

Telemedicine: Enabling Patients with Arrhythmias in Self-Care Behaviors

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Abstract

Telemedicine and video patient care visits have been present within the medical and nursing community for over twenty years. These visits serve an alternative purpose to in person face to face visits allowing continued care for those who may be too elderly to leave their home, those who cannot afford the high cost of traveling several hundred miles to a specialty center, or for those who have very busy lives, who need to compress the appointment into a short video or telephone visit. The electrophysiology department within the University of Michigan has adopted a research Telemedicine study to determine if video or phone visits can decrease the time needed to recognize, diagnose, and treat any change in arrhythmias. The study aims to improve the subject's self-efficacy of medication knowledge and use, activity, and understanding of the arrhythmia. This ongoing study has enrolled 31 subjects as of this date with 17 subjects in the telemedicine arm of the study and 14 subjects enrolled in the standard arm of the study. The telemedicine subjects receive monthly visits for three consecutive months compared with standard visit subjects who have face to face visits every six months. The two goals of the study are to improve or shorten the time to diagnosis of any new arrhythmia and treatment and to improve the subject's self-efficacy of medication knowledge and use, activity, and arrhythmia knowledge.

Keywords: *Telemedicine; Arrhythmia; Self-efficacy; Behavior*

1. Introduction

The telemedicine study, Telemedicine: Enabling Patients with Arrhythmias in Self-Care Behaviors (T:EPASB) is designed to decrease the time it takes to recognize an abnormal heart rhythm known as a dysrhythmia or arrhythmia [1], decrease its time

to diagnosis and increase the likelihood of prompt treatment and improved subject symptoms. It is also designed to assist the subject's knowledge and use of needed medications such as anticoagulants or blood thinners, rate controlling medications such as beta blockers or calcium channel blockers, and antiarrhythmics such as amiodarone. The study utilizes three survey tools to determine if the subject has an improved self-efficacy in management of the arrhythmia. The survey tools utilized are the Shortened Medication Use Survey (MUSE), the Functional Self -Efficacy Survey (FSES), and the Arrhythmia Self-Efficacy Survey (ASTA) and are designed to specifically assess the subjects self-efficacy of these three domains [2-4]. The null hypothesis is utilized to determine if there is no difference in time of recognition, time of diagnosis of a new arrhythmia and time of treatment of the new arrhythmia between the telemedicine and standard visit subject groups. The null hypothesis is also utilized with key survey questions asked of each subject within both groups [5]. Initial data from the study indicates there are specific subjects who demonstrate both a faster recognition, diagnosis, and treatment of a new arrhythmia and improved self-efficacy in all three areas of medication knowledge and use, activity, and arrhythmia knowledge. This case study demonstrates the importance of telemedicine and opportunities for key goals of the study.

2. Brief Literature Review

Please allow a brief literature review to understand the motivation in conducting a telemedicine study.

The T: EPASB is based upon studies showing improved clinical outcomes with the use of telemedicine. The TRUST trial compares the use of a telephone/video-conference to conventional in-person visits with individuals with ICDs. The TRUST trial determined the efficacy and safety of monitoring ICDs and the reduction of in-person visits [6,7]. This study displayed an adverse event rate of 10.4 for each group and no difference in the telemedicine versus the in-person visit group [6,8].

The Poniente trial determined that there was no difference in arrhythmia detection and functional capacity when monitoring elderly patients with pacemakers via home-monitoring and in-person monitoring [9]. The CHOICE AF was a pilot study to test the feasibility of a brief telephone-based program designed to decrease cardiovascular risk factors and improve health-related quality of life in patients with atrial fibrillation [10], demonstrating the exciting benefits of a telephone-based program patient support program. Ryan et al. [11] verified the efficacy of a theory-based Integrated Theory of Health Behavior Change (ITHBC) intervention using a cellular phone application to increase womens initiation and long-term maintenance of osteoporosis self-management behaviors. This study takes a chronic disease state, osteoporosis, and combines ITHBC-prompted behaviors with a cellular phone application to assist women in behavior change. Suter et al. [12] used self efficacy as a key component in managing one's health, noting patient empowerment in the management of chronic disease conditions such as diabetes mellitus and heart failure. The study identified the essence of telemedicine in its ability to empower patients with skills in managing their chronic health conditions.

