Workflow for image-guided interventions: Characterisation and Validation. Towards the Integrated Imaging Operating Room of the future.

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Introduction

Computer simulation has been applied successfully to study certain aspects of workflow for radiological environments, focusing mainly in improving scheduling and waiting lists. We aim to analyse, model and simulate endovascular and cardiovascular (EVC) procedures in X-Ray driven scenarios, acquiring an exhaustive understanding of the interventions pursuing the optimal development of procedures under Magnetic Resonance (MR) guidance in a multi-modal Imaging Operating Suite (IOS). Here, we present the characterisation and validation of workflow.

Methods

To meet the requirements for modelling and simulation of alternatives to optimise ECV workflows, Delmia Quest, discrete event simulation software, was chosen over 13 different tools. Data collected to date includes records from Iliac Angioplasty and Stenting (IAS), and Percutaneous Coronary Angioplasty and Stenting (PCAS) (Ninewells Hospital, Dundee, UK), and Transcatheter Aortic Valve Implantation (Rikshospitalet, Oslo, Norway). These records contain general patient data, previous related diagnosis, role and experience of clinicians involved during interventions, event logs for the different phases, etc.

Results

A statistical descriptive analysis and a study of mathematical relationships between the timings were done over the records. Preliminary findings highlight the variability of the data in certain phases of the procedures, e.g. times (min) of treatment in IAS (11.8 ± 9.25) or guidance of devices to area under treatment in PCAS (13.39 ± 9.9). In addition, the study of possible relations between phases reveals that the timings collected are independent between each other. Characterised workflows were simulated in Quest on the scenarios under study for validation of models.

Conclusion

Workflow analysis, modelling and simulation of ECV interventions could help establish a set of standard timings, reducing variability and problems with the used instrumentation as found in the current data. The independence found between some of the timings of the individual steps provides a measure of use in other scenarios for the development of new procedures.