2012-10

Evaluation of CIRS String Doppler Phantom as a Test Tool for Use in a Doppler Ultrasound Quality Assurance Program

Jacinta Browne
Technological University Dublin, jacinta.browne@tudublin.ie

S. Cournane
St. James's Hospital, Dublin

Andrew Fagan
St. James's Hospital, Dublin

Recommended Citation

Browne, J., Cournane, S., Fagan, A.: Evaluation of CIRS String Doppler Phantom as a Test Tool for Use in a Doppler Ultrasound Quality Assurance Program. Physica Medica, Vol. 28,no.4, p. 334. doi:10.1016/j.ejmp.2012.06.013

Evaluation of CIRS String Doppler phantom as a test tool for use in a Doppler Ultrasound Quality Assurance program

Browne JE[1], Cournane S[2], Fagan AJ[2,3]

[1] Medical Ultrasound Physics and Technology Group, School of Physics / FOCAS, Dublin Institute of Technology, Kevin's Street, Dublin 8, Ireland

[2]Medical Physics and Bioengineering, St. James's Hospital, Dublin 8, Ireland

[3]Centre for Advanced Medical Imaging, St. James's Hospital/Trinity College Dublin, Dublin 8, Ireland

Ultrasound Doppler systems are routinely used to perform blood flow velocity measurements which assist in the clinical assessment and diagnosis of vascular. Doppler measurements of peak velocities for vascular applications provide an indication of the degree of the stenosis which will ultimately assist in deciding how a patient is managed. It is imperative that Doppler systems are capable of accurately measuring blood flow velocities to ensure correct diagnosis and appropriate patient treatment; therefore such systems should be evaluated regularly as part of a Quality Assurance program. Although a range of Doppler test phantoms have been developed for quality control (QC) purposes to establish the measurement accuracy and stability of Doppler systems only a limited number of such test phantoms are commercially available, the easiest of these devices to operate is the String Phantom. Currently, only one string Doppler phantom is commercially available, namely the CIRS Model 043. In this study an evaluation of the performance of this test device was carried out as a number of problems currently exist with it such as the filament type, the fact that the filament passes through a water–air interface and vibrations from the motor. This study has established that the braided-silk filament, provided with the phantom, should not be used as it introduces errors of as much as 24% for the mean velocity accuracy and 20% for the intrinsic spectral broadening (ISB) depending on the soak time of the filament. Rather, to avoid such errors it is advised that the phantom be retrofitted with a filament made from an O-ring rubber. While this eliminates the temporal changes in backscatter seen with the braided-silk filament, further discrepancies were observed, even with an O-ring filament, when the filament velocity was set in the range 26–44cm/s, where a resonance effect significantly increased the variability of the maximum velocity accuracy and ISB measurements. This was most likely as a result of the imposed vibrations from the motor, which is mounted directly onto the tank wall; hence, it would prove practical to avoid taking measurements in this velocity range where resonance effects are observed.