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Half-Body Irradiation for Pain Relief

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Abstract—*Half-body irradiation (H.B.I.) is a relatively recent technique in the palliative and analgesic treatment of advanced disease. At Tenon Hospital 21 patients (17 males and 4 females) were treated with this technique (2 upper and lower half-body irradiation, 7 upper half-body irradiation and 12 lower half-body irradiation). The mid-plan dose was 8 grays in one fraction, limited to 6 grays at the level of the lungs. The pain relief effect was excellent in ten cases and very good in eight cases. The effect was prompt (before 48 hr) and long lasting. General tolerance was excellent without any pulmonary complication. The hematologic tolerance was good even in the patients previously treated by combined chemotherapy. This irradiation seems to be a major weapon as an antalgic treatment of the advanced solid tumours. It can be proposed as a treatment which will enable tumour reduction in the future.*

INTRODUCTION

HALF-BODY irradiation (H.B.I.) is a relatively new technique in the treatment of metastatic cancers. It was introduced in the early 1970's by Fitzpatrick and Rider [1] who obtained excellent antalgic results with good immediate tolerance. Studies presently under way, dealing primarily with multiple myelomas and epidermoid bronchial carcinoma, aim at widening the application of the method to improve survival rates when tumours are initially or secondarily chemoresistant.

Between January 1978 and December 1979, we treated 21 patients using this technique; in 18 cases the sole objective was the relief pattern of pain. The technique can, however, play a larger role in the therapeutic strategy of less advanced cancers; in three cases, we used it in this manner.

PATIENTS AND METHODS

Patients

The group was composed of seventeen men and four women, and represents less than 0.5% of the patients treated in our department during this two-year period. The technique was, in fact, used only after the failure of customary treatments and in cancers where metastases are known to be relatively radiosensitive.

Average patient age was 57 years; the median was 59 and the extremes 23 and 76 years. Five patients were over 70 years old; their tolerance was the same as that of the younger patients.

The histological distribution of the group was as follows:

- 12 adenocarcinomas (10 prostate, 1 breast and 1 kidney);
- 4 oat-cell carcinomas of the bronchus;
- 2 epidermoid carcinomas (bronchus and bladder);
- 1 testicular teratocarcinoma;
- 1 non-Hodgkin lymphoma;
- 1 multiple myeloma.

In 17 out of 21 cases, metastatic dissemination had occurred before the initial diagnosis. Dissemination was primarily to the bone (15 cases) accompanied in three cases by pulmonary and in two cases by liver metastases. In only two patients was there no radiologically evident bone involvement: one was an isolated metastatic liver, the other a bone marrow involvement.

Four out of the 21 patients had clinical dissemination (bone plus pulmonary metastases in two cases; bone involvement only in the other two) between initial diagnosis and treatment.

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Table 1. Type of irradiation according to the initial tumour localization

	Prostate	Breast	Kidney	Bronchus (epidermoid)	Bronchus (oat-cell)	Bladder	Testis	Lympho sarcoma	Myeloma
Upper half-body irradiation (7 cases)	2		1		3			1	
Lower half-body irradiation (12 cases)	7	1		1	1		1		1
Upper and lower half-body irradiation (2 cases)	1					1			
Total (21 cases)	10	1	1	1	4	1	1	1	1

In 13 of the 18 half-body irradiations whose sole objective was the relief of pain, narcotic preparations had proven to be no longer effective.

Three patients underwent half-body irradiation with the additional intent of reducing tumour volume prior to chemotherapy.

Pain intensity determined the body half to be irradiated. We had seven cases of upper half-body and 12 of lower half-body irradiation. Two patients underwent both upper and lower half-body irradiation; in one case the interval between treatments was one month, in the other it was four months (Table 1).

Methods

All patients were treated with X-rays from a 6 MV linear accelerator (CGR MeV Neptune). The dose rate was 0.70 grays/min at frontal mid-plane level (SSD: 1.80 m). The maximum field size was 0.40×0.40 m at 1 m, the treatment field was 0.72×0.72 m (Fig. 1).

