SINGLE DOSE HALF BODY IRRADIATION FOR PAIN RELIEF IN METASTATIC CARCINOMA

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SYNOPSIS

An analysis is made of the first 50 patients treated by a single dose half body irradiation at the Department of Therapeutic Radiology, Singapore General Hospital. This technique achieved a 78% subjective pain relief in the patients who had widespread bony metastases. Side effects were minimal and the technique could be used on an outpatient basis obviating the need for frequent visits or hospitalisation. As a palliative measure, it is a useful tool and pain relief can be obtained lasting several weeks and often until death. Its use is now being examined in other centres as an adjuvant in combination with chemotherapy for the treatment of small cell carcinoma of the lung, Ewing's sarcoma and neuroblastoma.

INTRODUCTION

Pain control in disseminated metastatic cancers often present special problems in its management. The presence of widespread disease requires systemic therapy. Narcotic analgesics with their attendant side effects have to be used in large doses. We would like to reduce these doses yet allowing the patient to be free of pain and be able to perform his daily work.

Radiotherapy has been used effectively in localised pain control. It has often been used in fractionated doses to cover the painful sites. The result is successful control of these sites but other areas take their place in attracting the patient's attention. As a result larger and larger fields have evolved and the half body field is now used to cover them (1).

Such a large field is possible because the untreated half provides marrow stem cells which would reseed into the treated half. This also allows a larger dose with better tumour kill than is possible if the entire body is treated in a single dose.

Treating one half in one fraction rather than with a fractionated scheme reduces the problems of frequent visits. We had initially warded our patients to observe for side effects after treatment. After the first five patients, we have used this technique on an outpatient basis. The most important side effects encountered were nausea and vomiting which began as early as half an hour after treatment and may last for six to eight hours. These can easily be prevented by adequate anti-emetics.

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MATERIALS AND METHODS

Patients were selected for half body irradiation when they had widespread painful bony metastases confirmed either by plain radiography or isotopic bone scan. These patients usually had pain not controlled by analgesics, hormonal manipulation or chemotherapy. This paper presents our experience with the first fifty patients treated by this technique since 1981.

They were then treated on a Saturday morning so that they did not disrupt the scheduled five day treatment schemes of the radical cases. The haematological parameters include the haemoglobin level, the total white cells and the platelet levels. Generally we treated patients with a haemoglobin level of $\geq$10g%, a total white cell of $\geq 4.0 \times 10^9$/L and a platelet level of $\geq 100 \times 10^9$/L.

The premedication included intramuscular stemetil, 12.5 mg given half an hour before treatment. We had initially included intramuscular valium 10 mg. However, we eventually omitted the valium as we began treating them as outpatients.

We used an AECL Theratron 780 Cobalt 60 unit equipped with a 5300 Ci source in 1981. The dose rate at 80 cm SSD was 150 cGy per minute. Treatment field varied from 35 to 45 cm square. Treatment times varied from 5 minutes to 8 minutes with a setting up time of about 10 to 15 minutes. The dose chosen varied with the general condition of the patient, the blood parameters, the histology and sometimes the ability of the patient to lie still for the period of treatment.

The landmark used was the umbilious which divided the upper and lower half bodies. The umbilious (2) was a convenient landmark and was easier to locate than the iliac crest. It did not vary tremendously in the three to eight week — periods between the two half body treatments. The lower half body generally extended only to the knees as metastases to the legs were seldom encountered. The upper half body treatment extended to the angle of jaw and the cranium was not included so as to avoid epilation. In the patients with nasopharyngeal carcinoma, the upper half body treatment extended only to the suprasternal notch as they would have received treatment to the neck.

Table I shows the distribution, by disease, of cases treated. The majority of the patients treated were for widespread nasopharyngeal carcinoma. The next largest group was for breast carcinoma. There were no patients with lymphoma or leukemia. There were, however, two patients with multiple myeloma. Lymphoreticular diseases are generally expected to respond well although there is indication that different lymphomas respond differently. (3)

RESULTS

Table II shows the subjective pain relief obtained from treating either the upper or lower half bodies. The 78% subjective response rate was similar to that of other series with a different disease distribution (2,4,5). Response to pain relief lasted from several weeks to months, often until death. 12% of the cases treated had no further follow up records of the success or failure of the treatment. Of these six patients, two returned to their country of origin, two had no further follow up records but two remained in contact through their relatives. We had no first hand indication from these patients that treatment was successful.

