

- ² Kangro HO. Evaluation of a radioimmunoassay for IgM-class antibodies against cytomegalovirus. *Br J Exp Pathol* 1980;**61**:512-20.
- ³ Rodeck CH, Campbell S. Sampling pure fetal blood by fetoscopy in second trimester of pregnancy. *Br Med J* 1978;ii:728-30.
- ⁴ Alford CA, Blankenship WJ, Straumfjord JV, Cassady G. The diagnostic significance of IgM-globulin elevations in newborn infants with chronic intrauterine infections. *Birth Defects* 1968;**4**:5-18.
- ⁵ Griffiths PD, Stagno S, Pass RF, Smith RJ, Alford CA. Congenital cytomegalovirus infection: diagnostic and prognostic significance of the detection of specific IgM antibodies in cord serum. *Pediatrics* (in press).

(Accepted 11 March 1982)

Departments of Obstetrics, Medical Microbiology, and Morbid Anatomy, King's College Hospital Medical School, London SE5 8RX

I LANGE, MD, research fellow, department of obstetrics (now at St Boniface General Hospital, Winnipeg, Manitoba, Canada)
 C H RODECK, BSC, MRCOG, senior lecturer in obstetrics
 P MORGAN-CAPNER, MB, MRCPATH, senior lecturer in virology
 A SIMMONS, MB, BCHIR, pathology demonstrator

Virology Department, St Bartholomew's Hospital, London EC1A 7BE

H O KANGRO, BSC, PHD, senior virologist

Prevention of doxorubicin-induced alopecia by scalp hypothermia: relation to degree of cooling

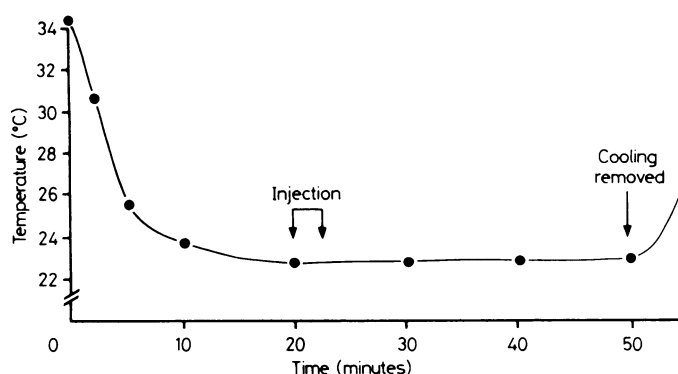
Although doxorubicin is extremely effective in treating carcinoma of the breast, many clinicians are reluctant to use it because of the almost certain alopecia that ensues.¹ The hair loss, which is usually complete, is particularly disadvantageous if the drug is part of adjuvant systemic treatment after mastectomy.

Because of the rapid clearance of doxorubicin from the circulation scalp hypothermia has been used to limit the amount of drug reaching the hair follicles, preventing hair loss. This is particularly effective when total doses are below 50 mg,²⁻⁴ but with higher doses results are less certain. We investigated the relation of the scalp skin temperature obtained with hypothermia to the degree of hair loss.

Patients, methods, and results

Scalp cooling was undertaken in 24 patients with breast carcinoma. Of these, 18 were receiving chemotherapy for advanced disease and six adjuvant systemic treatment for primary tumours. Results of liver function tests were normal in all cases. The same drug regimen was used in all 24 patients. Doxorubicin 40 mg/m² (average dose 60-70 mg) and vincristine 2.0 mg were given intravenously on days 1 and 8 of a four-week cycle. Prednisolone 10 mg was given by mouth for the first 14 days of the cycle.

Scalp skin temperature was measured with a thermocouple constructed from a hypodermic needle, which was introduced into the scalp to a depth of 1-2 mm to be at the approximate level of the hair follicles and remained in place throughout the cooling procedure. To cool the scalp frozen cryogel packs were moulded on to the head and held in place with a plastic helmet.