Patients were irradiated with anterior and posterior opposed fields, requiring two set-ups (one supine and one prone) per session.

Variations in body thickness were compensated by placing bags of rice over and around the patient, thus ensuring homogeneous dose delivering at the frontal mid-plan level.

The dose was eight grays in one session to the entire half-body, except at lung level where it was six grays. The lungs were protected by a 13 mm lead shield (1 HVL) used in the anterior field only; the lung tissue thus received only 75% of the dose delivered by the direct beam.

The upper and the lower limits of the field were determined by the topography of the disease and varied, in our population, from L_1 to L_4.

Where both upper and lower body halves were treated, the junction area was at mid-thickness, corresponding to a space of 4 cm at skin entry between the two beams (for an average thickness of 23 cm at this level).

No consideration was taken of possible prior irradiation except when one lung (1 case) or the spinal cord (two cases) had been exposed. In these cases, 70 mm lead shields (5 HVL) were placed in both anterior and posterior fields so as to prevent further exposure.

RESULTS

Pain relief

Bone metastasis. The pain relief effect of half-

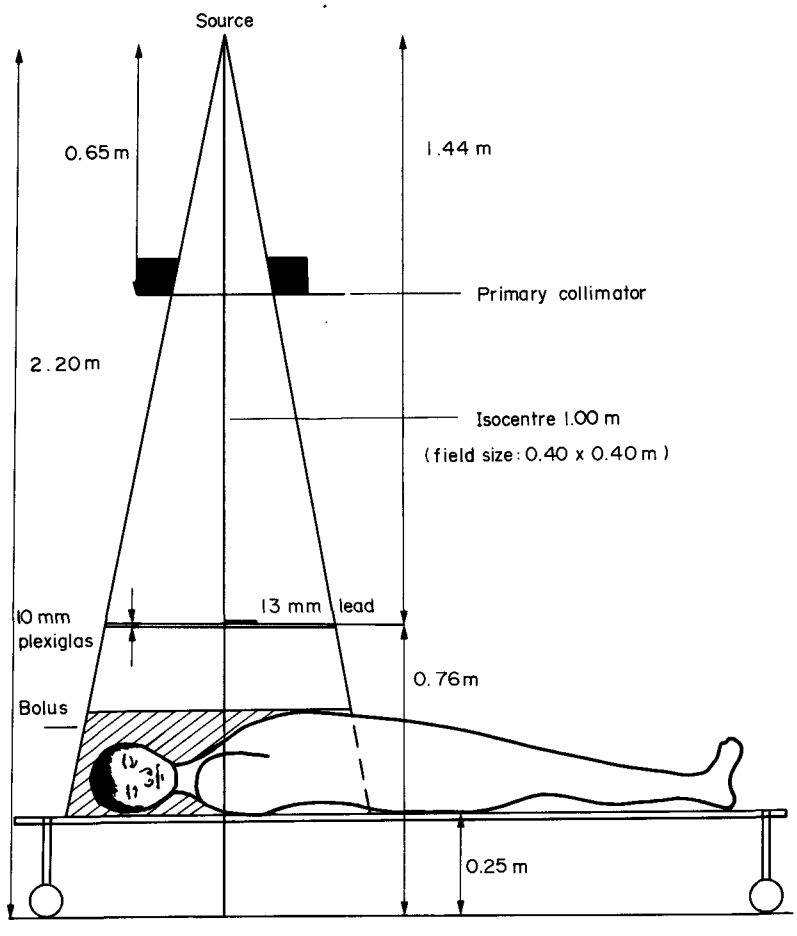

Fig. 1. *Patient position for the anterior field in the case of upper H.B.I.*

body irradiation is remarkable. Ten patients (47%) obtained total relief and needed no further pain relief medication; the pain suffered by eight patients (38%) was sufficiently relieved to stop narcotic drugs; three patients were not helped by this therapy. The speed with which pain was relieved is impressive: at most 48 hr, and in half the cases less than 24 hr. Pain increased, however, during the hours immediately after irradiation. It is difficult to evaluate the duration of the relief obtained because of the bad survival of our group of patients: twelve of our patients died within six weeks of treatment. But in all these cases, half-body irradiation elimated the need for major antalgic medication until the time of death. Among the eight surviving patients the average duration of the treatment's effectiveness was 6.5 months, the extremes were 1 and 14 months. One patient was lost to follow-up 2 months after his treatment, at which point he required no pain relievers.