3. Case Presentation

A 39-year-old gentleman presented to a hospital in the state of Michigan, USA in 2008 with complaints of palpitations, fast heart rate, headaches, and fatigue and was diagnosed with paroxysmal atrial fibrillation (PAF). The atrial fibrillation was managed initially with rate control medication and blood thinners, with Diltiazem and Rivaroxaban. He did well for several years and had minimal PAF and simply took short breaks from his activities. The PAF events lasted five minutes to a

maximum length of two hours. The gentleman turned fifty years old in 2019 and began to have more frequent symptomatic episodes of atrial fibrillation. He historically had essential hypertension and later developed an alcohol dependency and resultant gastroesophageal disease (GERD). In September 2019 he had several episodes of atrial with events lasting from two to four hours. He was evaluated with a stress test which was negative for ischemia and no evidence of structural heart disease. He was reminded to remain on his anticoagulation and noted a change in insurance coverage and resultant no use of anticoagulation for a few months. He was placed on Apixaban which was a covered medication on his new insurance policy. He took the Apixaban and newly prescribed Propafenone 150 mg three times daily for one month and then stopped the Apixaban after the one month, as he started to feel better. He also decreased the propafenone to 150 mg twice daily noting he thought this was what he should do, since he felt better.

In November he arrived at the emergency department in atrial fibrillation with rapid ventricular response (AF with RVR) and a computerized tomography scan (CT scan) revealed massive bilateral pulmonary emboli. Apixaban was restarted and he was admitted to the hospital for management of the AF with RVR. His propafenone was increased to 150 mg three times daily. While admitted, he was noted to have a short run of non-sustained ventricular tachycardia which was evident on more than one occasion. A full work up for any structural heart disease entailed a stress test and transthoracic echocardiogram. Both tests were noted as normal except an enlarged left atrium.

Given his episodes of NSVT in the setting of a class 1C antiarrhythmic, propafenone, he was switched to Amiodarone. During his in-person hospitalization he received an appropriate IV loading of amiodarone. He was discharged home in good health. Of note, with arrival to the hospital his magnesium was 1.8 and potassium 3.2 and he received ongoing supplements of both medications. He felt well initially on the amiodarone. Shortly thereafter he noted that he much more fatigue and lethargy while on this medication. He continued to have GERD complaints and at times admitted to drinking too much alcohol on only specific special occasions. He also reported having fast heart rates and feeling the atrial fibrillation was not well managed.

An event monitor displayed episodes of AF with RVR and atrial flutter and total atrial fibrillation and flutter burden of 7%, despite taking the strongest antiarrhythmic that was appropriate. He then presented to the emergency department in April 2020 with fatigue, rapid heart rates, chest pain and pressure and feeling completely exhausted. He was in AF with RVR with heart rates in the 140-180 beat per minute range. His electrolytes displayed a potassium of 2.4, magnesium of 1.3, an AST of 35, and a bilirubin of 1.5. His electrolytes were supplement while in the hospital and he was again placed on long term daily potassium and magnesium supplements. He noted he was drinking more over the past two months. He had long discussions with the admission team, who arranged treatment for alcohol- abuse and he enrolled in a program which entailed weekly meetings for three months. He attended all meetings and continued with regular meetings with a psychiatrist. In June 2020, he noted double vision and blurring of his vision. He described this as starting shortly after he began the amiodarone. The amiodarone was stopped. He saw ophthalmology within one day and was diagnosed with Adie's tonic pupil. This condition involves a dilated pupil which is slow to react to light and an absent or poor tendon reflex of the eye [13]. It is also described as a neurologic condition when no trauma is involved. An exam in one month showed no pupil, retinal, or scleral damage and improved response to light. The subject continued with the rate control medication diltiazem and with Apixaban. He requested an ablation for the management of his atrial fibrillation. Our service noted that we would like to see at least six

months abstinence from alcohol use and then the procedure would be scheduled. He agreed to continue to abstain from alcohol use. He shortly thereafter admitted there was a civil case in an adjoining state. He noted he may be sentenced to jail at his upcoming court date. He was sentenced to one month in jail. While in jail he was not given twice daily diltiazem and only received once daily apixaban.

Upon his release from jail, he was treated with twice daily apixaban for one month. His AF with RVR become much more symptomatic and Dronedaronone was started at 400 mg twice daily. He commented that he felt much better while taking the Dronedaronone and his fast heart rate and fatigue had resolved. He unfortunately developed a maculopapular rash within the first month of taking this medication and it was discontinued. He noted that he had not used alcohol in 4 months and that he wanted an ablation, as soon as one can be arranged.

