Evaluate and report the dissemination of state-of-the-art external beam radiotherapy (EBRT) treatments for 2017 in Spain.

Material and Methods

A collaboration between the HERO-ESTRO task group with the Spanish Association of Radiotherapy and Oncology (SEOR) and the Spanish Society for Medical Physics (SEFM) began in January 2018 and aims at applying the HERO cost calculation tool (hero.estro.org) to the Spanish situation. The objective of this tool is to estimate both the resource utilization and cost of the national EBRT treatments currently delivered in Spain to inform decision-makers on planning resources and reimbursement systems.

The HERO cost calculation tool requires three types of inputs: the number of treatments delivered annually in the country, the time in minutes required to perform each procedure of the treatment, as well as the cost of both personnel and equipment resources.

Given the limited available information on the first type of input at the national scale, a survey was conducted per tumour site amongst the 13 committees dedicated tumour sites of SEOR. The data were collected from May to September 2018. For the two other inputs requirements, national liaison persons contributed with the mean salaries and working times for each professional category involved in radiotherapy, and the time of procedures will be investigated based on previous publications by SEFM and SEOR.

Results

We have obtained in five months a detailed dataset that describe fractionations schemes of 90% of radical treatments and complexity of treatments referred to 2017 which will ultimately allow a calculation of the cost model in the HERO. We observe in Table 1, an impact of the renewal of the radiotherapy equipment which took place in Spain since 2016. Last Spanish Guidelines (SEOR 2013) suggest less aggressive treatments which is as well observe in the practice as the new equipment technology enable VMAT treatments delivery with higher doses to head and neck cancers and with SBRT to the lung tumours. Moreover, the daily use of IGRT for complex treatment has increase as well (Table 2).

This clinical data collection was a prerequisite to the application of the HERO cost model, the final results are expected in early 2019.

Table 1. Fractionation schedules per localisations: Breast, Prostate, Lung, Rectum, Head & Neck.

	Fractionation schedules (% treatment courses)			Doses (Gy)	Techniques
	Standard	Hypofractionated	Extreme Hypofractionated		
Breast	28 (2%)			50.4 Gy-54 Gy	85% 3DcRT, 10% IMRT, 5% IMRT Rotational.
	25 (38%)			50 Gy	85% 3DcRT, 10% IMRT, 5% IMRT Rotational.
		15 (56%)		40 Gy	85% 3DcRT, 10% IMRT, 5% IMRT Rotational.
			5 (4%)	30 Gy	100% IMRT Rotational.
Prostate	33 (30%)			78-80 Gy/72 Gy/fx	100% IMRT.
	28 (60%)			70 Gy/2.5 Gy	100% IMRT.
			5 (10%)	7-7.25 Gy/5fx	100% SBRT.
Lung	35 (10%)			70 Gy	5% 3DcRT, 15% IMRT, 80% IMRT Rotational.
	33 (50%)			66 Gy	5% 3DcRT, 15% IMRT, 80% IMRT Rotational.
	30 (17%)			60 Gy	5% 3DcRT, 15% IMRT, 80% IMRT Rotational.
	25 (10%)			50 Gy	5% 3DcRT, 20% IMRT, 75% IMRT Rotational.
	24 (3%)			48 Gy	5% 3DcRT, 20% IMRT, 75% IMRT Rotational.
		10 (5%)		40 Gy	100% 3DcRT.
			8 (5%)	50 Gy -60 Gy	100% SBRT.
			5 (15%)	50 Gy -60 Gy	100% SBRT.
			3 (5%)	45 Gy -54 Gy	100% SBRT.
Rectum	33 (10%)			59.4 Gy	25% IMRT, 75% IMRT Rotational.
	28 (45%)			50.4 Gy	75% 3DcRT, 5% IMRT, 20% IMRT Rotational.
	25 (35%)			45 Gy -54 Gy	100% IMRT Rotational.
		20 (10%)		50 Gy	80% 3DcRT, 10% IMRT, 10% IMRT Rotational.
Head and Neck	35 (25.1%)			70 Gy x 2 Gy, 80,5 Gy x 1,15 Gy x2fx/day	100% IMRT Rotational.
	33 (34.8%)			66 Gy x 2 Gy, 69,96 Gy x 2,12 Gy	100% IMRT Rotational.
	32 (0.2%)			70.4 Gy x 2,2 Gy	100% IMRT Rotational.
	30 (29.6%)			60 Gy x 2 Gy, 63 Gy x 2,1 Gy	100% IMRT Rotational.
	29 (1.2%)			65,25 Gy x 2,25 Gy	100% IMRT Rotational.
	28 (1.6%)			63 Gy x 2,25 Gy	100% IMRT Rotational.
	30 ()				100% IMRT Rotational.
		23 (0.2%)		51,75 x 2,25 Gy	100% IMRT Rotational.
		20 (2.1%)		60 Gy x 3 Gy	100% IMRT Rotational.
		18 (0.2%)		54 Gy x 3 Gy	100% IMRT Rotational.
			5 (1.2%)	40 Gy (5 fx x 8 Gy)	100% IMRT Rotational.

