

Reduction in evidence in children's teeth of use of tetracyclines

Since 1958 tetracyclines have been known to cause unsightly discoloration of teeth if they are given during the period that the teeth are being formed,¹ and wide publicity has been given to the problem since then. Tetracyclines form a complex with calcium orthophosphate in tissues undergoing mineralisation, and the resulting discoloration serves as a permanent record of the use of these drugs. Sections of such teeth examined in ultraviolet light show the incorporated tetracycline as yellow curvilinear bands in the dentine. Formation of the second primary molars occurs from birth until 3 years of age. Examination of extracted second primary molars thus gives information about tetracycline treatment during this period. In 1968 Stewart found that more than 70% of 3 to 5 year old children had received tetracyclines in their first three years of life,² and in 1973 he found that no particular improvement had occurred.³ I examined the current position to assess the effectiveness of the publicity given to this problem over the past 10 years.

Patients, methods, and results

During 1982 second primary molars extracted because of caries were collected from the same dental clinics as were used in the 1973 survey in Belfast.³ One tooth per child was examined, and to obtain the most up to date results attention was confined to children born in 1977-9. Specimens obtained were placed in lightproof containers until the time of examination. The teeth were examined in daylight and any staining of their crowns noted. The crowns and roots of each tooth were sectioned mesiodistally and examined in a darkroom under ultraviolet light. Any lines of fluorescence in the dentine were noted, and the total numbers of such bands were counted for each age group. A separate count was made of any cream coloured deposits judged to be due to oxytetracycline. In the case of children who had received multiple courses of tetracycline the growth and calcification of the teeth between courses had resulted in separate bands of fluorescence.

Of 382 teeth examined, 56 (14.7%) had deposits in their dentine, of which four were judged to be due to oxytetracycline. The mean number of deposits per tooth showing fluorescence was 1.79. Fourteen teeth were judged to have tetracycline staining of their crowns when viewed in daylight. The table shows the results according to the years of birth of the children and gives the years in which the antibiotic was used.

Details of second primary molars showing deposits of tetracycline (drugs given during first three years of life)

Year of birth	Years when tetracycline given	No of teeth examined	No (%) of teeth showing fluorescence	No of deposits	No deposits/tooth showing fluorescence
1977	1977-80	151	24 (15.9)	36	1.50
1978	1978-81	138	20 (14.5)	39	1.95
1979	1979-82	93	12 (12.9)	25	2.08

Comment

Chelation of tetracycline and calcium in the teeth serves as a permanent record of the use of these antibiotics. The drop in the proportion of children with tetracycline deposits from 70% in 1973³ to 14.7% in this survey indicates that prescription of this drug for young children has decreased considerably over the past 10 years. Oxytetracycline produces a smaller degree of discoloration of teeth than other tetracyclines, and yet the fluorescence in only four of the 56 affected teeth was judged to be due to oxytetracycline. In 1973 the mean number of deposits per tooth showing fluorescence was 3.48; in the present study it was 1.79. Thus not only has the number of children receiving the drug fallen but the number of courses prescribed per child has also fallen.

Specific indications for using tetracyclines in children are now rare.⁴ More effective alternatives are now available for common childhood infections, and prescribers have clearly taken note of this. Use of tetracyclines for children has medicolegal implications, and a successful action brought in the United Kingdom alleged that tetracyclines had resulted in discoloration of two children's teeth.⁵ If discoloration of children's teeth is to be avoided these drugs should not be prescribed for pregnant women or children less than 8 years old.

I thank Professor D J Stewart for his help and encouragement with this project, and the staff of the department of paediatric and preventive dentistry,

Royal Victoria Hospital, and Mr T Brannigan, district dental officer, for their help in collecting the teeth.

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- 3 Stewart DJ. Prevalence of tetracyclines in children's teeth. II. A resurvey after five years. *Br Med J* 1973;iii:320-2.
- 4 Smith H. *Antibiotics in clinical practice*. 3rd ed. Bath: Pitman Medical, 1977.
- 5 Medical Protection Society. *Annual report*. London: Medical Protection Society, 1982:31.

