Is Redundancy in Vital Signs Monitoring Useful?

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Abstract

During an ongoing study of wireless vital signs monitoring of post-triage patients with SMART [1] in the waiting area of the emergency department (ED) at the Brigham and Women’s Hospital in Boston, Massachusetts, USA, we observed that redundancy in vital signs monitoring can be advantageous.

Technology

The SMART [1] patient monitoring system consists of a pulse oximeter commercially available from Nonin [2] and a single-lead ECG, of our own design, using Texas Instruments’s INA321 Instrumentation Amplifier [3]. These sensors are attached to the “Patient PDA” which transmits data wirelessly via 802.11b to SMART Central, a computer where the data are processed and stored. SMART Central has a decision support module that determines what action to take on alarm conditions and a logistics support manager that determines how to identify and notify appropriate caregivers.

The patient monitoring system is housed in a “waist pack,” which is offered to patients presenting with “chest pain” or “shortness of breath.”

Observations

The Nonin sensor provides heart rate, in addition to oxygenation level. The ECG sensor provides the waveform, and a heart rate derived from the ECG waveform. The processing algorithm used is described in [4].

Usually the two heart rates are fairly consistent, although, the heart rate derived from the ECG has been observed to be less reliable. Of course, in the case where the patient gets tired of wearing the pulse oximeter on a finger, either temporarily or permanently, the ECG heart rate provides complementary data on patient status.

Unexpectedly, in one case, redundancy in heart rate measurement was significant: a 64 year old male who was sent from his primary care physician's office because of a pulse rate of 120 without symptoms, a past history of hyperthyroidism, and “irregular heartbeat.” Because the SMART Operator (a paramedic) noticed that the patient’s SpO2 heart rate and his ECG heart rate differed significantly (see figure 1), he suspected atrial fibrillation and notified the ED staff. The patient was admitted to the ED and initially the 12-lead ECG showed junctional tachycardia at a rate over 120 (almost indistinguishable from rapid atrial fibrillation). After two liters of IV fluids (his systolic BP was between 80 and 100), he had a PVC and spontaneously converted to normal sinus rhythm. He was discharged home with a diagnosis of paroxysmal supraventricular tachycardia, resolved. He will be followed by electrocardiology. This case illustrates a medical advantage to redundant vital sign monitoring in an ED waiting area.

Acknowledgments

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References

http://focus.ti.com/docs/prod/folders/print/ina321.html

Figure 1: Atrial Fibrillation: High ECG heart rate compared to low heart rate reported by SpO2 sensor.