Accuracy of a Novel Method to Measure In-Stent Restenosis Using Embedded Nanosensors

Levy, Ethan (School: Dr. Michael M. Krop Senior High School)

The purpose of this experiment was to measure the accuracy of in-stent nanosensors (1, 2, 3, & 4) at varying heart rates (60, 90, & 110 beats per minute) and varying levels of occlusion (70%, 75%, 80%, 85%, & 90%) compared to highly accurate pressure gauges in an experimental assessment using a modified Clarke's Error Grid Analysis (EGA). The procedure included assembling the in-stent nanosensor experimental device apparatus (designed by the researcher to simulate a heart disease patient), and constructing the 60 stents with 1, 2, 3, or 4 nanosensor(s) at each end. Artificial occlusion was developed and poured into the 60 stent tubes to mimic coronary artery in-stent restenosis at varying levels. Then, the experimental occluded coronary arteries were tested one by one in the experimental apparatus with various heart rates and five experiments per stent per heart rate. The data was gathered by recording highly accurate pressure differences, nanosensor pressure differences, and flow rate. In conclusion, the results established that in earlier restenosis stages, in-stent nanosensors are able to identify restenosis; however, in higher stages of occlusion, other methods of identifying coronary restenosis should be used. As the number of nanosensors increased, accuracy increased. The results of this study are significant as it can help improve the quality of life of heart disease patients by providing cardiac surgeons a method for evaluating accuracy of coronary in-stent restenosis measurement using embedded nanosensors and early detection of heart disease.

Awards Won:

Third Award of $1,000