Table 2. Frequency of utilization of radiotherapy treatment techniques per localisations: Breast, Prostate, Lung, Rectum, Head & Neck.

	Complexities			
	IGRT daily	IGRT weekly	Motion management	Customized immobilization device
Breast	5%	95%	5%	-
Prostate	100%	-	-	-
Lung	64%	36%	22%	100%
Rectum	42%	58%	-	60%
Head and Neck	85%	15%	-	100%

Conclusion

Collection of the clinical data was performed in a quite short time period demonstrate an example of the practical application of the HERO tool in a country, Spain.

Moreover, this intermediate step in the costing exercise, yet shed light on the pattern of care of EBRT in Spain and reveals changes in dose fractionation, aligned with latest Spanish guidelines.

These changes might also be explained by the new technology installed within the last two years, which allows for better dose distribution, with hypofractionation in many cases, and reduce the dose delivered to normal tissues.

The Spanish societies ultimately expect to evaluate national health system of radiotherapy services, to reveal its weakness and strengths and eventually c
ontribute to a bigger European picture.

Proffered Papers: PH 12: Proffered paper: Multi centre analysis of quality

**OC-0603 A 2018 IPEM audit of M
RI in external beam radiotherapy treatment planning in the UK**

R. Speight[1], M. Schmidt[2], G. Liney[3], R. Johnstone[4], C. Eccles[5], M. Dubec[6], B. George[7], A. Henry[1], H. McCallum[8]

[1]*Leeds Teaching Hospitals NHS Trust, Leeds Cancer Centre, Leeds, United Kingdom;* [2]*Royal Marsden NHS Foundation Trust & Institute of Cancer Research, Cancer Research UK Cancer Imaging Centre, London, United Kingdom ;* [3]*Ingham Institute, Liverpool Cancer Therapy Centre, Sydney, Australia;* [4]*University College London, Dept. of Computer Science, London, United Kingdom ;* [5]*The Christie NHS Foundation Trust, Radiotherapy, Manchester, United Kingdom;* [6]*The Christie NHS Foundation Trust, Medical Physics and Engineering, Manchester, United Kingdom ;* [7]*University of Oxford, Department of Oncology, Oxford, United Kingdom;* [8]*Newcastle upon Tyne Hospital NHS Foundation Trust, Northern Centre for Cancer Care, Newcastle, United Kingdom*

Purpose or Objective

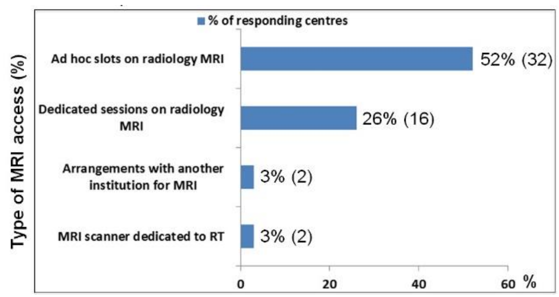
Interest in MRI for external beam radiotherapy (EBRT) planning is growing, as is the need for consensus guidelines for its use in the UK. In response to this, IPEM will report guidelines on MRI use for EBRT planning. As a first step, an audit has been performed to assess the current UK landscape of MRI in EBRT and the results are presented here.

