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Original Article

A National Audit of Radiotherapy in Head and Neck Cancer

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ABSTRACT:
Aims: To undertake a national audit of radiotherapy practice in head and neck cancer to estimate compliance with published guidelines and national standards.
Methods: A two-part electronic data entry form was distributed to all U.K. radiotherapy centres in September 2000. The first part examined the centres' policies for managing interruptions, the second collected summaries of the management of 50 consecutive patients treated in each centre for head and neck cancer. The outcome measures were: frequency and causes of interruptions to therapy; policy and compliance with policy for managing interruptions; prolongation; and time between first visit to clinic and start of treatment.
Results: Fifty-five out of 56 centres returned data on a total of 2553 patients. Overall, 1467 (55%) patients had one or more treatment interruptions. Of patients whose treatment was interrupted, 56% still completed on time due to compensatory steps, but in 32% no attempted compensation was undertaken. Seven centres had no policy for dealing with treatment interruptions. Centres whose policies included treatment on bank (public) holidays achieved higher compliance and fewer prolonged cases than those whose policies did not. Average time from first visit to head and neck oncology clinic to starting radiotherapy was 40 days; six centres had an average wait of less than 28 days.
Conclusions: This audit demonstrates wide variations in the quality of care between centres, failure to comply with guidelines for compensation for gaps and failure to meet national targets (for waiting times) that have serious implications both for patient outcomes and for the success of the National Cancer Plan. James, N. D. *et al.* (2003). *Clinical Oncology* **15,** 41–46

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Introduction

Repopulation of surviving normal and tumour cell clonogens occurs during the multiple weeks of conventional radiotherapy fractionation. This may result in reduced tumour control as a result of accelerated tumour clonogen repopulation when treatment schedules are prolonged [1] or when gaps inadvertently or deliberately occur in a course of radiotherapy. Many reports have been published suggesting that interruptions that prolong overall treatment times beyond the prescribed length adversely affect the local control rates for non-cutaneous squamous cell carcinomas of the head and neck [1–10]. The reduction in local control rate has been estimated to be approximately 0.7–1.4% for a gap of 1 day rising to 14–20% for a 7-day gap [3,4]. The majority of these reports relate to patients receiving treatment of 60–66 Gy over 6–6.5 weeks. We therefore set out to audit national practice in head and neck radiotherapy to examine the delays experienced by patients, both in starting treatment and during therapy (for which there are targets in the National Cancer Plan [13]), and the causes and management of unscheduled interruptions (for which there are guidelines published by The Royal College of Radiologists [12]).

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Methods

The 56 radiotherapy centres in the U.K. were contacted and asked to provide details on 50 consecutive patients who had completed definitive radiotherapy before the start date of inception of the audit. This number of patients spanned different time intervals in different

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centres depending on their overall workload but was felt necessary to allow a representative overview of practice in each centre.

A two-part electronic data entry form was created using Visual Basic. The first part collected the centre's policies for managing planned and unplanned interruptions to therapy: the choices for each were: 'transfer to another machine/treat twice on another day/use a biological compensation/treat on a Saturday or Sunday/treat on a bank (i.e. public) holiday'. The second collected data on 50 consecutive patients treated in that centre: reference number, date of birth and sex; primary site; stage; date of first visit to head and neck oncology clinic; date of start and completion of radiotherapy; prescribed dose and fractionation; whether interrupted and type of interruption (defined as 'service/breakdown/staff/toxicity/died or progressed/non-compliance'); and action taken to ensure an interrupted treatment was completed on schedule (defined as the choice list from part 1 plus 'No measures taken'). Choice lists were used for: centre (i.e. NHS Trust); primary site (coded by ICD-10); and tumour, node and metastasis (TNM) stages. Date fields were constrained so that, for example, start dates had to come before end dates. A treatment was regarded as interrupted if it included a day when the treatment could not be given as planned (on the day and machine expected); the causes of any interruption during the course of treatment were inferred from the patient's notes.

Users downloaded the tool from the web or received it as an e-mail attachment. Completed datasets were returned by e-mail or on disk to the National Cancer Service Analysis Team, who combined them into a single file using an Access database; this was converted into a clinical audit database by the RCR's Clinical Audit Office using 4D, another, more powerful, relational database. The initial analysis was presented at the 2001 British Cancer Research Meeting, and circulated to centres later in the year. The results were coded and each centre was only advised of its own code. After feedback from centres corrections were incorporated to produce the clean dataset reported here.

