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Use of IV contrast media in pre-treatment radiotherapy planning CT scans: A UK study (Abstract only)

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Citation:

Conclusion: This trial found significant improvement in students' attitudes towards both interprofessional teams and learning as a result of receiving the IPE intervention. It also found significant improvements in intervention group students' self-reported effectiveness as team members and self-perceived confidence, knowledge, and ability to manage long-term conditions. This study indicates that a brief, modular, multifaceted IPE intervention using purpose-developed resources can have immediate positive effects and contribute to the development of health professionals who are ready to collaborate with others to improve patient outcomes.

Darlow, B., Coleman, K., McKinlay, et al. (2015). The positive impact of interprofessional education: a controlled trial to evaluate a programme for health professional students. BMC Medical Education, 15, 98.

OC-0373
IGRTonline: development and evaluation of a free online course on Image Guided Radiation Therapy

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Purpose or Objective: Despite the rapid increase in use and availability of highly conformal treatment techniques and image guided treatment delivery, there is a lack of availability of focussed training in Image Guided Radiation Therapy (IGRT) for users in most countries. Online education has the potential to reach a wide audience across geographical regions, and offer flexibility of access. The aim was to develop a free, online, self-paced, interactive course on IGRT catering to the non-expert end-users of IGRT, primarily radiation oncologists and radiation therapists (RTT).

Material and Methods: An online platform for IGRT courses was developed (www.igrtonline.com) on a learning management platform called Moodle. The first course, called 'IGRT: Principles and Practice', was an introductory level online course was developed by radiation oncologists and medical physicists in our center, a tertiary care cancer hospital in India. The teaching material was created in the form of Flash and HTML5 interactive content, compliant with SCORM 1.2 standards. Interactive elements like triggered animation, inline quizzes were used. Nineteen modules were prepared in 3 sections covering the (a) principles of uncertainty, margins and correction protocols, (b) image guidance technology; and (c) clinical application in different anatomical sites. Self-assessment quizzes were prepared for every module with a question bank of > 200 questions, including optional preliminary and final assessment quizzes. Capabilities for downloading course modules to mobile devices was added. At the end of 6 months, course enrolment and participation was audited. A short online feedback survey was conducted.

Results: Course development took 16 months. The course was launched in April 2015. Between 15 April to 10 October 2015, 717 participants (from 44 countries across 5 continents) registered into the learning platform. The 5 most common countries of origin were India 409, USA 75, Brazil 37, UK 19 and Canada 10. The distribution of registrants according to job description consisted of radiation oncologists (49.4%), radiographer/therapists (31.4%) and medical physicists (19.2%). Of the registered students 553 enrolled themselves into the course in question. The number of students who completed > 5 modules was 337 (60.9%). Of the 48 students who completed both the preliminary and final quizzes, the score improved from a mean of 68.25% to 82.75% (p=0.002). A total of 103 responded to the online feedback survey. Results are shown in Table 1.

Table 1. Survey of users of IGRTOnline (total respondents = 103)

	Rad Onc	RTT	Dosimetrist	Physicist	
Job description	53 (51.4%)	15 (14.6%)	3 (2.9%)	32 (31.1%)	
	New	0-2 years	3-5 years	> 5 years	
IGRT Experience	45 (43.7%)	18 (17.5%)	19 (18.4%)	21 (20.4%)	
	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Were important topics covered?	53 (51.5%)	48 (46.6%)	2 (1.9%)	0	0
Were you able to understand the content?	62 (60.2%)	41 (39.8%)	0	0	0
Was the course a valuable addition to your knowledge and understanding of IGRT?	64 (62.1%)	39 (37.9%)	0	0	0
	Excellent	Good	Average	Poor	Very Poor
Rate Course Design	65 (63.1%)	38 (36.9%)	0	0	0
Rate Overall quality of content	60 (58.3%)	40 (38.8%)	3 (2.9%)	0	0
	Yes	Maybe	No		
Interested in more online courses on this platform?	102 (99.0%)	1 (1%)	0		

Conclusion: Online education platforms have the capacity to reach a wide audience across geographical boundaries. Quiz results suggest that the online course was successful in improving the student's knowledge and understanding of IGRT. User perception of the course was good and the majority of participants were keen on more online education opportunities.