Material and Methods

IPEM has supported a multidisciplinary working group, who developed a survey to assess the current landscape and needs of institutions regarding MRI in EBRT. The survey was split into six sections covering: institution details and MRI access; MRI use at the institution; MRI to CT registration; commissioning, QA and safety of MRI scanners; workflow, staffing and training; and, future applications of MRI. The survey was sent to 71 UK departments (63 NHS and 8 private groups) in June 2018 and closed after 8 weeks.

Results

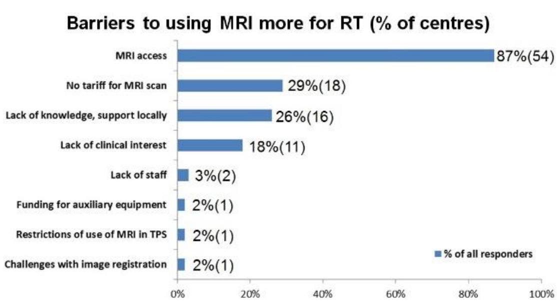
Responses were obtained from 62/71 centres (87%) with good engagement from both NHS centres (89%) and private groups (75%). Of the responders, 94% use MRI for radiotherapy treatment planning taken from PACs, potentially acquired at another institution or not optimised for radiotherapy purposes. 69% of responders have some access to an MRI scanner for EBRT, ie in some format where they have control over the MRI acquisition, see figure. It was reported that there are only two dedicated MRI-simulators in the UK.



All centres using MRI in EBRT use rigid MRI to CT registration and two centres are currently using deformable image registration in addition. Commissioning and QA of image registration and MRI for EBRT showed large inter-centre heterogeneity caused by a lack of guidance.

Physics support for setting up a new MRI for EBRT service is varied across the UK with links with radiology being very important and 23% of centres reporting no support from physics staff with specialist MRI knowledge.

The largest reported barrier to utilising MRI further is a lack of MRI access (87% of centres) but a large proportion of all concerns are financially driven with a lack of tariff meaning centres do not get reimbursed for an MRI scan, see figure.



Looking forward, within the next five years, 37% of centres intend to use functional MRI, 38% of centres are planning for an MRI-simulator, 16% of centres are planning to utilise MRI-only radiotherapy and 10% are planning for an MRI-linac (on top of the 3% that currently have access).

Conclusion

The current use of MRI for EBRT in the UK was audited. More than 2 in 3 of centres have some form of MRI access, but there are only 2 MRI-simulators at present. Collaboration with radiology departments is vital for both MRI access and staff support. The main barriers to fully integrate MRI are financially driven and a lack of tariff resulting in limited access. Knowledge gaps have been identified such as the lack of standardised QA guidance that will be addressed in the IPEM guidelines.

OC-0604 The first UK survey of dose indices from radiotherapy treatment planning CT scans for adult patients

M. Williams[1], T. Wood[2], A. Davis[3], J. Earley[4], R. Plaistow[5], R. Lindsay[6], A. Palmer[3], A. Nesbit[4], S. Edyvean[7], U. Findlay[8]

