RADIOACTIVE NEEDLE IMPLANT FOR HEAD AND NECK TUMOURS; IS IT A DYING ART?

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ABSTRACT

This paper aims to audit the treatment of head and neck tumours with radioactive needle implant techniques in our centre. A retrospective analysis of 50 patients who underwent this procedure from 1986 to 1994 was performed. Cancers of the oral tongue and buccal mucosa were the most common conditions treated, comprising 62% an 26% respectively. Prior external beam radiotherapy was employed in 70%. Implant doses ranged from 20 Gray to 75 Gray. The most frequent toxicity reported was mucositis (10%). While 33% remained free of recurrence, local recurrence was seen in 46%. Crude survival ranged from 1 to 126 months. Results for disease free survival and crude survival were better in the patients with node negative disease. Radioactive needle implants continue to play a significant role in early oral cavity tumours and should be considered in appropriate clinical situations.

INTRODUCTION

The role of primary radiotherapy in head and neck cancer has often been superceded by radical surgery up front although the results of both these modalities in early tumours are comparable. This is partly due to the fact that radioactive implants are less often used nowadays. This paper discusses the merits and problems encountered in this procedure.

As in other radiotherapy centres which practise radioactive needle implants, head and neck cancers form the major bulk of the patients undergoing this procedure. However, the patients must be carefully selected so as to optimize the results. This paper demonstrates that the patients who appear to benefit most in terms of crude survival and disease free interval are those in whom the regional nodes were not clinically involved at presentation.

MATERIALS AND METHODS

A retrospective study was conducted on patients who had undergone radioactive needle implants for head and neck cancer at the Institute of Radiotherapy and Oncology, Kuala Lumpur Hospital. The study population were patients with head and neck cancer who underwent this procedure at this Institute between 1986 and 1994. The radioactive source for the implants needles in our institute was changed from Radium-226 to Caesium-137 in January 1993. The source arrangement and calculation of the prescribed dose adopted the system devised by Paterson and Packer.[1-3] The sample included all patients who met the following inclusion criteria: any primary malignant tumour of the head and neck which had been implanted with radioactive needles, tumours that had been histologically verified. The exclusion criteria applied in this study were: patients whose tumours were not histologically verified and

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patients whose records could not be traced.

The records were retrieved manually, using the list of patients undergoing procedures in the Operating Theatre of the Institute. Records of 50 patients were traced. Data were collected using a check-list questionnaire. Case notes, referral letters, histolopathology reports, laboratory tests, operation findings, radiotherapy records, worksheets for the calculation and prescription of brachytherapy and relevant investigations were reviewed. Information on patient demographic data, tumour characteristics, external beam therapy, brachytherapy, complications of treatment, crude survival, disease free interval and recurrence pattern were retrieved from these notes. Staging was based on the T.N.M. system. The dose prescription for the external beam therapy was based on the International Commission on Radiation Units and Measurements, *Dose specification for reporting external beam therapy with photons and electrons*, I.C.R.U. Report 29[4] and the dose prescription for brachytherapy was based on the system of Paterson and Parker which had been compiled into the Manchester system.[1-3] Crude survival time was calculated from the date of implant to the date of last follow-up or date of death. Relapse-free interval was calculated from the date of implant to the date of first relapse after the implant. Patients who were lost to follow-up had the vital status verified by sending their National Registration Identification Card Numbers to the Director, Identity Card Section, Malaysian National Registration Department to determine the date of notification of death. The status of 3 patients are still unknown as their identity card numbers were not traceable from our records or they were from areas other than Peninsular Malaysia.

RESULTS:

The records of 50 patients were analysed. The male:female ratio was 2 : 3 . The median age was 55 years with a range from 26 to 89 years (Table 1). Indians comprised 46%, Chinese 28%, Malays 22% and other races 4%.

Patients with tumours involving the anterior two thirds of the tongue comprised 62%, while buccal mucosa made up 26%. Other head and neck sites included the lip (2 patients), alveolus (1 patient), frenulum of tongue (1 patient), submandibular region (1 patient) and maxillary region (1 patient). Ninety per cent of the tumours in this series was histologically confirmed to be squamous cell carcinomas. The other histologies included adenocarcinoma (1 patient), non-Hodgkin's lymphoma (2 patients), soft tissue sarcoma (1 patient) and unrecorded in one patient. The grade of these tumours were well differentiated in 36%, moderately well differentiated in 36%, poorly or undifferentiated in 4% and unrecorded in 24%. Only a biopsy was carried out in most of the patients (92%) before the implant procedure. Tumour stage was 28%, 40%, 16%, 14% and 2% for T1, T2, T3 and Tx respectively. Metastases in the cervical lymph nodes was absent in 84%, present in 12% and unrecorded in the rest. None of the patients were known to have distant metastases at the time of the implant. Radioactive needle implants were used for locally recurrent tumours in 2 patients. The WHO/ECOG performance status was 0 in 20%, 1 in 56%, 2 in 16%, and unrecorded in 8%.

Prior to the radioactive needle implant, 70% of the patients received external beam radiation with doses ranging from 27 Gy to 65 Gy. Among the more frequently used dose-fractionation regimens were 50 Gy in 25 fractions (5 patients), 60 Gy in 30 fractions (3 patients), 50 Gy in 20 fractions (2 patients), and 55 Gy in 25 fractions (2 patients). The external beam radiotherapy was delivered by a two-field technique in 23 patients and a single-field technique in 12 patients.

