cases had been caused by the television programme the boys had watched. Post-traumatic stress disorder due to watching a television programme has not been reported previously, although Saigh reported on an 11 year old girl in Lebanon who developed the disorder after being told of the war related death of her uncle.⁴

The treatment in both our cases specifically addressed the children's preoccupations and anxieties. Behavioural and cognitive strategies including relaxation techniques and the management of anxiety were used, rather than an eclectic approach being taken as McFarlane suggested.⁵ Although both boys had anxiety traits and overdependent relationships, risk

factors for the development of post-traumatic stress disorder in children remain inconclusive.

- 1 Udwin O. Annotation: children's reactions to traumatic events. *J Child Psychol Psychiatry* 1993;34:115-27.
- 2 Garnezy N, Rutter M. Acute reactions to stress. In: Rutter M, Hersov L, eds. *Child and adolescent psychiatry: modern approaches*. 2nd ed. Oxford: Blackwell, 1985: 152-76.
- 3 Yule W, Udwin O. Screening child survivors for post traumatic stress disorder: experiences from the "Jupiter" sinking. *Br J Clin Psychol* 1991;30:131-8.
- 4 Saigh PA. Verbally mediated childhood post-traumatic stress disorder. *Br J Psychiatry* 1992;161:704-6.
- 5 McFarlane AC. The treatment of post traumatic stress disorder. *Br J Med Psychol* 1989;62:81-90.

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Metal residues after cremation

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Cremation takes place in two chambers. The primary chamber is heated to about 700°C; the coffin containing the body is placed inside, and spontaneous combustion occurs. The temperature increases to 900-1100°C during combustion, which lasts 60-90 minutes if the body is obese or up to 120 minutes if the body is thin or cachectic. The remains are raked down into the secondary chamber to cool. After the cooling process any metal is removed and the residue is crushed to the consistency of coarse sand. This residue weighs about 2.0 kg.

Many metal prostheses are implanted in people in Britain: about 40 000 hip replacement operations are performed each year.¹ Seventy per cent of the population is cremated (Federation of British Cremation Authorities, personal communication) and only cardiac pacemakers and radioactive implants are removed beforehand. As a result of the Environmental Protection Act 1990 all implants may soon have to be removed before cremations. I studied the scale of this potential problem and why removal may be necessary.

Methods and results

I sent a standard letter about the disposal of implants to 20 crematoriums in Greater London; I subsequently visited six of these. The staff of five of the crematoriums had collected all implants found after cremation for a short period before my visit; the other crematorium had collected a few unexpected metal implants or ingested objects found over the years. The table shows the data that they supplied. Only one crematorium disposed of implants in the general rubbish, a practice that is contrary to the recommendations of the Federation of British Cremation Authorities.

The most common metal residues were hip and knee replacements. Other implanted items collected

included intramedullary nails, sliding hip screws, and components from hemiarthroplasties. Less commonly retrieved were McLoughlin nail plates, Jewett nail plates, and Enders nails; one Souttar's tube and one triangular fixation device for hip fractures were also retrieved.² At one crematorium a substantial number of coins were found: their presence is probably related to social customs in some ethnic groups. The unexpected items found included a variety of forceps (Spencer-Wells, Jean's, and artery), a pacemaker, a ring cutter, a micrometer, and a pair of Mayo scissors.

Comment

The hazards of cremation have been discussed,³ but little work on metal residues after cremation has been published. A study in 1976 of 6000 cremations found that 5% resulted in metal residues.⁴ In this study 23-76% of cremations resulted in metal residues (table), but this percentage range does not reflect the actual number of bodies with metal residues as one body may have more than one implant. The study shows that implants are common and have increased since 1976.

As a result of the Environmental Protection Act 1990 the temperature for cremation may have to be raised to 1600°C in the primary chamber to reduce emissions of dioxin.⁵ All crematoriums will have to comply by 1996. This act has two implications. Firstly, in all the crematoriums I visited the cremating furnace will have to be replaced because the new higher temperatures would damage the existing ovens. Secondly, and of particular concern to the health service, at 1600°C stainless steel and cobalt-chrome implants will melt; the melting point for stainless steel is 1290°C and for cobalt-chrome 1350°C (Corin Medical, personal communication). This melting would result in damage to the fire bricks, and because of financial constraints in the public sector the costs of repair might have to be met by health authorities. To avoid this, all implants may have to be removed; this would require logging and tracking, which would be a considerable undertaking and would increase demand on pathology services as on average 42% of all bodies would require intervention.

I thank the management and staff of the six crematoriums visited for their help.

Data on implants collected for short period by six crematoriums in 1993

Crematorium	Cremations/year	Maximum temperature (°C)	Collection period (days)	No of implants collected	Estimated proportions* (%) of cremations with implant	Coins present
1	3000	1000	5	31	31/4 (76)	Yes†
2	1000	900	21	20	20/57 (35)	No
3	1500	1000	14	13	13/57 (23)	Yes
4	3500	1100	5	25	25/48 (52)	Yes
5	1800	1000	21	26	26/103 (25)	No
6	3000	1000	NA	NA	NA	No

Crematorium 1 threw out implants; all others buried them.

NA=Not applicable as no collection had been made.

*Calculated from number of cremations a year and one implant came from one body.

†A substantial number were found.

- 1 Bulstrode CJK, Seagroatt V, Heng Soon Tan, Goldacre M, Gill L, Nugent I. The epidemiology of total hip replacement. In: *Proceedings of the Institute of Mechanical Engineers: joint replacement in the 1990s*. London: Institute of Mechanical Engineers, 1992.
- 2 Smith EHJ, Ellis JS, Manifold MC, Dewey PR. Triangle pinning for fractures of the femoral neck. *J Bone Joint Surg [Br]* 1964;46:664-73.
- 3 Hidden hazards of cremation [editorial]. *BMJ* 1977;iii:1620-1.
- 4 Thomas HO. A study of metallic implants from crematoria. *J Bone Joint Surg [Br]* 1976;58:135.
- 5 Department of the Environment. *Environmental Protection Act 1990, part 1. Secretary of state's guidance—crematoria*. London: HMSO, 1991.

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