Data were described by simple descriptive statistics with, where relevant, 95% confidence intervals. Overall treatment times and delay times were calculated from start and finish dates by simple calendar subtraction. Traditionally dose/fractionation schedules have been devised to allow for weekend breaks. Scheduled 2-day weekend breaks alone are therefore not regarded as interruptions in the context of this study.

Results

Audit leads were contacted on 10 September 2000 and by the initial target date of 10 November 2000, 34 (61%) centres had returned data. After reminders, the initial datasets were all returned by 31 January 2001 (total duration: 143 days inception to completion). A preliminary analysis was circulated to participating centres in the autumn of 2001. Corrections were incorporated and results from the final dataset are presented here. Data on a total of 2553 patients (93% of target) were returned by 55 of 56 eligible radiotherapy centres contacted (98% of target). A small number of cases (18/2553) had received doses of more than 3.5 Gy per fraction, presumably with palliative intent; a further 24/2553 received doses of less than 1.5 Gy per fraction. The final dataset gives a comprehensive picture of radio-therapeutic patterns of care for head and neck cancer across the U.K.

Table 1 – Causes of interruption to radiotherapy: the top six categories ($n=1506$)

Cause	Percentage of interrupted cases
Machine service only	37
Unspecified	36
Patient toxicity	8
Machine breakdown	8
Machine service and breakdown	5
Patient non-compliance	5

Interruptions to Treatment

The primary aim of the audit was to examine interruptions in therapy once commenced, to document individual centres' policies for dealing with any interruptions, both planned (e.g. service days) or unplanned (e.g. machine breakdown) and to audit their compliance with their stated policy. A total of 7/55 Trusts had no policy for dealing with interruptions and a range of policies were documented. Overall, 1506 (55%) patients had one or more treatment interruptions. The main causes are shown in Table 1; the commonest was machine service [546/1506 (37%)]. Centres varied widely in the proportion of interrupted cases with no reason specified [median 26%; range 0% (12/55) to 90% (3/55)]; there was no central tendency in the histogram of this score by centre (not shown), implying that there is a real difference between centres in their standard of record keeping.

Figure 1 shows centres ranked by the percentage of all cases completing treatment within 1 day of target; the centres have been assigned arbitrary three-character codes. Of cases that were coded as 'interrupted' 62% still completed within 1 day of target (not shown). However, only 87% of the 'not interrupted' cases finished within 1 day of target, suggesting that some or all of those finishing late should have been coded as interrupted. The overall mean score was 73%.

The interruption policies used, compliance with those policies, and their success as measured by the proportion of cases receiving no remedy are shown in Table 2. The 45% of centres that had incorporated bank holiday (BH) working into their policies were able to comply with their policy more often (74 vs 49% of cases) and apply a