Typical scalp cooling curve.

Cooling was maintained until the lowest temperature was reached and doxorubicin then injected. Cooling continued for a further 30 minutes.

Hair loss was categorised as slight, moderate, severe, or complete at the patient's third cycle of chemotherapy.

Scalp temperature in the 24 patients varied from 18.5°C to 28.5°C. In each individual patient, however, a consistent temperature was obtained on repeated measurement. Maximal cooling occurred after 20-30 minutes of hypothermia, which was maintained for 30-40 minutes (figure).

Ten of the 24 patients (42%) receiving high-dose doxorubicin showed satisfactory hair retention. All these patients suffered slight hair loss but not sufficient for them to require a wig.

The degree of alopecia was temperature dependent. In 19 patients in whom temperature was measured during two cycles of chemotherapy that reached in women who showed good hair retention was significantly lower ($p < 0.001$) than that reached in those with alopecia (20.8°C *v* 24.2°C). To prevent alopecia scalp temperature had to be reduced to 22°C or below.

Comment

Altogether 42% of patients showed appreciable hair preservation, compared with 5% before scalp cooling was introduced. When frequent pulses of high-dose doxorubicin are used it appears that the scalp temperature must be reduced below 22°C before injection and this temperature maintained for 20 minutes to prevent alopecia. Vincristine contributes to the alopecia, which will not, because of this drug's prolonged clearance, be prevented by hypothermia.

These results compare favourably with those reported by other groups using high-dose regimens.⁵ The improvement in this study was probably due to the delay in administering the chemotherapy until maximal cooling had been obtained—that is, 20-30 minutes after the initiation of hypothermia. In other studies injection was given after five to 10 minutes of cooling. The degree of alopecia is undoubtedly drug-dose dependent,^{2,5} with a much higher proportion of hair preservation occurring at lower dosage regimens of less than 40 mg/m².

The large variation in scalp temperature between patients could not be explained by differences in hair thickness or density of scalp tissue. The degree of cooling obtained in each woman, however, was remarkably consistent at each recording, and differences between patients were therefore not due to changes in procedure.

- ¹ Middleman E, Luce JK, Frei E. Clinical trials with Adriamycin. *Cancer* 1971;**28**:844-50.
- ² Anderson JE, Hunt JM, Smith IE. Prevention of doxorubicin-induced alopecia by scalp cooling in patients with advanced breast cancer. *Br Med J* 1981;**282**:423-4.
- ³ Luce JK, Raletto TJ, Crisp M. Prevention of alopecia by scalp cooling on patients receiving Adriamycin. *Cancer Chemotherapy Reports* 1973;**57**:108.
- ⁴ Edelstyn GA, Macdonald M, Macrae KD. Doxorubicin-induced hair loss and possible modification by scalp cooling. *Lancet* 1977;ii:253-4.
- ⁵ Dean JC, Salmon SE, Griffiths KS. Prevention of doxorubicin-induced hair loss with scalp hypothermia. *N Engl J Med* 1979;**301**:1429-31.

(Accepted 18 March 1982)

University Department of Surgery, Southampton General Hospital, Southampton SO1 6HU

R P GREGORY, medical student
 TIMOTHY COOKE, MD, FRCS, lecturer in surgery

Department of Medical Oncology, Southampton General Hospital

JANICE MIDDLETON, SRN, chemotherapy nurse
 R B BUCHANAN, MRCP, FRCR, consultant radiotherapist
 C J WILLIAMS, MD, MRCP, senior lecturer in medical oncology

Tamoxifen-induced tumour regression associated with dermatomyositis

Carcinoma of the breast is the commonest tumour associated with dermatomyositis and precedes the rash in only 20% of cases. When the tumour is controlled with surgery, radiotherapy, chemotherapy or hormone treatment there may be improvement of the dermatomyositis.¹ No cases have been described in which the tumour was regressing with treatment when dermatomyositis started. We describe three