

autopsy;^{3,5} cerebral cell atrophy in relation to the metabolic disorder is also a possibility.

We conclude that children with nephropathic cystinosis have cortical and subcortical atrophy after 10 to 20 years of age, and this feature suggests specific central nervous system complications, which are not yet fully understood.

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Received 9 December 1985

Myocarditis after triple immunisation

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SUMMARY We describe a 3 month old infant who developed myocarditis several hours after diphtheria, tetanus, and pertussis vaccination. The time of occurrence of symptoms, the clinical course, and the negative virological studies suggest a possible cardiogenic adverse reaction to the vaccine.

Severe systemic adverse reactions after diphtheria, tetanus, and pertussis vaccination are uncommon and include extreme irritability, collapse or shock like episodes, convulsions, and encephalopathy.^{1,2} Cardiac side effects associated with this vaccination have been reported rarely and are most probably related to the pertussis component of the vaccine.^{3,4} To the best of our knowledge, myocarditis after the vaccination has not been reported. We describe a case of acute myocarditis that developed a few hours after diphtheria, tetanus, and pertussis vaccination.

Case report

A 3 month old infant was admitted to our hospital 24 hours after receiving his second diphtheria, tetanus, and pertussis and oral polio vaccination because of severe respiratory distress and cyanosis. The infant was delivered at term, weighing 3250 g, and had had an uneventful neonatal period. The first diphtheria, tetanus, and pertussis and trivalent oral polio virus immunisation was administered at 6 weeks without

any adverse reaction. The parents stated that the child had been normal and playful until 12 hours after the second administration of the vaccines, when irritability and mild respiratory difficulties appeared.

On admission, physical examination revealed a 3 month old, well nourished, well developed, acutely ill infant. The temperature was 38.5°C, pulse rate 200 beats/minute, and respiration rate 150/minute. His colour was ashen, and a mild oedema of the extremities was evident. On auscultation the heart sounds were of poor quality, occasionally a gallop rhythm was heard, and no murmurs were audible. The lungs were clear, and the liver edge was palpated 5 cm below the right costal margin. All the peripheral pulses were weak. The capillary blood gases showed metabolic acidosis with pH 6.7, carbon dioxide tension 28 mm Hg, oxygen tension 67 mm Hg, base excess -28 mM/l, and bicarbonate 5 mM/l. White blood count was $20.6 \times 10^9/l$, with 70 per cent lymphocytes; haemoglobin 93 g/l; serum urea nitrogen and creatinine 14 mmol/l and 90 mmol/l, respectively. The sodium, potassium, and calcium concentrations were normal.

The serum creatine phosphokinase activity rose abruptly to 348 IU/l (normal is 5-80 IU/l) on the second day after admission, reflecting myocardial damage. An electrocardiogram disclosed low voltage QRS complexes on limb leads and non-specific ST changes and T wave flattening on precordial leads. X ray film showed generalised cardiac en-

Table *Echocardiographic findings during the illness and after recovery*

	Study at six weeks	Study at 10 months	Normal values according to weight ⁵
Left atrial dimension (cm)	3	2	1.7-2.7
Left ventricular systolic dimension (cm)	4.1	2.1	—
Left ventricular diastolic dimension (cm)	4.6	2.8	2.4-3.8
Left ventricular ejection fraction (%) [*]	0.20	0.44	≥0.50

^{*}Estimated according to Teicholz's formula.

largement. The result of pertinent echocardiographic findings recorded using a M-Mode echocardiogram were as follows (Table):

(1) An increased left ventricular diastolic (4.6 cm) and systolic (4.1 cm), dimensions that are consistent with the enlargement of the left ventricular chamber.

(2) Moderately enlarged left atrium.

(3) Intraventricular septum with normal thickening (0.5 cm) but a diminished excursion, 0.3 cm (normal is 0.5-0.7 cm).

A diagnosis of heart failure probably secondary to myocarditis was made. The infant was placed on oxygen, digitalised intravenously, and diuretics were given. He remained severely distressed for 48 hours, after which a moderate gradual improvement was noticed. The heart rate dropped smoothly back to expected levels for his age. Subsequently, he made uneventful recovery. Serial chest x ray examination showed progressive resolution of the cardiac enlargement. The electrocardiogram showed persistent widespread non-specific ST and T wave changes but returned to normal four months later. At 7 months of age he was given his third trivalent oral polio virus vaccine. No complications were observed; pertussis, tetanus, and diphtheria vaccine boosters, however, were not administered.

A M-Mode echocardiogram at 10 months showed a normal atrial and ventricular size with only a slight decrease in left ventricular ejection fraction (Table). At this stage treatment with digoxin was stopped. Follow up examinations showed normal growth and development.