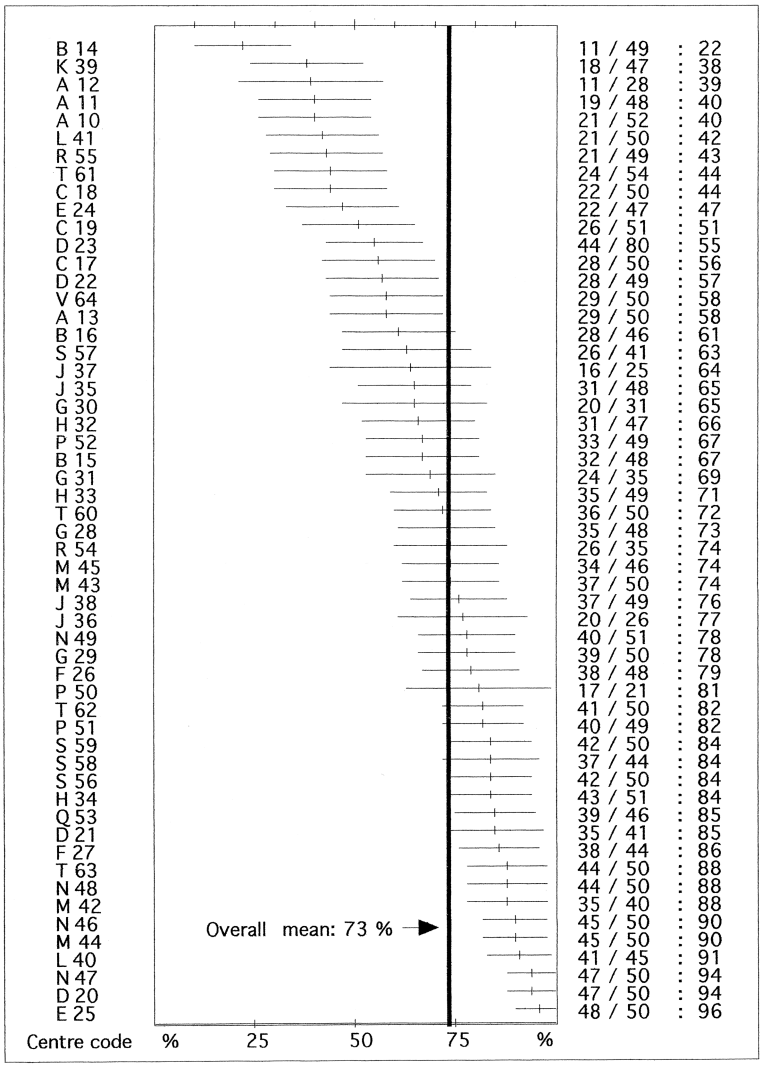

Fig. 1 – Estimates and 95% confidence intervals for the proportion of cases completing radiotherapy within 1 day of the planned finish date. Vertical dotted line represents the national average of 73%.

remedy more often (86 vs 69% of cases). Analysis by the day of the week that treatments started on showed no correlation with interruption rate; 43% of cases started on a Monday and only 3% on a Friday. Table 2 also shows the proportion of cases prolonged by more than 2 days for each policy group. The policies that include BH working (i.e. B, C, E, G and I) had fewer such cases (10.0%; 95% CI 8.0–12.0) than those that excluded BH working (i.e. A, D, F and J: 17.3%; 95% CI 14.7–19.9) and those that had no or incomplete policies (i.e. Z and H: 37.9%; 95% CI 31.6–44.2).

Treatment length also affects the interruption rate: an analysis of the larynx cases (ICD-10 code C32) showed that the rate for short treatments (15–22 fractions; $n=591$) was 50.9% (95% CI 43.7–58.1); for long treatments (=30 fractions; $n=401$) it was 61.1% (95% CI 56.3–65.9).

Time to Start of Treatment

The distribution of times to start of treatment is shown in Fig. 2 ($n=2391$; omitted are 25 cases with waits between 22 and 158 weeks and 137 cases with no recorded date seen): only 41% of cases started within 4 weeks of first being seen in the oncology head and neck clinic. Mean time to starting treatment was 5.2 weeks; it took up to 9 weeks to start 90% of the patients. When delay times were analysed according to treatment start date, an upward trend was observed with more recent treatment start dates, with mean delay of 5.1 weeks for patients commencing treatment in 1999 and 6.0 weeks for those commencing in 2000. These results may be partly affected by smaller centres taking longer to collect data on 50 patients and thus being over-represented in the 1999 data. There was however no correlation between centre size and delay time. When

Table 2 – Compliance with stated interruption policy and proportion of cases prolonged by policy group

Policy group (no. of centres adopting it)	Policies for unplanned+ planned interruptions	Cases interrupted *n*	Cases interrupted and managed as per policy *n*	%	Cases interrupted and receiving no remedy *n*	%	Proportion of all cases prolonged by more than 2 days %
Policies that exclude Bank Holiday (BH) working							
A (14)	Other/twice for both	373	220	59	86	23	16.2
D (4)	Other for both	86	11	13	42	49	28.0
F (2)	Twice for both	56	26	47	21	38	12.5
J (2)	Mixed policies excluding BHs	75	32	43	33	44	11.0
Subtotals for policies A/D/F/J (22)		590	289	49	182	31	17.3
Policies that include BH working							
B (7)	Other+other/BH	214	139	65	54	25	19.0
C (4)	Other/twice/BH for both	131	103	79	14	11	8.5
E (4)	Twice/BH for both	78	59	76	7	9	7.8
G (1)	Other/BH for both	17	16	94	0	0	4.0
I (9)	Mixed policies including BHs	265	222	84	26	10	1.4
Subtotals for policies B/C/E/G/I (25)		705	524	74	101	14	10.0
Subtotals for all centres with complete policies (47)		1295	813	63	283	22	13.7
Incomplete policies							
Z/H (8)	None for both/none+other	236	n/a	n/a	184	78	37.9
Totals for all 55 centres		1531			467	31	18.0

