Utility of a Bayesian Updating Computer Tool to Monitor Safety Data in Real Time: An Example Evaluating Subacute Stent Thrombosis for the CYPHER Drug Eluting Stent

Michael E. Matheny, Leo Chi-chiu Kum, Lucila Ohno-Machado, and Frederic S. Resnic

Brigham and Women’s Hospital, Boston, Massachusetts

Abstract

Background: Low event rates and rapid evolution of technology create challenges for safety monitoring in interventional cardiology. A Bayesian method incorporates prior information (prior) and risk estimates and exploits prior information in future data collection, allowing the posterior risk estimate of safety issues rather than a corresponding frequentist analysis. We explore the feasibility of a software monitoring tool that uses the Bayesian method to detect significant changes in event rates.

Methods: Our software tool evaluated CYPHER subacute thrombosis (SAT) rates at our center. The system includes a web-based user interface and an SQL database to perform the data manipulation and analysis. For any new procedure or product, initial risk estimates (priors) are calculated using the D Cohen approach. We update the risk estimates by using the first fourteen months of CYPHER use after FDA monitoring in interventional cardiology. A Bayesian method incorporates previous information and exploits prior information in future data collection, allowing the posterior risk estimate of safety issues rather than a corresponding frequentist analysis. The example analysis confirmed that CYPHER SAT rates were within acceptably predicted ranges for low and high risk patients at our center. The system is structured to provide flexible monitoring options for any new device or procedure.

Background: Safety monitoring of medical devices, under the inspection of the FDA, has undergone significant change over the last few decades. Post-market data is now reviewed by the FDA using data from both required and voluntary sources. However, it is suspected that large numbers of events fail to be reported. Recent FDA actions surrounding suspected CYPHER stent subacute thrombosis events, and TAXUS stent balloon-wire definitions highlight the need for further development of early detection systems. In addition to a clear need for early monitoring systems, interventional cardiology (IC) operates on an ever-increasing data stream for each risk stratification. In this example, we illustrate the DELTA system for monitoring safety data in real time and show its efficiency in detecting changes in event rates.

Conclusion: The example analysis confirmed that CYPHER SAT rates were within acceptably predicted ranges for low and high risk patients at our center. The system is structured to provide flexible monitoring options for any new device or procedure.

Discussion: This example demonstrates the use of the DELTA system for real time safety monitoring for SAT with respect to implementing a new DES device in IC. This study confirmed fact: CYPHER SAT rates were within acceptably predicted ranges for low and high risk patients at our center. The example analysis confirmed that CYPHER SAT rates were within acceptably predicted ranges for low and high risk patients at our center. In addition to a clear need for early monitoring systems, interventional cardiology (IC) operates on an ever-increasing data stream for each risk stratification. In this example, we illustrate the DELTA system for monitoring safety data in real time and show its efficiency in detecting changes in event rates.

Methods: To provide an example of the system in operation, a simulation trial was setup to monitor CYPHER drug-eluting stent events. A prospective randomized, multicenter, non-inferiority study (RAVEL, NCT00189298) began in May 2002 with a follow-up period of 12 months. In December 2003, the FDA released a letter communicating a call for data on CYPHER SAT rates due to the recent press release. The data were collected and analyzed using the same approach as in the example analysis. A detailed description of the interventional cardiology (IC) operations was used to monitor any potential deviations from the expected SAT rates. The data were then analyzed using the same approach as in the example analysis.

Results: The example analysis confirmed that CYPHER SAT rates were within acceptably predicted ranges for low and high risk patients at our center. The system is structured to provide flexible monitoring options for any new device or procedure.

Conclusion: The example analysis confirmed that CYPHER SAT rates were within acceptably predicted ranges for low and high risk patients at our center. The system is structured to provide flexible monitoring options for any new device or procedure.

Discussion: This example demonstrates the use of the DELTA system for real time safety monitoring for SAT with respect to implementing a new DES device in IC. This study confirmed fact: CYPHER SAT rates were within acceptably predicted ranges for low and high risk patients at our center. In addition to a clear need for early monitoring systems, interventional cardiology (IC) operates on an ever-increasing data stream for each risk stratification. In this example, we illustrate the DELTA system for monitoring safety data in real time and show its efficiency in detecting changes in event rates.

Methods: To provide an example of the system in operation, a simulation trial was setup to monitor CYPHER drug-eluting stent events. A prospective randomized, multicenter, non-inferiority study (RAVEL, NCT00189298) began in May 2002 with a follow-up period of 12 months. In December 2003, the FDA released a letter communicating a call for data on CYPHER SAT rates due to the recent press release. The data were collected and analyzed using the same approach as in the example analysis. A detailed description of the interventional cardiology (IC) operations was used to monitor any potential deviations from the expected SAT rates. The data were then analyzed using the same approach as in the example analysis.

Results: The example analysis confirmed that CYPHER SAT rates were within acceptably predicted ranges for low and high risk patients at our center. The system is structured to provide flexible monitoring options for any new device or procedure.