[1]Velindre University NHS Trust, Medical Physics, Cardiff, United Kingdom ; [2]Hull and East Yorkshire Hospitals NHS Trust, Radiation Physics, Hull, United Kingdom ; [3]Portsmouth Hospitals NHS Trust, Medical Physics, Portsmouth, United Kingdom ; [4]Royal Surrey County Hospital NHS Foundation Trust, Medical Physics, Guildford, United Kingdom; [5]Cambridge University Hospitals NHS Foundation Trust, Medical Physics, Cambridge, United Kingdom ; [6]St James Institute of Oncology, Medical Physics, Leeds, United Kingdom ; [7]Public Health England, Radiation Dosimetry, Chilton, United Kingdom ; [8]Public Health England, Medical Exposure, Chilton, United Kingdom

Purpose or Objective

CT scans are an integral component of modern radiotherapy treatments, enabling the accurate localisation of the treatment target and organs-at-risk, and providing the tissue density information required for the calculation of dose in the treatment planning system. For these reasons, it is important to ensure exposures are optimised to give the required clinical image quality with doses that are as low as reasonably achievable. However, there is little guidance in the literature on dose levels in radiotherapy CT imaging either within the UK or internationally. The first UK wide dose survey for radiotherapy CT planning scans has been completed. The survey was initiated by a working party of the Institute of Physics and Engineering in Medicine (IPEM).

Material and Methods

Patient dose metrics were collected for prostate, gynaecological, breast, 3D-lung, 4D-lung, brain and head & neck scans. Median values per scanner and examination type were calculated and national dose reference levels and 'achievable levels' of CT dose index ($CTDI_{vol}$), dose-length-product (DLP) and scan length are proposed based on the third quartile and median values of these distributions, respectively.

Results

A total of 68 radiotherapy CT scanners were included in this audit. The proposed national dose reference levels and achievable levels are shown in the table below. Significant variations in dose indices were noted, with head & neck and lung 4D yielding a factor of eighteen difference between the lowest and highest dose scanners. There was also evidence of some clustering in the data by scanner manufacturer, which may be indicative of a lack of local optimisation of individual systems to the clinical task.

		Proposed reference level			Achievable level		
Examination	PD (cm)	$CTDI_{vol}$ (mGy)	DLP (mGy · cm)	Scan length (mm)	$CTDI_{vol}$ (mGy)	DLP (mGy · cm)	Scan length (mm)
Breast	32	10	390	360	8	280	330
Gynaecological	32	16	610	400	12	510	380
Lung 3D	32	14	550	390	10	410	370
Lung 4D	32	63	1750	340	36	1170	330
Prostate	32	16	570	340	13	420	310
Brain	16	50	1500	290	42	1110	250
Head and neck	16	49	2150	420	26	1080	400

Conclusion

The first UK wide audit of dose indices for adult patients undergoing CT scans for radiotherapy planning has been completed, and the results published (Tim J Wood et al 2018 Phys. Med. Biol. 63 185008). Reference values and achievable levels for $CTDI_{vol}$, DLP and scan length have been proposed for seven common types of CT scan. It is anticipated that providing this data to the UK and wider radiotherapy community will aid the optimisation of treatment planning CT scan protocols.

OC-0605 Is DIBH more robust than FB in VMAT left breast irradiation? Multicenter and multivendor analysis

S. Russo[1], M. Esposito[1], V. Hernandez[2], J. Saez[3], G. Nicolini[4], E. Vanetti[4], F. Rossi[5], L. Paoletti[6], P. Bastiani[5], G. Reggiori[7], S. Tomatis[7], M. Scorsetti[8], P. Mancosu[7]

[1]Azienda USL Toscana Centro, SC Fisica Sanitaria - Firenze, Florence, Italy ; [2]Hospital Universitari Sant Joan de Reus-Reus, Department of Medical Physics-, Tarragona, Spain; [3]Hospital Clinic de Barcelona, Department of Radiation Oncology, Barcelona, Spain ; [4]Radiqa Developments, Medical Physics Team, Bellinzona, Switzerland; [5]Azienda USL Toscana Centro, SC Radioterapia- Firenze, Florence, Italy ; [6]Azienda USL Toscana Centro, SC Radioterapia - Firenze, Florence, Italy ; [7]Humanitas Research Hospital, Medical Physics