Labs revealed potassium was 4.2, Magnesium 2.1, AST 18 and Bilirubin 0.6. The ablation was then scheduled. He unfortunately had recurrent of atrial fibrillation with RVR which resolved after receiving intravenous diltiazem. He was then discharged from the hospital on Diltiazem 480 mg daily, metoprolol succinate 25 mg daily and apixaban 5 mg twice daily (FIG. 1). Of note, he had decided to increase the Apixaban dosing prior to this admission and was found to have transient hematuria and negative CAT scan for any urologic abnormality. He was instructed on the appropriate apixaban dosing and resumed 5 mg twice daily (TABLE 1 & 2).

TABLE 1. Subject Specific Telemedicine Points.

Concerning findings	Telemedicine Opportunity	Improved Diagnosis time	Improved Treatment time	Plan:
Adherence	Apixaban	Monthly checks	Rhythm checks	Close follow up
Pulmonary Emboli	Treat promptly	Coincidental with ED visit	Frequent Assessment	Close follow up monthly visits
Labs	Mag, Potassium	Monthly labs	Corrected values	Close follow up
Subject's Understanding	Correct misconceptions	Rapid assessment	Allows ongoing improvement	Ongoing answers

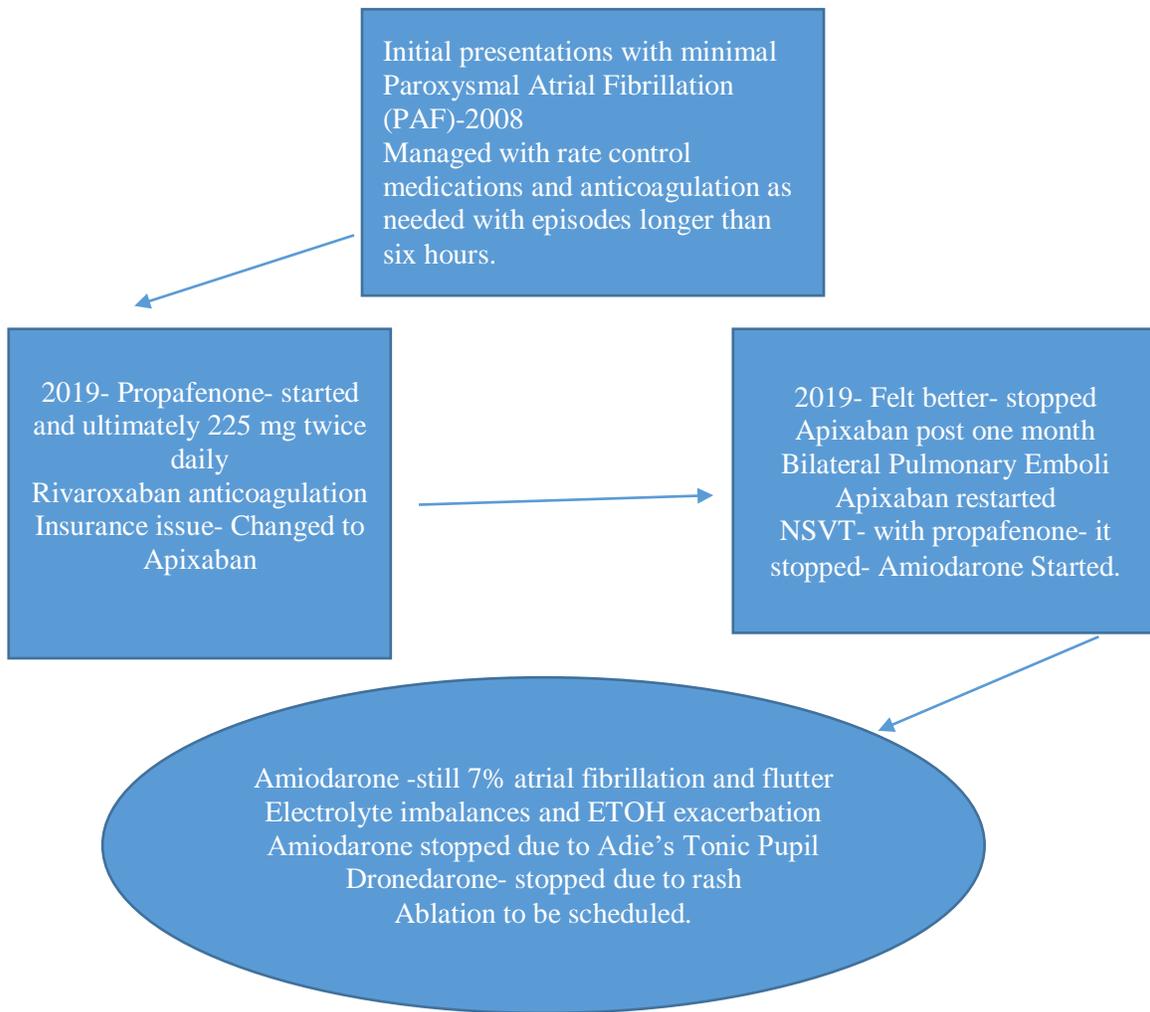


FIG 1. Subjects Progression with increasing atrial fibrillation events/ evolving persistent atrial fibrillation.

