References

- ¹ Kirklin JW, Wallace RB, McGoon DC, *et al.* Early and late results after intracardiac repair of tetralogy of Fallot. Five years' review of 337 patients. *Ann Surg* 1965;165:578-89.
- ² Gersony WM, Battany S, Bowman FO Jr, *et al.* Late follow-up of patients evaluated haemodynamically after total correction of tetralogy of Fallot. *J Thorac Cardiovasc Surg* 1973;66:209-13.
- ³ Clayman JA, Ankeney JL, Liebman J. Results of complete repair of tetralogy of Fallot in 156 consecutive patients. *Am J Surg* 1975;130:601-5.
- ⁴ Hallidie-Smith KA, Dulake M, Wong M, Oakley CM, Goodwin JF. Ventricular structure and function after radical correction of the tetralogy of Fallot. *Br Heart J* 1967;29:533-47.
- ⁵ Meyer EC, Tulskey AS, Sigmann P, Silber EN. Pregnancy in the presence of tetralogy of Fallot. *Am J Cardiol* 1964;14:874-9.
- ⁶ James FW, Kaplan S, Chou TC. Unexpected cardiac arrest in patients after surgical correction of tetralogy of Fallot. *Circulation* 1975;52:691-5.

(Accepted 4 June 1982)

Changes in serum amylase and its isoenzymes after whole body irradiation

A BARRETT, A JACOBS, J KOHN, J RAYMOND, R L POWLES

Abstract

A study was carried out to assess the effect of total body irradiation on pancreatic and parotid isoenzymes of amylase in patients about to undergo bone-marrow transplantation who had received high-dose cyclophosphamide. Twelve patients were studied, enzyme activity being measured before and at various times after total body irradiation. Serum total amylase activity rose rapidly within 12 hours of irradiation to a maximum at 36 hours, returning to normal by six days; most of the increase was derived from salivary damage, with a much smaller pancreatic component.

These results confirm that radiation produces acute changes in amylase activity, which may be of use in assessing radiation-induced damage.

Introduction

The preconditioning regimen for patients undergoing bone-marrow transplantation for acute leukaemia includes high-dose cyclophosphamide ($3 \text{ g/m}^2 \times 2$) followed by total body irradiation to a dose of about 10 Gy (1000 rad). A rise in serum amylase activity was noted in these patients, and acute parotitis occurred. We therefore undertook a study to determine the effect of total body irradiation on pancreatic and parotid isoenzymes of amylase.

Patients, methods, and results

Serum amylase activity was measured in 10 consecutive unselected patients before total body irradiation and daily until it returned to normal using the Phadebas method.¹ Serum amylase and pancreatic and salivary isoenzyme activities were then measured in a further 12 patients before total body irradiation and at varying times after

treatment using a quantitative inhibition technique, a diagnostic isoamylase test (Pharmacia),² and electrophoretic separation cellulose acetate as reported by Davis.³ Control values were obtained in 16

Amylase activity before (pre) and after total body irradiation*

Case No	Time of measurement (hours)	Total amylase (U/l)	Pancreatic isoenzyme (U/l)	Salivary isoenzyme (U/l)
1	Pre	90	6	84
	24	2490	594	1896
	48	1296	360	936
	60	918	270	648
	72	216	54	162
2	Pre	78	48	30
	12	720	420	300
	24	1600	732	870
	48	290	486	1800
	72	432	180	252
3	Pre	36	24	12
	24	520	180	342
	48	660	144	420
4	Pre	66	42	24
	24	2400	480	1920
	48	2600	192	1440
	72	420	150	270
5	Pre	290	60	204
	12	4800	1100	3420
	36	2100	414	1550
	48	1700	470	1170
	60	1000	288	740
6	Pre	800	48	792
	24	1530	36	396
	36	4000	72	3888
	48	4460	324	4140
	60	720	306	414
7	Pre	468	126	342
	12	2340	522	1818
	24	2160	522	1638
	48	864	204	660
8	Pre	360	66	294
	12	132	6	126
	36	2340	522	1818
	60	540	144	396
9	Pre	78	12	66
	12	132	6	126
	36	2160	504	1656
	60	1080	252	828
10	Pre	288	48	240
	12	138	42	96
	36	810	180	630
	60	195	12	183
11	Pre	180	66	114
	12	90	36	54
	24	9000	1200	6024
	48	5600	1000	4500
12	Pre	3000	210	3000
	12	1100	78	900
	36	140	120	40
	60	2300	620	1920

*Control values—normal subjects (n=16): total amylase 170 U/l, pancreatic isoenzyme 87 U/l, salivary isoenzyme 83 U/l; leukaemic patients (n=9): total amylase 178 U/l, pancreatic isoenzyme 80 U/l, salivary isoenzyme 98 U/l.