(Accepted 4 August 1983)

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Addiction to aerosol treatment: the asthmatic alternative to glue sniffing

Experimenting with drugs, ranging from illegal and addictive drugs to apparently harmless and commonly used substances, is common in adolescence and includes glue sniffing and inhalation of domestic aerosols. We report on a girl with asthma who abused her bronchodilator aerosols.

Case report

A 17 year old girl was referred to Brompton Hospital because she required a canister of beclomethasone and salbutamol weekly to "control" her asthma. She had had asthma, hayfever, and eczema from 1 year of age. Her usual treatment consisted of salbutamol and beclomethasone aerosols, beclomethasone and cromoglycate nasal sprays, and oral aminophylline.

She admitted to having inhaled excess drugs from 12 years of age, when, out of curiosity and in defiance of a warning on the packet, she had inhaled excess beclomethasone and became amnesic for one hour. Further experimentation with excessive inhalations produced transient, pleasurable hallucinations, with maximum effect from inhaling the entire contents of a canister. Salbutamol was as effective as beclomethasone. She did this compulsively whenever she obtained a fresh canister, and her addiction led her to solicit aerosols from friends and to consider stealing from a local pharmacy. She was concerned about the detrimental effect her abuse might have on her asthma and became ambivalent about her addiction. Nevertheless, she continued to abuse her aerosol treatment during weekend leave from hospital. While in hospital she used a placebo canister and experienced a similar "high" with no observed change in electrocardiographic and vitalographic recordings.

She had no discernable psychiatric or domestic stress factors. Her aerosol drugs were subsequently prescribed as inhalation capsules (Rotacaps) to aid withdrawal, and we are unaware of her having had further problems.

Comment

Pressurised aerosols are effective for treating airways obstruction and have been prescribed extensively. The patient controls this treatment, and monitoring drug consumption is difficult. If excessive use is recognised physicians generally assume it is in response to worsening airways obstruction rather than addiction. Few cases of dependency on inhalers have therefore been reported. The first report was a 51 year old woman who used multiple inhalations of salbutamol, as well as salbutamol tablets, to treat her hyperventilation and found that "salbutamol made her feel bright, alert, and forgetful of her anxieties."¹ Subsequently Edwards and Holgate reported on a 24 year old man with asthma who used 60-90 inhalations daily whether he had bronchospasm or not.² Only two other patients, both 15 years old, who used salbutamol aerosols to excess have been described.³ One experienced euphoria and suffered grand mal convulsions; the other used excessive inhalations of salbutamol to make his asthma less conspicuous and found that it increased his confidence.

Most probably our patient depended not on the salbutamol and

beclomethasone components of her aerosols but on the fluorinated hydrocarbons used as the propellant. Addiction to fluorocarbons, which are used in domestic aerosols, results in euphoria and intoxication.¹ Fluorocarbons may cause cardiac arrhythmias and electroencephalographic changes, and many deaths have been described.¹ The serum concentrations of fluorocarbons achieved when patients abuse their inhalers are not known. Not all fluorocarbons can be readily measured, different manufacturers use different propellants, and few studies have been performed. In one study inhalation of three 25 µl doses (115 mg of propellant) produced arterial blood concentrations of 1.7 mg of one of the fluorocarbon components.^{1,5} Commonly used aerosol canisters deliver 63 µl doses containing about 85 mg of fluorocarbon, which would give higher serum concentrations. Our patient inhaled up to 400 doses of drug and fluorocarbon (34 g) at one time, and considerably raised blood concentrations must have occurred.

Less severe forms of abuse of inhalers may possibly be common, especially in younger age groups. If excessive use of aerosol treatment is noted dependence should be suspected, especially when the asthma is mild. Psychiatric intervention and the use of inhalation capsules may be helpful in preventing morbidity and mortality.

We thank Dr B Woods for referring this patient to us.

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⁴ Bass M. Sudden sniffing death. *JAMA* 1970;**212**:2075-9.

⁵ Dollery CT, Draffan GH, Davies DS, Williams FM. Blood concentrations in man of fluorinated hydrocarbons after inhalations of pressurised aerosols. *Lancet* 1970;ii:1164-6.

(Accepted 4 August 1983)

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Does metabolic bone disease follow truncal vagotomy and gastrojejunostomy?

