The Use of Electronic Medical Records and Data Mining to Facilitate Best Patient Care in an Outpatient Clinical Setting

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**Background:** Data mining thru the use of electronic medical records (EMR) and scanning has led to the identification of 1,965 unique patients that may meet the risk for sudden cardiac death (SCD) and meet the criteria of the Multicenter Automatic Defibrillator Implantation Trial II (MADIT-II) for the consideration of an implantable cardioverter defibrillator (ICD).

**Methods:** The electronic database for medical records was transferred via encrypted text and sent over secure file transfer protocol connection to a medical informatics company. A program was developed that can scan each medical record in its entirety and identify patients that meet the MADIT-II criteria of prior myocardial infarction and ejection fraction of 30%. A pilot validation study was performed prior to the full data transfer to ensure the accuracy of the program that yielded a 99.79% accuracy rate.

**Results:** Cardiologists have assessed 631 of the 1565 identified patients. There have been 43 electrophysiologist referrals, 109 T-wave alternans tests, 339 echocardiograms, 4 signal average electrocardiograms, 20 ICD implantations, 272 deemed ineligible after cardiologist reassessment, 21 patients who refused consideration of ICD therapy, 78 deaths prior to this assessment, and 22 who moved out of the area.

**Conclusion:** Data mining and scanning of the EMR has led to increased patient referral for electrophysiologist evaluation potentially resulting in greater patient care outcomes in this outpatient facility. The EMR aids the physician in the ability to identify patients who meet specific clinical criteria, or require reevaluation of treatment based on new recommendations.
Identification of Electrocardiogram Characteristics: Wavelet Transform Versus Derivative-Based Method

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Background: ECG is an important tool in the diagnosis of ischemic heart disease and arrhythmia. Computerized automatic diagnostic tools may help clinicians in diagnosing these diseases and give early warning when the ECG is continuously monitored. Their success depends on the availability of reliable ECG wave identification systems. The conventional algorithms include the use of derivative-based methods and non-linear filtering. In the past decades, the wavelet transform has been advocated. Although investigators [1] have compared the performance of wavelet transform with the conventional algorithms on QRS detection, research is still needed on the performance of these algorithms on P and T wave detection. In this study, we compared the accuracy of a derivative-based method and the wavelet transform in P, R and T wave detection.

Methods: ECG signals were downloaded from 48 files of the European ST-T database. We extracted 11 one-minute recordings to cover a variety of ECG morphologies. The signals were filtered by a bandpass filter. The derivative-based method identified the ECG waves by applying rules on the smoothed differentiated signal. For the wavelet transform, we utilized a high-pass filter and the first derivative of a Gaussian was used as the basis function. The number of P, R and T waves correctly identified by the derivative-based method and the wavelet transform were compared.

Results: 806 ECG beats were analyzed. 89.4% of the P waves were identified correctly using wavelet (compared to 80.2% for the derivative-based method). The lack of statistical significance (p=0.07) may be due to a lack of power. 99.0% of R waves were identified correctly using wavelet compared to 98.8% for the derivative-based method. 91.8% of the T waves were correctly identified using wavelet compared to 77.3% for the derivative-based method (p=0.05).

Conclusion: The wavelet-based method was shown to be superior to the conventional derivative-based method especially in T wave identification.

Reference:

1020-74 A Bayesian Network to Evaluate Risk Factors Profiles in Patients With Coronary Artery Disease

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Background: Bayesian neural networks (BNN) are computational models for encoding probabilistic inferences among variables of interest. BNN encode dependencies among all variables, learn from actual data to evaluate causal and probabilistic relationships in a complex setting. We developed a BNN for evaluating the risk factor profiles and the dependencies among the various risk factors and their relations to the presence and to the extent of coronary artery disease (CAD) at angiography.

Method: We fed a BNN development tool (MS-Research) with the XML-formatted data from the electronic records of risk factor profiles and coronary angiography of 5180 patients (3878M; age 62; 54-68; median 25°-75° percentile). Data were randomly divided in training and testing data sets in a 70/30 proportion.

Results: We obtained a Bayesian graphical "node-relationship" model (see below) that calculated the causal and probabilistic dependencies among risk factors and towards the result of the coronary angiography, (normal, vs. 1-, 2- and 3-vessel disease). The model can be queried for any node/variable to explore the dependencies and its predictive value towards other variables. The model also provides probabilistic decision tree for each node/variable and its related nodes to help evaluating the probability of the presence and extent of CAD.

Conclusion: BNN are useful for the analysis of large clinical datasets. BNN can provide a teaching and evaluation tool for estimating the determinants of outcome from clinical data.