Received:
12 June 2014

Revised:
19 September 2014

Accepted:
23 September 2014

doi: 10.1259/bjr.20140422

Cite this article as:

Brammer CV, Pettit L, Allerton R, Churn M, Joseph M, Koh P, et al. Impact of the introduction of weekly radiotherapy quality assurance meetings at one UK cancer centre. *Br J Radiol* 2014;87:20140422.

FULL PAPER

Impact of the introduction of weekly radiotherapy quality assurance meetings at one UK cancer centre

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Objective: The complexity of radiotherapy planning is increasing rapidly. Delivery and planning is subject to detailed quality assurance (QA) checks. The weakest link is often the oncologists' delineation of the clinical target volume (CTV). Weekly departmental meetings for radiotherapy QA (RTQA) were introduced into the Royal Wolverhampton Hospital, Wolverhampton, UK, in October 2011. This article describes the impact of this on patient care.

Methods: CTVs for megavoltage photon radiotherapy courses for all radical, adjuvant and palliative treatments longer than five fractions (with the exception of two field tangential breast treatments not enrolled into clinical trials) were reviewed in the RTQA meeting. Audits were carried out in January 2012 (baseline) and September 2013, each over a 4-week period. Adherence to departmental contouring protocols was assessed and the number of major and minor alterations following peer review were determined.

Results: There was no statistically significant difference for major alterations between the two study groups; 8 alterations in 80 patients (10%) for the baseline audit vs 3 alterations from 72 patients (4.2%) in the second audit ($p = 0.17$). A trend towards a reduction in alterations following peer review was observed. There has, however, been a change in practice resulting in a reduction in variation in CTV definition within our centre and greater adherence to protocols. There is increasing confidence in the quality and constancy of care delivered.

Conclusion: Introduction of a weekly QA meeting for target volume definition has facilitated consensus and adoption of departmental clinical guidelines within the unit.

Advances in knowledge: The weakest areas in radiotherapy are patient selection and definition of the CTV. Engagement in high-quality RTQA is paramount. This article describes the impact of this in one UK cancer centre.

The complexity of radiotherapy planning has increased rapidly over the past decade in the UK with the introduction of three-dimensional conformal therapies and more recently intensity-modulated radiotherapy (IMRT) and image-guided radiotherapy.^{1,2} Delivery and planning of radiotherapy is subject to detailed quality assurance (QA) checks. The two widest variables in this process are delineation of the clinical target volume (CTV) by the oncologist and patient selection.³⁻⁶ There is an expanding body of literature from clinical trials confirming that deviation from radiation outlining protocols is associated with an increase in the risk of treatment failure and mortality.⁷⁻⁹ In the Trans-Tasman Radiation Oncology Group 02.02 study for advanced head and neck cancer, 12% of treatments were considered at QA review to have a protocol violation, which represented a major deficiency, predicting reduced local control. Considering only those patients who received >60 Gy, the overall

survival and locoregional control for patients with major deficiencies in the treatment plan were 50% and 54%, respectively, compared with 70% and 78% for those whose treatment plan was protocol compliant ($p < 0.001$).⁸ Efforts to improve quality and consistency of radiotherapy within co-operative groups is essential for interpretation of data; however, translating results of studies into clinical practice requires adoption of the same approach within local multidisciplinary teams (MDTs).

Radiotherapy QA (RTQA) clinical meetings to review CTV delineation are common place in Europe, the USA and Australasia but are not routine in the UK.¹⁰⁻¹³ At the Royal Wolverhampton Hospital, Wolverhampton, UK, a weekly RTQA was commenced in October 2011. The RTQA is a considerable investment in resources by the trust. Outcomes of the meeting were audited to assess impact on the quality of patient care.

METHODS AND MATERIALS

From October 2011, the CTVs for megavoltage photon radiotherapy courses at the Royal Wolverhampton Hospital, for all radical, adjuvant and palliative treatments longer than five fractions, with the exception of two-field tangential breast treatments not enrolled into clinical trials, were reviewed in a weekly RTQA meeting. Adherence to departmental contouring guidelines or trial protocols where appropriate was reviewed in the meeting. Departmental policy is that gross tumour volume (GTV), CTV and planning target volume (PTV) are demarcated for all radical treatments, CTV and PTV for all adjuvant treatments and GTV, CTV and PTV for all palliative treatments where this was deemed appropriate. Where there is more than one CTV with different prescribed doses, it is a requirement to label the CTV and PTV with the prescribed dose, for example, CTV 65 and CTV 54.

Initially, CTV outlines were reviewed in the week in which treatment was commenced. However, following the first audit, timescales were amended and contouring was reviewed in the meeting held on the week before the working week of the first fraction to ensure cases had been peer reviewed prior to the first fraction with sufficient time for any amendment, if required, to prevent delay to the start of treatment.