Up to 20% of patients who have undergone partial gastrectomy have been found to have metabolic bone disease 10 years later. Alleged causal factors are reduction of appetite, reduced intake of dairy food due to dumping, intolerance of milk, a feeling of fullness, malabsorption, raised concentrations of faecal fat, and diarrhoea. Postoperative reduction of acid decreases absorption of calcium. These effects may all be encountered after truncal vagotomy and gastrojejunostomy. Total bypass of the duodenum, where calcium and vitamin D are maximally absorbed, is not essential as metabolic bone disease has been described after partial gastrectomy with gastroduodenal anastomosis.¹ Theoretically, therefore, metabolic bone disease might be expected after truncal vagotomy and gastrojejunostomy. We studied a group of patients for metabolic bone disease eight to 15 years after they had undergone truncal vagotomy and gastrojejunostomy for chronic duodenal ulceration.

Patients, methods, and results

In the course of a postoperative review² we studied 69 patients (54 men and 15 women; mean age 55.3 years) eight to 15 (mean 11.2) years after

truncal vagotomy and posterior gastrojejunostomy for chronic duodenal ulcer to assess the incidence of metabolic bone disease.

Corrected serum calcium concentrations and alkaline phosphatase activities were measured by autoanalyser, as were serum bilirubin concentrations and aspartate aminotransferase activity to exclude a hepatic cause of raised alkaline phosphatase activity. Bone mineral content was measured by photon absorptiometry with a Norland-Cameron 178 bone mineral analyser.³ Reduced bone mineral content usually indicated osteoporosis, but if alkaline phosphatase activities were raised in addition osteomalacia was diagnosed. Faecal fat was measured over three days. A dietary survey was carried out over four days. Corrected serum calcium concentration was below 2.2 mmol/l (8.8 mg/100 ml) in two patients, and alkaline phosphatase activity was above the laboratory normal of 91 IU/l in three patients (above 120 IU/l in one), in all of whom tests of liver function and bone mineral concentrations were normal. In one patient the bone mineral content was more than 2 SD below the mean for the patient's age and sex (estimated from 114 volunteers); serum calcium concentration and alkaline phosphatase activity and a biopsy specimen of iliac crest bone were normal in this patient.

Mean intakes of energy, protein, fat, and carbohydrate were no different in patients with bone mineral concentrations more than 1 SD below the mean. Dietary intake of calcium was below 500 mg/day in one patient whose bone mineral content was normal. Dietary intake of vitamin D was below 2.5 µg/day in 35 patients (51% of the series) and below 1.25 µg/day in 12 of these (17%). Mean intake of vitamin D was 2.4 µg/day in patients with a bone mineral content more than 1 SD below the mean and 1.9 µg/day in the others. One patient with a raised alkaline phosphatase activity had a vitamin D intake of 1.9 µg/day. Symptoms and steatorrhoea after vagotomy were not related to abnormal biochemical values or reduced bone mineral content. Stress fractures did not occur.

Comment

This study failed to show an increased incidence of metabolic bone disease eight to 15 years after truncal vagotomy and gastrojejunostomy. Although dietary intake of vitamin D was generally low, confirming previous studies,⁴ there were no detectable metabolic consequences over this period. Inadequate intakes of energy and calcium were not shown, although they have been commonly found after gastrectomy and in association with bone disease after gastrectomy.

Osteomalacia after gastrectomy has been diagnosed in previous series by the finding of raised alkaline phosphatase activity in 10-20% of patients. Raised activities, however, are also found in patients with liver disease (excluded by biochemical tests in this series), patients who have not fasted, patients with blood group O (who are in excess in a population with duodenal ulcer), and patients with steatorrhoea, which is a common problem after gastric surgery. When histological examination of bone is not possible osteomalacia should be diagnosed only if raised alkaline phosphatase activities are found in association with reduced bone mineral content. Radiological methods of assessing demineralisation are poor, but photon absorptiometry is simple to carry out, is reproducible, and correlates with total body calcium and bone mineral content measured by ashing.⁵ The one patient with low bone mineral content was statistically expected, and this patient volunteered to undergo biopsy of the iliac crest, which yielded normal results.

This series of 69 patients showed no clinical evidence of osteoporosis or osteomalacia 11 years after vagotomy and gastrojejunostomy.

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(Accepted 18 August 1983)

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