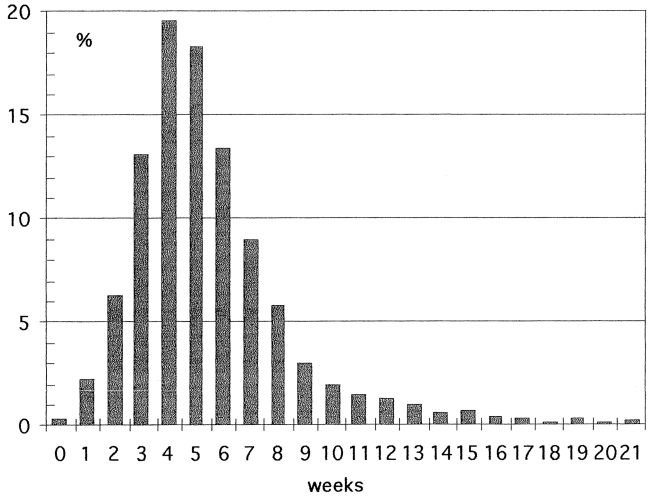

Fig. 2 – Distribution (%) of time interval (weeks) between the date the patient was first seen in a head and neck oncology clinic and the date of starting radiotherapy for time intervals up to 21 weeks (n= 2391).

data were analysed by centre, wide variation was seen: seven centres started to treat more than two-thirds of their patients inside 4 weeks; 10 centres started less than 10% (Fig. 3).

Discussion

Clinical audit is a key component of modern medical practice, of central importance for both clinical governance and quality assurance. National comparative data are hard to obtain in a timely fashion and suffer from variations in methodology, time lags in collection, inconsistency of coding and logistic constraints on data entry and analysis. We used a novel electronic tool for data entry, which, we believe, may be of great value for further national comparative audits because of its ease of use, consistency and the speed with which it can create a large representative sample of cases for analysis. Future audits using the same methodology are planned. The system also allows the audit and standard analyses to be repeated on a comparable basis.

This audit shows widespread variation in centres' performance in respect of management of interruptions to treatment. Guidelines were first published by the RCR in 1996. Despite this seven centres stated that they had no policy for managing interruptions. Overall 55% of cases experienced at least one interruption, although 62% of these cases still completed within 1 day of target. Again there was a wide range of performance between centres (Fig. 1) with the best four scoring better than 90% and the worst three less than 40%. As the estimated reduction in local control rate has been estimated to be 0.7–1.4% for a 1-day gap and 14–20% for a 7-day gap [3,4], this failure to compensate for interruptions in treatment may be leading directly to a worse outcome for affected patients. As most gaps in treatment were caused by predictable factors (Table 1), it ought to be possible to schedule compensation for these interruptions (e.g. a twice daily treatment) within the current resource base. These results have informed the College's recent revision of its guidelines [12]; it plans to repeat the audit in the near future.