The RTQA weekly meetings were attended by all consultant clinical oncologists, specialist registrars, representatives from the therapy radiographer body and medical physicists. The meetings were scheduled to run over 1 h. Therapy radiographers and medical physicists were encouraged to raise queries surrounding the planned treatments in these meetings.

In each audit, the number of major and minor alterations was determined. Major alterations were defined as any alterations that required a change in the delivery of radiotherapy. Classification of major alterations did not necessarily indicate error, but improvement following peer discussion. Minor alterations were defined as those that did not require a physical alteration of the treatment plan, that is, alterations in documentation or labelling.

RESULTS

Audit 1 (baseline)

80 patients were reviewed over 4 weeks during January 2012. There were eight major alterations where there were changes in the treatment plan following peer review at the meeting; four required alteration in CTV delineation, two required a change in dose fractionation and two treatments were cancelled. There were five minor alterations; three had volumes that were not labelled according to policy, that is, not labelled with intended dose or had just been labelled “target” without further definition. In two further cases, there had been no identification of CTV merely a geometrical GTV expansion to PTV that was not compatible with departmental policy on definition.

Audit 2

72 patients were reviewed over 4 weeks in September 2013. There were three major alterations requiring change in treatment plan following peer review, all requiring alteration in CTV delineation; there were no alterations where a change in dose

was required and no treatments cancelled. In one further case, it was identified that an incorrect CTV to PTV expansion had been made. Three cases required minor modification owing to the PTV being labelled as target with no further definition.

The meeting had evolved over the 18 months since the January 2012 audit with clinicians now bringing cases to the meeting for formal discussion with their clinical oncology colleagues prior to radiotherapy planning. Although this was outside the initial scope of the RTQA meeting, this was found to be both clinically useful and practical, as all clinical oncologists were present. In the audit period, eight complex cases (defined as cases where the treating oncologist had any doubt over the indication or technique) were brought to the meeting. The outcome of the discussions resulted in confirmation that two patients did not warrant treatment, the treatment intent was confirmed as being palliative in another, extent of CTV was clarified in two further cases and, in one case, clarification of aberrant anatomy (duplex ureters) was sought. Discussions around appropriate dose were requested for two patients with individual requirements owing to comorbidity. Discussions in another seven cases were prompted by queries raised by the medical physicists regarding optimum technique or beam arrangement for patients prior to planning.

Other topics discussed during the audit period prompted an update of the IMRT protocol for radical prostatic radiotherapy with prophylactic regional lymph node irradiation and evaluation of MRI-guided planning within the department.

Statistics

There was an absolute reduction in major alterations between the 2 study groups; 8 alterations in 80 patients (10%) *vs* 3 alterations from 72 patients (4.2%) in the second audit, although this did not reach statistical significance (χ^2 test $p = 0.17$).

DISCUSSION

It is recognized that there have been significant changes in radiotherapy delivery and service over recent years. The increasing workload and complexity of the service require greater team co-operation and an end to the “radiotherapy silo”. At Royal Wolverhampton Hospital in October 2011, following a departmental expansion of additional two clinical oncologists to our team of six clinical oncologists and three medical oncologists, job plans were restructured to ensure all oncologists could be present in the cancer centre and free of clinical commitments one morning per week for departmental meetings. Job plan changes to reduce travel during the working day helped by altering peripheral clinics to run on the day of the relevant MDT meeting and use of videoconferencing helped reduce “dead-time”. The appointment of two additional colleagues allowed for further site specialization, which reduced the number of site-specific MDTs for individual consultants to attend, also freeing up time.

This created the capacity to hold a weekly RTQA meeting. This provided a forum to allow all members of the radiotherapy team to meet and discuss treatment plans. Attendance is mandatory with attendance levels reviewed at individual job planning

meetings annually. A target of 70% attendance of all meetings is expected, protected time with monitored attendance is considered a pre-requisite for successful QA peer review meetings.¹⁴

Oncologists have found the meeting useful—demonstrated by the fact that plans may be altered following discussion within the MDT. The rate of modification required following peer review in our audit is similar to other studies in the literature, which have reported rates to be between 3.8% and 7.7%.^{14–16} While there was no statistically significant difference between the results of our two audits, this may be the result of small sample size. There has, however, been a change in practice resulting in a reduction in variation in CTV definition within our centre and greater adherence to protocols. This is consistent with other evaluations of quality improvement programmes in radiation oncology.¹⁷ There is increasing confidence in the quality and consistency of care delivered from our service across the professions.