Table 2 shows antalgic effect by location and histology of primary tumour. Best results were obtained in cases of disseminated adenocarcinomas of the prostate, giving total pain relief in seven cases out of ten and partial relief in two others.

Extraosseous metastasis. The effect of half-body irradiation is far more difficult to determine. However, three patients in our small sample suffered before their treatment from very painful hepatic metastasis.

Pain relief was complete in two of these three cases; in the third case, partial relief of pain was obtained simultaneously with the relief of pain in his bone metastasis.

Tumour reduction

It is difficult to evaluate the extent of tumour reduction in our population. The three patients (two oat-cell carcinomas of the bronchus and one multiple myeloma) treated

Table 2. Results of pain relief effect of the half-body irradiation according to histologic type of the primary tumour

	Total	Complete remission of pain	Partial remission of pain	Failure
Irradiation with pain relief intent (18 cases)				
Adenocarcinoma of the prostate	10	7	2	1
Adenocarcinoma of the breast	1	1		
Adenocarcinoma of the kidney	1		1	
Bronchus epidermoid	1			1
Bronchus oat-cell	2		2	
Bladder	1		1	
Lymphosarcoma (centrocytic–centroblastic)	1		1	
Testicular teratocarcinoma	1			1
Irradiation with pain relief and tumour reduction intent (3 cases)				
Oat-cell carcinoma of the bronchus	2	1	1	
Multiple myeloma (IgG)	1	1		
	21	10	8	3

with this objective received chemotherapy ten days after half-body irradiation; the precise effects of irradiation on tumour size could not be deduced from examinations made in the interval. At present, however, these three patients (follow-up time: 1–11 months) are proceeding well.

Tolerance

G.I. tract. Premedication by parenteral anti-emetics was systematic, in order to minimize early digestive reactions. Nevertheless, nausea and vomiting were frequent when the coeliac area was irradiated (seven cases out of nine). These complications were hardly minimized at all by anti-emetics, even those acting on the central nervous system. However, the symptoms were moderate and never lasted more than a few hours; in no case did the patient require parenteral rehydration.

Lower half-body irradiation gave rise to far less digestive intolerance. We observed only two cases of diarrhea, both of which were controlled by diet and symptomatic treatment.

GI tract complications do not appear to be more serious where previous treatment has taken place, either radiotherapy of the abdomen or chemotherapy.

Pulmonary. One patient, 58 years of age, died from acute pulmonary oedema 1 month after upper half-body irradiation. However, this death is probably due to an unrelated cardiac failure. None of the four surviving patients treated by upper half-body irradiation has presented delayed pulmonary complications, but our maximum follow-up is 24 months.

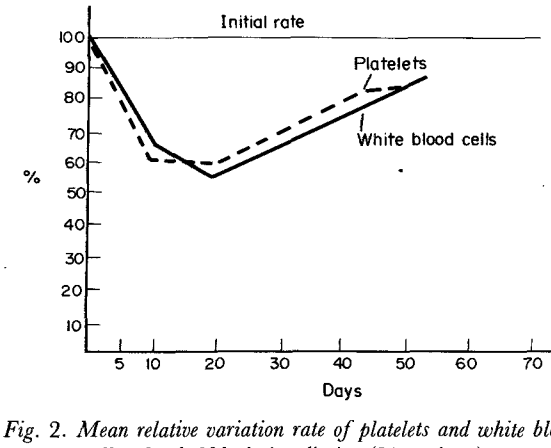

Fig. 2. Mean relative variation rate of platelets and white blood cells after half-body irradiation (21 *patients*).