†One unit of amylase is the amount of enzyme catalysing the hydrolysis of 1 μmol of substrate (glucosidic linkage)/minute at 37°C and is equivalent to 60 μkatal s.

Institute of Cancer Research and The Royal Marsden Hospital, Sutton, Surrey

A BARRETT, MB, FRCP, senior lecturer and honorary consultant in radiotherapy

A JACOBS, BSC, MRCP, registrar in haematology (present appointment: fellow, Division of Haematology-Oncology, University of California, Los Angeles, California 90024, USA)

J KOHN, FRCPATH, DCP, consultant clinical pathologist

J RAYMOND, BSC, medical laboratory scientific officer

R L POWLES, MD, FRCP, physician in charge, leukaemia unit

normal subjects (laboratory workers) and nine patients with leukaemia who were not undergoing total body irradiation after chemotherapy to induce remission.

Acute parotitis occurred in most patients within 12 hours after the start of total body irradiation, with considerable swelling and tenderness. This returned to normal within 48 hours, although dryness of the mouth and altered taste persisted for up to six months

Mean total serum amylase activity after total body irradiation. (Bars indicate SEM; broken horizontal line indicates upper limit of normal.)

after irradiation. Out of 121 patients who underwent bone-marrow transplantation at this hospital, none had clinical signs or symptoms of acute pancreatitis and none developed chronic pancreatitis or evidence of pancreatic insufficiency, the maximum follow-up being three years.

Serum amylase activity rose rapidly within 12 hours of total body irradiation to a maximum at 36 hours, with a rapid return to normal in all cases by six days (figure). Later rises in activity were not

observed. All values for the normal and leukaemic controls except one fell within the normal range for our laboratory (70-300 U/l).

Electrophoresis and the quantitative inhibition technique showed that most of the increase in amylase activity was derived from salivary damage, with a much smaller pancreatic component. Quantitation showed that values were usually maximal between 12 and 24 hours, although in half of the patients maximum salivary amylase activity occurred later, at 36 to 48 hours (table). Pretreatment values were regained within four to six days.

Discussion

Total body irradiation and cyclophosphamide given before bone-marrow transplantation produce a transient rise in serum amylase activity, which returns to normal by six days. Most of this rise is due to the salivary isoenzyme and is associated with symptoms of acute parotitis. Rises in pancreatic isoenzyme activity occur but are much smaller, and clinical pancreatitis has not been seen in our patients. Measurement of amylase activity may be used as an end point for radiation damage in some animal models.⁴ This study confirms that radiation produces acute changes in amylase activity that may be of use in man in assessing the degree of radiation-induced damage.

Further studies are needed to correlate the dose of irradiation with the amount of parotid damage as shown by a rise in serum amylase activity. This may then prove a useful end point in estimating doses received in radiation accidents.

References

- Ceska M, Hultman E, Ingelman B. A new method for determination of alpha-amylase, *Experientia* 1969;25:555-6.
- O'Donnell MD, FitzGerald O, McGeeney KF. Differential serum amylase determination by use of an inhibitor, and design of a routine procedure. *Clin Chem* 1977;23:560-6.
- Davies TJ. A fast technique for the separation and detection of amylase isoenzymes using a chromogenic substrate. *J Clin Pathol* 1972;25:266-7.
- El-Mofty SK, Kahn AJ. Early membrane injury in lethally irradiated salivary gland cells. *Int J Radiat Biol* 1981;39:53-63.

(Accepted 28 May 1982)

SHORT REPORTS

Bladder fever: rare complication of the "safe period" method of contraception

There is an increasing fashion for the use of the so-called "natural" method of contraception which is recommended by its proponents on the basis of its lack of side effects. We draw attention to a potentially serious associated risk that must be anticipated and may be avoided by careful explanation of the method.

Case report

An 18-year-old girl presented to the casualty department of this hospital stating that she had been practising the natural method of contraception and, while attempting to measure her temperature vaginally, had lost her thermometer. During the next five hours she had experienced some dysuria.

Examination showed a healthy young woman with no abdominal signs. Rectal examination was normal and on vaginal examination there was no evidence of vaginal injury, but the thermometer could be palpated anterior to the vaginal wall in the upper third. Plain abdominal radiography confirmed that the thermometer was in the pelvis (figure). We concluded that the thermometer was in the bladder and that she had inadvertently passed it via the urethra.

She was taken to theatre and at cystoscopy the thermometer was visualised

lying transversely in the bladder (reading 37°C). Attempts to remove it with biopsy forceps, which had been proved able to grasp a hospital clinical thermometer, failed. After some consideration a lasso was constructed using

Radiograph showing thermometer in the pelvis.