While there was no discernible difference in minor labelling errors in the two audits, this may be in part owing to the time taken to adapt to different departmental policies by locums and specialist registrars rotating within the region. Labelling of target volumes in our department is standardized, so there can be no confusion in the planning process as to what dose is required where. Standardization is considered important to prevent error. Ballo et al¹⁸ in their review of prospective peer review from the MD Anderson Cancer Centre, Houston, TX, showed that a reduction in changes to treatment plan was seen over a period of time, falling from 16.5% in 2007 to 7.8% in 2010, reducing steadily each year. In this study, the number of changes varied by disease site, with head and neck, gynaecological and gastrointestinal radiotherapy accounting for the majority of changes made. Head and neck cancer treatment plans were the most significant, reducing from 44% of treatments being recommended for change in 2007 to 26.1% in 2010. This is likely to be explained by the technical complexity of radiotherapy at this disease site, that is, IMRT requiring a large degree of normal tissue and nodal volume outlining.¹⁸ Contouring is considered by the American Society for Therapeutic Radiation Oncology to be one of the most important medical decisions, which benefits from peer review, especially for treatments delivered with curative intent. While outlining of normal tissue structures can be atlas guided, delineation of the CTV is often subject to interpretation.¹⁹

Although the meeting was initially designed to be for RTQA (*i.e.* ensuring adherence to departmental contouring guidelines and trial protocols where appropriate), the meeting evolved over time to include clinical discussion of individual challenging cases prior to contouring or planning. Although not strictly a QA function, this may prevent wasting valuable physics time in planning inappropriate treatment and could prevent an unnecessary radiation exposure if discussion has taken place prior to the simulation visit. Treatment decisions are usually made in the pre-treatment site-specific MDT meetings; however, referral to the oncologist for most tumour sites is not made until after these meetings, and not all cases referred are found to be appropriate for radiotherapy treatment when seen by the oncologist. A second opinion from the radiotherapy team can be reassuring for both the clinician and patient in this situation.

At present, the meeting is scheduled to run over 1 h. With the evolution of the meeting, ever increasing complexity of radiotherapy planning and increase in patient numbers, it is particularly challenging to cover the requirements within the time constraints. Given the importance of RTQA, it would be desirable to increase the time dedicated to this over the coming years. Alternatively, a more “sub-site” dependent meeting may develop; although this approach is more challenging within a medium-sized department.

The RTQA meeting has also been beneficial in helping to build a team structure where protocols can be agreed and therefore provide site-specialized cover from consultant colleagues to prevent unnecessary delay to treatment start dates. The weekly meeting to discuss treatment plans has had a service development as well as a service delivery component allowing for all to contribute to shaping the future of our department.

The meeting is still evolving and while clinical target volume definition is reviewed, currently, there is a need for the introduction of peer review of dose distribution in some cases, particularly so for IMRT plans. Dose–volume parameters, while based around guidelines, are often subject to qualitative decisions, particularly when comorbidity needs to be taken into account, in more advanced cases, and when a compromise may need to be made. Whether this would be best carried out in the full team meeting or in smaller site-specific fora is still to be decided. In an audit by Brundage et al,¹⁵ a large group format resulted in <1% of plans being identified as having deviated from departmental policy, while 13% were found to do so following introduction of a more structured smaller site-specific group meeting. As a medium-sized department, sub-site specialization results in a limited number of clinicians able to give an opinion on complex plans, which can limit the value of review during periods of annual leave. Introduction of a mechanism for re-review within the sub-site team following periods of leave may be a way forward to counteract this problem. Smaller group peer review for head and neck and gynaecological cancer IMRT could be recommended from the MD Anderson experience.¹⁸

Within the meeting, educational opportunities can also be exploited by involving specialist registrars and other junior members of the teams directly in the running of the meeting.

Transparency and a supportive culture are essential to the success of such meetings. Discussion and challenge should not be perceived as negative, but as an opportunity to learn and develop. Internal peer review of this kind requires a team approach to be successful, where all feedback is constructive and all multidisciplinary team members are respected and regarded as equals.

While there are limitations with full peer review in a medium-sized department, the RTQA meeting has been a significant development in patient care within our unit.

CONCLUSION

High-quality radiotherapy treatment demands appropriate clinical target volume definition, choice of dose prescription and treatment

technique. QA peer review facilitates this. The essential requirements for a successful meeting include protected time in the clinicians' job plans, a space suitable for the required number of attendees with image display capabilities and access to full patient records, including diagnostic radiology, plus the infrastructure

and support staff to produce the discussion list and minute discussions and changes to the treatment plan.¹⁴ Most importantly, an open, transparent, no blame culture with all participants engaging positively with the process is the key to high-quality departmental peer review.

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