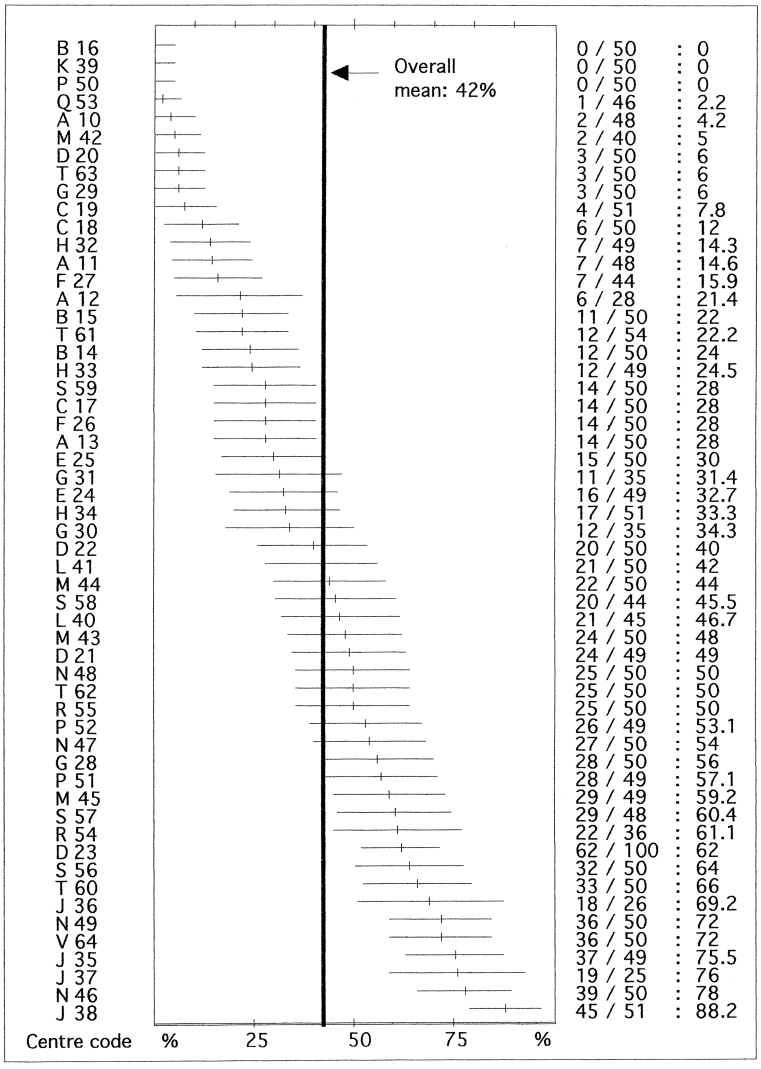

Fig. 3 – Estimates and 95% confidence intervals for the proportion of cases starting radiotherapy within 4 weeks of the date the patient was first seen in a head and neck oncology clinic. Vertical dotted line represents the national average of 42%.

In respect of waiting times, the Government has set a 4-week target (for the average interval from the decision to treat to the start of radical therapy) in the Manual of Cancer Standards [11] (Standard 5/18). The audit collected data on the date first seen in the oncology head and neck clinic; this may not coincide with the date of decision to treat and may thus over-estimate the Cancer Plan delay time in some cases. Nonetheless, the distribution of waiting times will be of great relevance to patients. A target for the future in the NHS Cancer Plan [13] is a maximum of 4 weeks from diagnosis to treatment (by 2005). As presumably the diagnosis has been made prior to attendance at the oncology clinic, this audit suggests that this target will be difficult to achieve without substantial improvement in radiotherapy waiting times as overall only 42% of cases were treated within 4 weeks of attendance. This overall figure hides large inter-centre variation (Fig. 3): three centres started no patients within 4 weeks. In addition, the decision to treat may have been preceded by a period of time in which the patient may have had a diagnosis of cancer but was undergoing staging investigations prior to the final treatment decision. Thus the total waiting time as perceived by the patient may have been considerably longer than the intervals reported here.

Another future target in the NHS Cancer Plan (by 2005) is a 2-month maximum from urgent referral to first definitive treatment. The fact that substantial numbers (10%) of patients were waiting more than 9 weeks from first visit to oncology clinic to radiotherapy suggests that this target also will be hard to achieve without a substantial change in the current picture. During the audit period, there was a trend to increased time between clinic and treatment. This may be because different centres collected data over different time periods although no correlation with centre size was detectable.

Possible reasons for this increase are rising referrals, the recent move to assessment by multidisciplinary clinic and the ongoing shortage of radiographers and other key health professionals such as medical physicists. It is clear that continuing investment is necessary in both radiotherapy machines and staff if the time to treatment targets in the NHS Cancer Plan are to be achieved. A further audit is planned to define more precisely the causes of the interval between clinic and treatment and to find out whether this apparent upward trend is continuing.

In conclusion, the audit shows widespread variation in the management of interruptions to therapy with potential adverse consequences for treatment outcome. Time to commencement of treatment also varied widely, suggesting that much further progress and investment is necessary to meet future targets for waiting times set out in the National Cancer Plan.

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