TABLE I
NUMBER OF PATIENTS BY DISEASE

Nasopharynx	21	42%
Breast	13	26%
Bronchus	6	12%
Prostate	4	8%
Multiple Myeloma	2	4%
Others*	4	8%
Total	50	100%

*Includes Cervix (1)
Colon (1)
Unknown Primary (2)

TABLE II
RESPONSE TO TREATMENT WITH HBI

	Number	Response Rate
Pain Relief	39	78%
No Pain Relief	5	10%
No Further Follow Up	6	12%

Table III shows the response to treatment by disease distribution. In a Radiation Therapy Oncology Group Study, bronchogenic carcinoma responded less well than that of breast or prostatic carcinoma (6).

Table IV shows the distribution, by dose, of the upper and lower half body treatments. 57% of the patients treated for the upper half received 500 or 600 cGy while 97% of the patients treated for the lower half received 600 or more cGy. The lower doses were used for the upper half body in order to avoid radiation pneumonitis. The doses are uncorrected for tissue inhomogeneity. Fryer et al (7) showed an incidence of 18% radiation pneumonitis with a dose of 600 cGy uncorrected. In a study employing corrected doses (8), it showed an incidence of only 3% with a dose of 800 cGy. However, in this study, patients with previous thoracic irradiation or chest disease were excluded. Most of our patients would have received some irradiation to the lungs or mediastinum. Secondly, some would have lung parenchyma metastases, pleural metastases or pleural effusion. Although none of the patients treated complained of chest symptoms attributable to acute radiation pneumonitis, we would certainly have been unable to exclude this cause in the majority of such patients with lung or mediastinal disease.

Twenty percent of the patients received both half body irradiation as is shown in Table V. The majority of them were patients with nasopharyngeal carcinoma. This is not surprising as it is the natural history of the disease to find control of the primary but widespread bony metastases. Secondly, unlike diseases such as breast or prostatic carcinoma, there is no room for other forms of treatment. Hormonal manipulation and chemotherapy are not generally effective in bony metastases in nasopharyngeal carcinoma.

Either half body may be treated first, depending upon which being more symptomatic. After an interval of at least three weeks, the second half is treated if the blood parameters are within the accepted limits.

TABLE III
RESPONSE TO TREATMENT BY DISEASE

Diagnosis	Relief of Pain	Response Rate	No Relief	No Further Follow Up
Nasopharynx	16	76.2%	2	3
Breast	10	76.9%	2	1
Bronchus	5	83.3%	1	0
Prostate	4	100%	0	0
Multiple Myeloma	2	100%	0	0
Others	2	50%	0	2
Total	39		5	6

TABLE IV
DISTRIBUTION OF TREATMENT WITH HBI

Upper Half Body		Lower Half Body	
Dose (cGy)	No. of Patients	Dose (cGy)	No. of Patients
450	2 (14.3%)	450	0 (0%)
500	5 (35.7%)	500	2 (4.3%)
600	3 (21.4%)	600	16 (34.8%)
700	2 (14.3%)	700	17 (37.0%)
800	2 (14.3%)	800	11 (23.9%)
TOTAL	14 (100%)	TOTAL	46 (100%)

TABLE V
PATIENTS WITH BOTH HALVES TREATED

Diagnosis	No.
Nasopharynx	8
Bronchus	1
Multiple Myeloma	1
TOTAL	10

Table VI shows the distribution of the relief of pain, by dose. There is a dose response association and, as expected, the higher the dose the better the pain control. It would seemed appropriate to use a dose of 700 cGy or more to control pain. The results are not statistically significant ($p > 0.2$) and even a dose of 500 cGy achieved a 71.4% pain relief. The two patients who received 450 cGy had multiple myeloma and similar results were obtained for multiple myeloma in other studies (4).

The ability to use this technique on an outpatient basis greatly facilitates its wider use. 44% of the patients treated were outpatients. Except for the first five patients who were admitted for observation of side effects, the remaining inpatients were admitted for other problems such as pleural effusion, paraplegia or pain control.