OC-0374
Use of IV contrast media in pre-treatment radiotherapy planning CT scans: A UK study

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Purpose or Objective: The primary aim analysed adherence to current UK Royal College of Radiologists (RCR) 2004 and 2015 guidelines. The secondary aim identified if current guidelines are adequate for optimum enhancement and image quality or should be redefined to reflect new evidence based practice.

Material and Methods: Questionnaires were sent to 80 UK cancer centres; 34 questions covered a wide range of topics including RCR compliance, contrast timings, cannulation protocols and administration in conjunction with advanced techniques to ensure comprehensive analysis could be performed.

Results: Eighty three percent of centres responded; 22% were excluded from analysis due to incomplete responses or duplication where one questionnaire applied to multiple satellite centres resulting in 52 responses.
Ninety eight percent of centres administer IV contrast to at least one tumour site. However, only 6% of centres administer to all 8 of the RCR 2004 recommended tumour sites (pharynx, neck nodes, lung, oesophagus, stomach, pancreas, cholangiocarcinoma, liver) with 40% of centres administering to 5 sites or less. Sixty two percent of centres routinely administer IV contrast to at least three tumour sites not supported by RCR 2004; most commonly para-nasal sinus (73%) prostate (62%) and brain (60%).
RCR 2015 compliance was also poor with the most common response to which eGFR formula used was stated as unknown, although 88% of centres do check eGFR for every patient. Fifteen percent of centres did not have an extravasation policy although centres with policies had a wide range of procedures with no standardised requirements.
Only 35% of centres use IV contrast in conjunction with 4DCT, of the centres that don't use IV contrast with 4DCT most

patients are dual scanned i.e. IV contrast 3D scan followed by non contrast 4DCT.

Sixty five percent of centres agreed or strongly agreed updated guidelines would be useful.

Conclusion: The results suggest adherence to RCR guidelines is poor. Very little current evidence exists relating to optimal IV contrast protocols both in the UK and internationally. No standardised guidelines exist in relation to 4DCT IV contrast protocols and timings which in some centres is resulting in patients being dual scanned. There are many areas such as flow rates, timings and administration in conjunction with advanced techniques which require further research to enable updated standardised guidelines to be identified. The need for updated guidelines is supported by 65% of respondents of this study.

Poster Viewing: 8: Physics: Inter-fraction motion management II

PV-0375
**Comparison of carina- versus bony anatomy-based registration for IGRT in esophageal cancer.**

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Purpose or Objective: In image-guided radiotherapy (IGRT) for esophageal cancer, it is common to use bony anatomy-based registration (BR) for setup verification. A recent study, in which we investigated fiducial marker-based registration relative to BR, indicated marker-based registration to be infeasible due to tissue deformation. In the present study, we investigated the feasibility and geometric accuracy of carina-based registration (CR) for CBCT-guided setup verification in esophageal cancer IGRT.

Material and Methods: Retrospectively, 24 esophageal cancer patients with 65 implanted fiducial markers, visible on planning CTs and follow-up CBCTs, were included in this study. Fiducial markers were considered as standard for tumor position. All available CBCT scans (n=236) were independently rigidly registered to the reference CT with respect to either the bony anatomy or to the carina using XVI software (Elekta Ltd. Crawley) to determine the individual marker displacement relative to the bony anatomy and to the carina, respectively. Automatic registrations were visually checked and manually adjusted when necessary. Subsequently, we assessed and compared per individual marker the mean marker displacement over the treatment course (systematic position error, SE) associated with either BR or CR. Markers were classified into four subgroups based on their locations in the esophagus (proximal, mid-esophagus, distal, cardia) and analysis was similarly as mentioned above performed per subgroup. Comparison between both registration methods was done using a paired Wilcoxon signed-rank test.

