to get professional medical guidance from doctors who are familiar with aviation physiology and airline operations.[3] It has also been shown that involvement of a medical professional and telemedicine decreases the rate and improves the appropriateness of flight diversion.[6]

In conclusion, this case report is the first to our knowledge of a documented cardioversion of an in-flight SVT using Valsalva maneuvers advised via telemedicine. It demonstrates the value of technology in enabling the accurate diagnosis and appropriate treatment of IFMEs, particularly SVTs. By doing so, significant morbidity and potential mortality can be avoided as well as unnecessary flight diversions. As better point-of-care diagnostic medical devices become available and with improved in-flight connectivity, more and more life-threatening IFMEs can be diagnosed and treated successfully.

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