for it. Since wholemeal Manitoba flour contains 3.8 to 3.9 mg iron/100 g, compared with 1 mg/100 g, in unsupplemented white bread, the amounts of iron absorbed from both types of bread are similar (0.11 mg/100 g from wholemeal and 0.09 mg/100 g from white flour). Further isotopic studies are needed to determine whether supplementation of white bread with elemental iron increases the absorption of iron. We suggest that supplementation of white bread with iron may be unnecessary as the higher iron absorption compensates for the lower iron content.

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¹ Widdowson, E M, and McCance, RA, *Lancet*, 1942, **1**, 588.

² Elwood, P C, *et al*, *American Journal of Clinical Nutrition*, 1968, **21**, 1162.

³ Callender, S T, and Warner, G T, *American Journal of Clinical Nutrition*, 1968, **21**, 1170.

⁴ Elwood, D A, *et al*, *American Journal of Clinical Nutrition*, 1970, **23**, 1267.

⁵ Layrisse, M, and Martinez-Torres, C, *American Journal of Clinical Nutrition*, 1972, **25**, 401.

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Second report on results of a randomised clinical trial of fast neutrons compared with x or gamma rays in treatment of advanced tumours of head and neck

Patients with advanced tumours of the head and neck were allocated at random to treatment with neutrons or photons (x or gamma rays). All except one (whose tumour was stage T_2N_1) had tumours of stage T_3 or T_4 , N_0 , N_{1b} , N_{2b} , or N_3 (TNM classification¹). The neutron-treated patients received a standard dose of 1560 rads given in 12 treatments over four weeks, the MRC's cyclotron at Hammersmith Hospital being used. Of the photon-treated patients, 40% were treated at Hammersmith Hospital and the others at collaborating hospitals. The doses ranged from 4540 to 6840 rads over four to six weeks. Details of eligibility for the trial were reported previously together with the results in the first 107 patients.² The final total number of patients admitted to the trial was 161, and we report here the results up to September 1976.

Results

The early results showed highly significant benefit to the neutron-treated patients in local control of the tumour. The present analysis, two years later, shows that this benefit has been maintained and that, with one exception, local control in the neutron series has persisted without recurrence. Further details are given in the table.

The proportions of patients whose tumours clinically completely regressed were 77% in the neutron series and 43% in the photon series. Only one tumour recurred in the neutron series, compared with 15 in the photon series. Survival was slightly better in the neutron series, but the differences were not significant. Twice as many patients in the photon series (21) as in the neutron series (10) underwent further treatment with chemotherapy, radiotherapy, or surgery for suspected residual disease. Malignancy was found in only four of the 10 surgical specimens from the neutron-treated patients, compared with 11 of the 12 from those in the photon series. The number of severe complications in patients whose tumours were apparently cured was greater in the neutron series, and these were most common and most troublesome in the larynx and oropharynx. In some cases, however, the tumours may already have caused irreparable damage, which did not become evident in the photon series because of poorer local control.

Comment

In this first, multicentre co-operative trial most of the treatments with photons and follow-ups were done in the hospital of origin. The treatments given and the patients' records consequently differed between the two series: a wider range of doses was given to the photon-treated patients, the average dose being lower than in the neutron series. Nevertheless, among subgroups of patients who were receiving equivalent doses of the two types of radiation complete regression of tumour without recurrence was much rarer when photons were used.

Results in neutron- and photon-treated patients

	Neutron series	Photon series
<i>Patients in trial</i>		
Total admitted to trial	82	79
Excluded for various reasons	12	16
Included in analysis	70	63
<i>Local control of tumour</i>		
Complete regression clinically:		
Which persisted	53 (76%)	12 (19%)
Later recurrence	1 (1%)	15 (24%)
No or incomplete regression	16 (23%)	36 (57%)
<i>Survival (actuarial percentages)</i>		
Alive at 1 year	53	42
Alive at 2 years	28	15
<i>Additional treatment for suspected residual disease</i>		
Radiotherapy	0	4
Chemotherapy	0	5
Surgery	16 (6*)	12 (1*)
Total	10	21
<i>Severe complications in patients with cured tumours</i>		
Eyes	2	1
Spinal cord	2	
Larynx and pharynx	6	1
Total	10	2
<i>Causes of death (numbers of patients)</i>		
Residual or recurrent cancer in treated site with or without metastases	10 (4†)	44 (4†)
Metastases with treated site controlled	13 (9†)	2
Complications of radiation or surgery	10 (3*†)	2
Uncertain (tumour controlled)	5	0
Unrelated to cancer (tumour controlled)	7 (3†)	0
Total	45 (19†)	48 (4†)

*Patients in whom no malignancy was found in surgical specimen.

†Patients in whom confirmation of cause was obtained at necropsy.

In this trial the patients had such advanced tumours that death often occurred from degenerative or metastatic disease, thus making it impossible to assess the long-term effects in most patients. The encouraging results of treatment with fast neutrons suggest that it may be of long-term value to patients who have smaller tumours and are in better general condition. To investigate these long-term effects of neutron treatment a new trial has been started to compare neutrons with photons, or photons plus surgery, in patients with T_2 and T_3 tumours of the head and neck.

¹ International Union against Cancer, *TNM-Classification of Malignant Tumours*. Geneva, UICC, 1968.

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