Radioactive needle implants were executed in a single plane in 50%, double plane in 48%, and as a volume implant in one patient with tongue cancer. The prescribed doses for brachytherapy ranged from 20 Gy to 75 Gy. The main morbidities

encountered were mucositis (10%), ulceration (7%) and pain (8%). The other problems encountered were needle dislodgement (8%) and retained needle in one patient when the needles were removed after the end of a tongue implant; an invasive procedure under general anaesthesia was subsequently used to remove it.

The disease free interval ranged from 0 months to 120 months, with a median of 29 months. Thirty four per cent of the patients were free from recurrence, all of whom had clinically negative nodes at presentation. Recurrences involving the local site alone comprised 26% while loco-regional recurrences was found in 20%. The recurrence status of the rest of the patients could not be ascertained. Of the 6 patients who had clinically involved cervical nodes at presentation, at least 4 patients have developed a local or loco-regional recurrence.

The survival status of the patients were as follows: Alive (58%), Dead (36%) and Unknown (6%). The crude survival ranged from 1 month to 126 months, with a median of 22 months. One third of the patients with known regional node positive disease were still alive. In the two patients who underwent radioactive needle implants for locally recurrent tumours, their respective survival was 7 months and 2 months respectively.

The characteristics of the sub-group of 13 patients who survived for at least 60 months after their implants deserve to be highlighted. The age range in this sub-group of 12 patients was 36 years to 76 years. The patients had T1-2 N0M0 squamous cell cancinomas of either the mobile tongue or buccal mucosa. Prior to radiotherapy, all these patients underwent only a biopsy. The external beam radiotherapy dose used in 5 of these patients ranged from 40 Gy to 55 Gy. The brachytherapy dose ranged from 30 Gy to 75 Gy. In patients in whom no external beam was given, the brachytherapy doses ranged from 60 Gy to 75 Gy. A single plane implant was used in nearly 70% of the patients while a double plane technique was used in the remaining patients.

DISCUSSION

Interstitital brachytherapy is often indicated in the management of primary or recurrent head and neck tumours. Radioactive needle implant is an old technique but has been well tried and tested. The principal aims of radiotherapy treatment planning are to achieve a homogenous dose distribution in the target volume, i.e. within and around the tumour, whilst sparing the surrounding normal tissues. Radioactive needle implants can deliver the prescribed radiation dose to the target volume with less radiation to the adjacent normal tissues mainly because of the 'Inverse Square Law' of radiation attenuation. The lower dose-rate of radiation received by the normal tissues during an implant treatment also allows for further sparing of late effects of radiation on such tissues. One of the main advantages of implant treatment over radical surgery in patients who are cured of cancer is the preservation of function of the affected organ, e.g. tongue. The usefulness in the palliative setting has also been suggested by the 7 month survival of one the patients with locally recurrent disease for whom the implant was performed. If some measure of local tumour control could be achieved in these patients in the remainder of their lives resulting in relief of their local symptoms, their quality of life could be improved.

In centres which practise intra-oral needle implants routinely, the single-plane implant is the commonest form of implant used.[5] Radioactive needles have been used, either alone or in combination with external beam, to treat lesions of the tongue and the floor of the mouth.[6] In centres where radioactive needle implants are performed, calculations have been based on the Paterson-Parker system.[1-3] On the other hand, the Paris system[7] is used in centres which practise implants using iridium-192. The disadvantages in using iridium-192 sources include higher operational costs due to the shorter half-life of 74 days and

the potential problems associated with the necessity of regular supplies of this isotope.

Generally, it is not desirable to deliver the whole radiotherapy treatment solely as an implant as the treatment time would be uncomfortably long for the patient. Moreover, the distant areas such as the regional lymph nodes would not be adequately treated by the implant. This has been demonstrated in this study whereby the recurrence rate in patients who had clinically involved cervical nodes at presentation was considerably higher than those patients whose nodes were negative. The course of external beam radiotherapy given before an implant serves to treat both the tumour site as well as the presumed spread in the regional lymphatics.

The results of disease local control in this study suggest that the implants and the subsequent calculations for the prescribed dose had been carried out with acceptable quality. It has been demonstrated by other authors that local recurrence in cancers of the mobile tongue and floor of mouth were significantly related to dose; an increase in local failure was seen when the implant dose was below 62.5 Gy.[8] Typical local control rates of radiotherapy for carcinoma of the tongue and buccal mucosa are in the region of 57% and 75% respectively.[9] Hence the overall local recurrence rate in our centre which was 46% appeared to be within acceptable limits.

The morbidity experienced by patients in this study demonstrated that this procedure was generally well tolerated despite its apparent invasiveness. The only serious complication encountered clinically was a retained needle when the implant was being removed from the tongue. In contrast to another study where necrosis (defined as soft tissue ulceration occurring or persisting longer than 3 months after implantation or osteonecrosis) was seen in 28% at 5 years for mobile tongue and 58% for floor of mouth,[8] late effects appeared to be insignificant in our study. This could be due to the relatively lower implant doses used, differences in techniques employed, incomplete follow-up as well as death occuring before the late effects became evident.

The figures for crude survival, disease free interval and morbidity have to be interpreted with caution as a proportion of the data were censored (excluded due to insufficient follow-up time before the end-point was reached). The main difficulty in defining disease free intervals lies in the fact that time to recurrence is not easy to measure as an end-point. Other limitations were the inability to measure the quality of life in the patients as well as under-reporting of the side effects which can be expected from the retrospective nature of the study.

CONCLUSION

Despite the limitations, this paper has demonstrated the usefulness and practicality of radioactive needle implants for head and neck cancers in the Malaysian setting. The importance of local tumour control in patients was demonstrated in both the curative as well as palliative settings. This treatment is cost-effective and can be recommended for patients with tumours that may otherwise entail extensive and mutilating surgery. In centres which have these radioactive needles, this treatment would be indicated in appropriately selected patients.

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