TABLE 2. Subject Specific Response to Anti-arrhythmia medications.

Medication	Effectiveness	Acceptable with normal heart structure	Acceptable with structural heart disease	Limiting Side Effect
Propafenone	Very Effective	Yes	No	Several Episodes NSVT-Non sustained VT-had to be discontinued.
Amiodarone	Surprisingly, in this case-somewhat limited; 7 % AF and AFL Burden	Yes	Yes	Adie's Tonic Pupil Amiodarone Discontinued
Dronedaron	Very Effective	Yes	Yes	Maculopapular rash-required Discontinued.

The subject did not tolerate the class IC antiarrhythmic, which in the setting of induced ventricular dysrhythmias, required discontinuation. This class of antiarrhythmics can lead to ventricular arrhythmias which when present, require discontinuation of the propafenone [14]. Amiodarone, the most effective atrial and ventricular antiarrhythmic [14] failed to eliminate this subject's atrial fibrillation and atrial flutter. It also resulted in a concerning ocular condition, which is a major warning sign to stop the amiodarone [14]. The Dronedarone is often effective, in the setting of those who have not tolerated a 1C agent and or have structural heart disease [14]. This medication worked well to eliminate the atrial dysrhythmias. Unfortunately, he had a progressive maculopapular rash which would not be tolerated over time and Dronedarone was then stopped.

4. Discussion

This case presentation is an excellent example of the natural and expected progression of atrial fibrillation. It gives the initial diagnosis of paroxysmal atrial fibrillation, first presenting in 2008 and eventually becoming persistent, after the use of three antiarrhythmics. It outlines some of the challenges and side effects of the medications. A cardinal rule in prescribing 1c agents, such as propafenone includes an evaluation to show no structural heart disease exists, prior to prescribing the medication [14]. Unfortunately, in some instances the medication is noted to be pro-arrhythmic, as in this case and the 1c agent must be stopped [14]. Amiodarone and Dronedarone are excellent medications, used in the setting of structural heart disease (although this case does not prove structural heart disease, it is assumed in the setting of NSVT) which are not free of side-effects. Visual impairment involving diplopia, poor focusing, or changes in the function of the pupil are immediate cause to discontinue amiodarone [14]. Finally, a rash with dronedarone is relatively rare, but also an indication for discontinuation of the medication [14]. The management of paroxysmal and persistent atrial fibrillation can be challenging and involves choices of rate control medications, rhythm control medications and at times the only logical course of treatment is an ablation [15]. This case involves subject misconceptions, concurrent alcohol abuse and other social issues, which did not allow an immediate choice of ablation options. The electrophysiology team is often faced with balancing several ongoing subject's issues, much like a liquid puzzle to give ongoing care for atrial fibrillation.

5. Learning Points

1. Telemedicine offers frequent and ongoing assessment to identify, diagnose and treat changes in the subject's arrhythmias. This case involved AF, AFI, NSVT, and the rapid change in treatment with this rapid assessment.
2. Telemedicine provides a setting to educate, inform, and adjust the subjects use of medications-IE- improve the subjects self- efficacy of medication use. This case involves the need for ongoing anticoagulation, with bilateral PE while off anticoagulation.
3. Telemedicine allows discussion of comorbidities such as alcohol abuse. It allows the adoption of alternative behaviors. Addressing electrolyte imbalances and increased AF burden in the setting of alcohol use is addressed in the telemedicine sessions. This education allows increase arrhythmia self-efficacy.
4. The Electrophysiology Department at the University of Michigan has adopted Telemedicine in the unfortunate setting of the Covid-19 pandemic. Prior to the pandemic this study was developed to examine any advantage with telemedicine in diagnosing arrhythmia changes and treating such changes faster than in the setting of standard six- month visits. The study was also designed to examine if the subject's medication, activity, and arrhythmia self-efficacy improved with telemedicine. This case study is an example of the advantages of telemedicine in the arrhythmia care setting.

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