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CoRIPS Research Award - £1600

Observer Variation of Abdominal Aortic Aneurysm Measurements on CT datasets

Abstract

Abdominal aortic aneurysms (AAAs) are abnormal swellings of the abdominal aorta and if left untreated may continue to swell and eventually rupture which in many cases is fatal. The majority of AAAs are found accidentally on radiographic imaging, treatment options allow for successful repair of the aneurysm, however, the surgical risk for small aneurysms is higher than the risk of rupture and therefore only aneurysms above a certain size criteria are offered intervention. With the widespread availability of keyhole surgery CT scanning is often used to measure the aneurysm prior to deciding treatment. There are many reports in the literature which highlight differences in CT measurements between the same and different observers. The maximum aneurysm diameter is used to decide on whether to intervene, it is possible that measurement variability could have clinically significant implications and therefore we feel this issue warrants further investigation. With image interpretation currently extending beyond the role of the radiologists and vascular surgeons becoming increasingly keen on endovascular planning we wish to examine the effect of experience on the accuracy of vascular CT measurements.

Aims and Objectives

This small study will aim to investigate whether inter- and intra-observer variability is associated with the level of experience of the observer(s). Whilst exploring the overall aim of the study the following objectives will be met:-

- Identify the inter-observer variability of maximum aneurysm diameter measurements taken from CT images specifically looking across the different observer types and within each observer types e.g. vascular radiologists or student radiographers.
- Identify the intra-observer variability of maximum aneurysm diameter measurements taken from CT images specifically looking across the different observer types and within each observer types e.g. consultant radiologists or non-imaging related volunteers.
- Identify whether maximum diameter or maximum area measurements are more resistant to observer variability.
- Improve understanding of the decision making process surrounding the identification and measurement of the maximum extent of the AAA.
- Gain an understanding of whether measurement accuracy can improve with training and experience.

### Methodology

The study will take place in the Division of Medical Imaging & Radiotherapy, University of Liverpool. The University has a collaborative relationship with the Departments of Vascular Surgery and Radiology at the Royal Liverpool University Hospital and is therefore in a key position to undertake this research.

A database of six pre-operative CT scans will be loaded on to a laptop computer. Each of the six CT datasets will be allocated a patient identifier (e.g. Patient-A). Out of the series of six patients, two of the patient's scans will be repeated in the series in order to test intra-observer variability. Using a MS Windows based DICOM viewer observers will be asked to perform maximum diameter and maximum area measurements on each of the six patients.

A total of 25 observers will be recruited to the study; these will consist equally of radiologists, vascular surgeons, radiographers, radiography students and non-imaging related volunteers. The order of patients and the measurement types will be randomised for each observer in order to reduce the effect from learning within the experiment. The following parameters will be recorded for each measurement and the viewing conditions will be standardised:-

- Table position for measurement.
- Diameter/Area Measurement.
- Time per measurement.
- Confidence on measurement, Likert scale 1-5.
- Screen capture of the electronic callipers recording the measurement.

### Potential Impact

The study will aim to identify whether experience plays a role in measurement accuracy and this study may be used to guide observers to seek formal training. Also if area measurements prove to be less prone to variation it may lead to a change of treatment criteria moving away from traditional diameter measurements. A large amount of reports use maximum aneurysm diameter as an outcome measure following AAA treatments therefore it is extremely important to understand the potential variability of this parameter.

### Evaluation and Disseminate Strategy

This project will involve two A Level students on placement for the summer at the University of Liverpool. It is proposed that the use pre-university students within radiographic academic research should be disseminated in Synergy at the earliest opportunity in order to highlight this initiative to other interested parties. Early findings from this study will be disseminated by an oral presentation abstract for UKRC 2009 and when fully completed a formal journal article will be written for either Clinical Radiography, British Journal of Radiology or Radiography and will highlight the support of the SCoR if successful. As part of this venture we would also be keen to see if any international presentations would be possible either at the ASRT, RSNA or the

International Society of Radiographers and Radiological Technologists annual meetings.

### Timetable

This project has ethical approval and will run for a period of four weeks during July and August 2008. Both students studying on this project are required to complete a written report for their base institutions. Consequently completion of the project is expected by the end of September 2008 with submission to a peer reviewed journal in October 2008. During July/August the plan would be to complete a short article for Synergy on this initiative which would pre-empt the main results of this project and highlight the funding contribution of the SCoR.

### Background

Abdominal aortic aneurysms (AAA) are frequently asymptomatic and often detected incidentally on abdominal imaging for another purpose. Although some aneurysms may become symptomatic (manifesting with abdominal or back pain), in many cases the first clinical manifestation is rupture. The risk of rupture is low for aneurysms with a diameter of 5.5 cm or less, but above this threshold the risk of rupture increases markedly[1].

Surgical or endovascular repair is effective in preventing aneurysm rupture; however, open surgery for small aneurysms may carry a risk exceeding that of rupture. Therefore, once diagnosed, the current practice is to follow these aneurysms at 6- to 12-month intervals with imaging until the diameter exceeds 5.0 cm in women and 5.5 cm in men. Currently decisions regarding the treatment of AAAs are based on the evaluation of absolute maximal diameter size or growth rate. Cayne and colleagues[2] found from a study of 25 CT scans that repeated measurements of the same AAA on the same CT scan by the same and different observers can yield quite different values with clinically significant implications.

Such is the reliance on aortic diameter measurement from CT imagery that we wish to consider the effect of observer experience on diameter measurements. With the widespread utilisation of CT for vascular imaging and the increasing role of non-radiologists in the evaluation of aortic CT images it appears appropriate to investigate the effects of training and experience on measurement variability.

[1] Greenhalgh RM, Powell JT. Endovascular repair of abdominal aortic aneurysm. *N Engl J Med.* 2008 Jan 31;358(5):494-501.

[2] Cayne NS, Veith FJ, Lipsitz EC, Ohki T, Mehta M, Gargiulo N, et al. Variability of maximal aortic aneurysm diameter measurements on CT scan: significance and methods to minimize. *J Vasc Surg.* 2004 Apr;39(4):811-5.