Virological studies. Throat and rectal swabs taken on the second and 14th days of illness inoculated into tissue culture did not yield any cytopathic viral agent. Because of technical reasons poliovirus isolation was not performed. Complement fixing viral antibodies were studied using a microneutralisation test, which included Cocksackie B1-5 and A9, echo 4, 6, 9, 14, 24, 30, respiratory syncytial, mumps, herpes, adeno, influenza A, and influenza B virus antigens. No change in the complement fixing antibody titre was observed during the illness and convalescence. A raised neutralising antibody titre against all three polioviruses was observed during

admission to hospital and follow up, most probably reflecting a fair immunological response to the first oral polio vaccination administered at 6 weeks (polio 1 and 2: titre of 64; polio 3: titre of 256). No change occurred in the poliovirus antibody titre throughout the course of illness.

Discussion

Cardiac complications and specifically myocardial damage after diphtheria, tetanus, and pertussis and other vaccinations are rare. Helle *et al* found electrocardiogram changes suggestive of myocarditis without evidence of cardiac disease in 3% of a study population consisting of new army recruits after vaccination against diphtheria and smallpox.³ In addition, several episodes of paroxysmal supra-ventricular tachycardia were observed within a few hours after diphtheria, tetanus, and pertussis immunisation in a 2 month old infant prone to paroxysmal supra-ventricular tachycardia. Diphtheria and tetanus toxoids, however, failed to induce paroxysmal supra-ventricular tachycardia, implicating the pertussis component of the vaccine in the case,⁴ and the authors speculate that manifestations such as extreme irritability, collapse, or shock like episodes observed in children three to six hours after diphtheria, tetanus, and pertussis vaccination may have a cardiogenic origin. Our patient developed signs of cardiac failure several hours after receiving triple vaccination. The possibility that a viral infection might have been responsible for myocardial damage in our patient cannot be definitely excluded. The negative viral serology and cultures observed during his illness and convalescence, however, make this a remote possibility. Moreover, the rapid recovery of our young patient is rather unusual for fulminant myocarditis at this age.

We believe that the myocardial reaction described was associated with the diphtheria, tetanus, and pertussis vaccination. Of the three components of the vaccine, either the diphtheria or the pertussis component probably provoked the myocardial damage. We therefore intend to complete the infant's basic immunisation with tetanus toxoid only.

Although cardiac involvement after diphtheria,

tetanus, and pertussis vaccination is apparently rare, we concur with the suggestion that evaluation of cardiac state—that is, x ray films, electrocardiography, echocardiography, and tests for myocardial enzymes—should be performed in recently vaccinated infants who manifest tachycardia, extreme irritability, or shock like episodes.⁴

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Received 27 November 1985

Diffuse varioliform gastritis

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SUMMARY Diffuse varioliform gastritis in a 10 year old girl is reported. The girl has been followed for four years. Biopsy specimens taken before and after three months' treatment with sodium cromoglycate showed a considerable fall in chronic inflammatory infiltrate. A rapid clinical improvement was also observed.

Diffuse varioliform gastritis is an uncommon type of chronic inflammation of the gastric mucosa, characterised by scattered erosions situated on discrete mucosal elevations, causing radiological and endoscopic ('varioliform') appearances. Immunohistochemical and clinical studies have provided evidence that this form of gastritis may have an allergic basis, or at least that type 1 hypersensitivity plays some role in its pathogenesis.^{1,2} This lesion of the gastric mucosa occasionally occurs after ingestion of anti-inflammatory drugs such as aspirin, indomethacin, phenylbutazone, and salazopyrin.

Case report

A 10 year old girl was referred to our department with epigastric pain, anorexia, and nausea, which had been increasing over a period of six months. Apart from evidence of recent weight loss (4 kg), there were no abnormal findings on physical examination. Antacid drugs and a three week course of cimetidine had been unsuccessful. No drugs were taken before the onset of the symptoms. The girl

had been treated in hospital only once before, at the age of 4, for bronchial asthma. Her father suffered from duodenal ulceration. No other member of the family suffered from allergic disorders.

A double contrast barium examination of the stomach showed many radiolucent haloes with or without a central barium spot. The entire mucosa was involved (Fig. 1). The small intestine and colon were normal on barium examination.

At gastroscopy, erosions with a diameter of 3–5 mm surrounded by a ring elevation of mucosa (Fig. 2) were found in the antrum, in the body and the fundus of the stomach.

Histology of gastric biopsy specimens showed diffuse infiltration in the lamina propria by many lymphocytes, plasma cells, and some polymorphonuclear leucocytes. The glands showed hyperplasia without loss of specialised cells. No atypical cells were found.

Total serum protein and iron concentrations, sedimentation rate, and erythrocyte and leucocyte counts were normal. Serum eosinophil concentrations were 270×10^6 cells/l. The serum IgG concentration was 18.2 g/l (normal 7–16.5 g/l), IgE 290 KIU/l (normal 48–120 KIU/l), IgA 1910 mg/l (normal 290–2700 mg/l), and IgM 1630 mg/l (normal 500–2600 mg/l). In the saliva the IgA concentration was 12.1 mg/l (normal 28–150 mg/l) and IgE 14.3 KIU/l. C₃ and C₄ concentrations were normal. The tests of cell mediated immunity and T and B lymphocyte populations in the blood yielded normal results, with the exception of T helper, which was slightly decreased ((OKT4) 39.7% (normal 54.5 ± 6.5%).)