Hematological. Half-body irradiation is followed by a marked drop in platelet and white blood cell counts (Fig. 2). This phenomenon is temporary and, in our population, without

clinical significance. The long-term consequences on the red blood cell count on the hemoglobulin rate are negligible.

Ten of our 21 patients were treated by combined chemotherapy before half-body irradiation. Of the eight survivors of this subgroup, three had had heavy combined chemotherapy; half-body irradiation does not appear to have caused any additional complications.

Miscellaneous. Muco-cutaneous tolerance was excellent. Only one of our patients suffered buccal infection and parotidis, rapidly responsive to steroid therapy. The alopecia that follows cranial irradiation is temporary. Finally, we encountered no acute ocular complication such as conjunctivitis, although no protective shielding was used for the eyes. However, the number of survivors is small and follow-up time is as yet insufficient to reveal potential cataracts.

No renal function abnormality was observed. The lower half-body irradiation of one patient encompassed both kidneys although his serum creatinine level was 600 μmol/l. He subsequently had a ureteral derivation, without complication. Data are lacking for the evaluation of potential long-term renal complications.

DISCUSSION

Palliative half-body irradiation is a promising technique, allowing the delivery of a single therapeutically effective dose with no significant hematological toxicity. Eight grays can be delivered into the half of the body volume in one session, the limiting factor being pulmonary tolerance [2, 3].

The problem of potential pulmonary complications appears, *stricto-sensu*, vital: lung damage may lead to death. Extreme caution is therefore necessary in an upper half-body irradiation. We feel that it is dangerous to so treat patients with bacterial or viral pulmonary infection as well as those having undergone recent or prolonged Bleomycin therapy. Patients suffering from pleural effusion or pulmonary metastasis may, on the other hand, be treated by this half-body irradiation.

Rapid pain relief is the essential feature of the treatment. Relief was obtained in 18 out of 21 patients, in half in less than 24 hr. In most cases the antalgic effect lasted until death; survival condition was thus dramatically improved.

We did not study the tumour regression rate secondary to half-body irradiation. Important though it may be, the destructive effect upon a tumour of a single eight-gray dose is, in the opinion of all authors, at best temporary. Salazar [4] observed an objective response rate of 80% in 21 patients; the regression obtained was estimated at 50–75% of initial tumour volume. In fact, tumour regression is difficult to assess, except in a few cases such as subcutaneous nodules, palpable thoracic masses and radiologically measurable lung tumours.

In Fitzpatrick and Rider's study [5], 13 out of 82 patients (16%) were alive after a follow-up period of 6–31 months. The median survival time of those patients deceased at the time of publication was 6 months. Pain relief was obtained in 75% of the patients and in three cases out of four it lasted until death.

In a recent series, Jaffe *et al.* [6] used half-body radiotherapy on multiple myeloma patients not responsive to chemotherapy. Tumour regression occurred in 50% of the cases; however, two patients died of pneumonitis.

Others have studied the technique and, having observed excellent palliative results, advocated its use in various types of cancer, particularly epidermoid cancer of the bronchus [7] and myelomas [6]. The technique may also be effective in the treatment of Kaposi's sarcoma [8].

Among the advantages of the technique are its remarkable ease of utilisation and the rapidity with which pain can be relieved. Tolerance appears excellent, although the literature reports a 12% pulmonary complication rate [6]. Half-body irradiation therefore seems to be a good palliative treatment for advanced disease, permitting the patient to return to his normal surroundings free from the need for major analgesics. The best indication actually seems realized in prostatic carcinomas [9].

Although objections remain and most especially the unresolved problem of long-term after-effects, this type of irradiation opens new approaches of research into the treatment of generalized cancers. Its place in relation to chemotherapy in the treatment of disseminated disease remains to be defined.

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