Previous irradiation or chemotherapy did not preclude these patients from half body irradiation. 96% of the patients had previous radiotherapy of some sort. 62% had treatment previously which was within the half body fields. 36% of the patients treated had chemotherapy and 34% had both radiotherapy and chemotherapy. These patients can still benefit from half body irradiation so long as we weigh the possibilities of side effects against benefits. Another 12% went on to receive further radiotherapy.

Finally, Table IX shows the time till the patients' last follow up or death. The median time of follow up or death was three months. The benefits of half body irradiation is not survival but pain relief and many patients continued to have pain relief up till the time of death. The patient who survived for more than a year is a case of multiple myeloma and he is still alive at 2½ years.

TABLE VI

DISTRIBUTION OF PATIENTS WITH PAIN RELIEF BY DOSE

Dose	No. of Patients with Pain Relief	Total No. of Patinets	Respone Rate
450cGy	2	2	100%
500cGy	5	7	71.4%
600cGy	14	19	73.7%
700cGy	16	19	84.2%
800cGy	11	13	84.6%

TABLE VII
NUMBER OF INPATIENTS AND OUTPATIENTS TREATED

No. of Inpatients	27	(54%)
No. of Outpatients	22	(44%)
Unknown	1	(2%)
TOTAL	50	100%

TABLE VIII

PREVIOUS TREATMENT WITH RADIATION OR CHEMOTHERAPY

Patients with Previous Radiation Treatment	48	(96.0%)
Outside Half Body Fields	17	(34.0%)
Within Half Body Fields	31	(62.0%)
Patients with Previous Chemotherapy	18	(36.0%)
Patients with Both Previous Radiation and Chemotherapy	17	(34.0%)
Patients with Radiation Treatment after HBI	6	(12.0%)

TABLE IX

TIME TILL PATIENTS' LAST FOLLOW UP OR DEATH

	No. of Patients
No follow up	8
2 Weeks	2
1 Month	6
2 Months	5
3 Months	13
4 Months	5
5 Months	3
6 Months	3
7 Months	2
8 Months	1
9 Months	1
> 1 year	1

Median Time of Follow Up or Survival 3 months

DISCUSSION

Evidence from radiobiology suggests that a single dose of 300 cGy has a cell lethality of 90% and larger doses increase this cell kill to as high as 99.5 to 99.9%. Thus, with such large single doses, one may obtain remission rates from 5 to 10 doubling times of the tumour. A doubling time of two months would mean a remission rate of nearly 10 to 20 months (1).

A dosde of 800 cGy would certainly be lethal if the whole body were treated in a single exposure. So long as adequate marrow is left out of the field, it would be able to provide marrow stem cells for reseeding. On the other hand, it is expected that the tumour cells do not reseed during the intervening period. Even if they do, as a palliative measure, large numbers of tumour cells would have been killed with each treatment thus relieving pain.

We found that we required at least three weeks before the haemotological parameters are within the accepted limits for treating the second half. Generally between three to eight weeks intervene before the second half is treated. A shorter period is advantageous in patients with widespread painful disease. In adjuvant treatment, a shorter period will prevent tumour seeding. So long as the haematological parameters are within the accepted limits, we went ahead with the second half treatment.

The side effects were mainly nausea and vomiting. It did not occur during treatment as the treatment and set up times were short, generally between 20 to 30 minutes. Diarrhoea was minimal, unlike some fields which included a mid-body irradiation. This mid body irradiation encompassed the whole abdomen. Radiation pneumonitis was not encountered because the numbers that were treated with doses above 700 cGy was small.

The dose rate was kept within a narrow range, between 150 cGy and 100 cGy per minute. This is because only one Cobalt 60 Unit was used for all the half body treatments. There is a wider variation in some studies where the linear accelerator as well as the cobalt machines wre used. The contribution of dose rate to the success of treatment and the side effects is unknown.

The usefulness of this technique is best reflected in the subjective pain relief of about 78%. This is comparable to other centres which describe a similar subjective response rate although having a different disease distribution. It has also been used to control hypercalcaemia in multiple myeloma. We have used a lower dose for the treatment of multiple myeloma and it has been reported that there were unexpected bone marrow toxicity with doses that were normally tolerated well (6). It also plays an important role as an adjuvant treatment in combination with chemotherapy and studies are currently on for small cell carcinoma, Ewing's sarcoma (6) and neuroblastoma (9). Perhaps, it has a role in poor prognosis nasopharyngeal carcinoma where there is a possibility of local control but where these patients die of widespread metastases.

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