Results: The distributions of the absolute mean systematic position error of the individual markers relative to the bony anatomy and the carina are given in Figure 1.A. Overall, a large SE is associated with the use of both bony anatomy and carina, especially in the CC direction. Figure 1.B, illustrates the slightly favorable use of the BR for proximal located markers. Markers located in the mid-esophagus show a smaller SE in CC and AP direction when using the CR, however this difference was not significant. For markers located in the distal esophagus and cardia, the BR is favorable in AP direction (p<0.001). Furthermore, the majority of the CRs were more challenging given the low contrast resolution in comparison with the BRs.
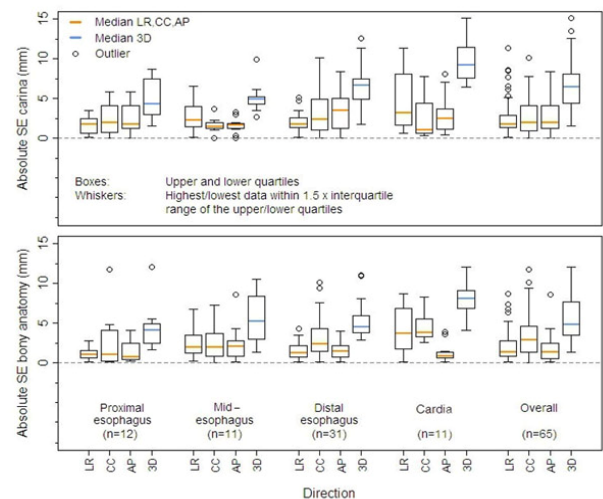
Figure 1.A Distributions of the absolute mean systematic position errors (SE) of the individual markers relative to the carina (upper) and the bony anatomy (lower). The distribution of absolute mean SE is given for each marker subgroup separately as well as for all markers together (Overall). Results are given in the left-right (LR), cranio-caudal (CC), and anterior-posterior (AP) direction as well as in the 3D vector distance (3D).
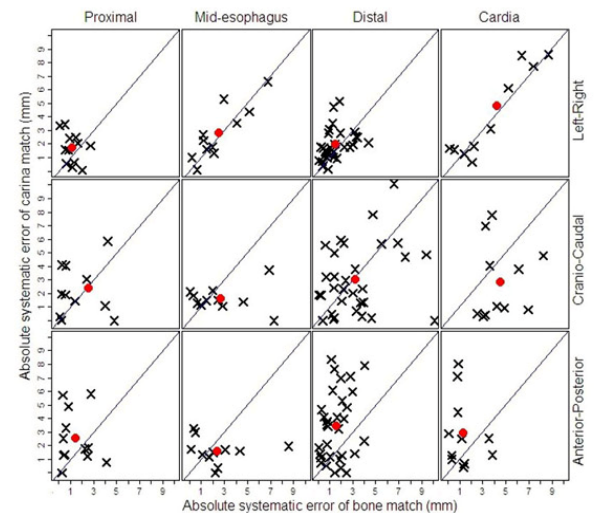
Figure 1.B. Scatterplots of the absolute systematic position errors (SE) of the individual markers relative to the bony anatomy versus the carina. Results are given in 3 directions for all 4 subgroups. Above blue line = preference for bony anatomy-based registration. Underneath blue line = preference for carina-based registration. The red dot indicates the mean absolute systematic error.

Conclusion: The mean marker displacement (SE), residual tumor position error, over the treatment course remains large and is in most directions even slightly larger when using CR compared with BR. Only for tumors located in the mid-esophagus the CR can be slightly favorable. However, esophageal tumors typically extend across regions and the majority of tumors are located distally. Therefore, our data endorse the use of BR over CR for setup verification.

PV-0376
Contrast-enhanced respiration managed cone-beam CT for image-guided intrahepatic radiotherapy

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