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Virus-like particles in paraspinal muscle in scoliosis

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Summary

Biopsy material from the skeletal muscle (paraxials) of 21 patients with scoliosis was examined by light and electron microscopy. Virus-like particles, 17 nm in diameter with a crystalline structure, were identified in the skeletal muscle fibres of four patients. Associated changes in the sarcoplasm included swelling of mitochondria, presence of lipid droplets, and vesicular structures. Serological studies and culture for virus isolation gave negative results. An excess of lipid (predominantly in type 1 fibres) was noted in the skeletal muscle of several other cases. The significance of these findings is obscure, but the morphology of the paraxial muscles of patients with scoliosis and controls is currently being investigated in greater detail.

Introduction

Idiopathic scoliosis is a crippling and distressing disorder of childhood, most cases occurring in young girls. Pathological studies of the musculoskeletal system have not succeeded in elucidating the cause of the condition.¹ Scoliosis secondary to neurological disease or myopathic processes is well recognised,² and it is therefore tempting to speculate that an undisclosed disorder affecting muscles of the spine might be responsible for causing the condition. Nevertheless, clinical³ and traditional histological methods have failed to show any important abnormalities. Hirano⁴ in an electronmicroscopical study has described degenerative changes in the back muscles of patients with idiopathic scoliosis. It was suggested on the basis of these findings that a myopathic process might be implicated in the aetiology of the condition.

Patients and methods

Through the kindness of colleagues at the Princess Margaret Rose Orthopaedic Hospital, Edinburgh, we have had the opportunity of

examining biopsy specimens of skeletal muscle (taken from paraspinal muscles: rotators and multifidus) from 21 patients with scoliosis; 12 had idiopathic disease, seven had congenital scoliosis, and two had neurofibromatosis. At open exposure of the spine for intra-articular fusion, or at revision, blocks of muscle tissue were taken from each side from the deeper parts of the paraspinal muscles at the apex of the curve. Frozen sections were cut for histological and histochemical study, and 1-mm³ pieces of tissue were fixed in 2.5% buffered glutaraldehyde for electron microscopy.

Results

No definite histological abnormality was observed in the muscle on light microscopy and no appreciable changes were seen in the type 1 and type 2 fibres, as shown by the dihydronicotinamide adenine dinucleotide diaphorase and myosin adenosine triphosphatase (at pH 9.4) methods. In some cases a slight excess of intracellular lipid was noted, mainly in type 1 fibres. This was confirmed on electron microscopy (fig 1).

A wholly unexpected finding in four patients (see table) was the presence of virus-like particles within the muscle fibres (fig 2). They consisted of uniform electron-dense particles aggregated into a

FIG 1—Electron micrograph of skeletal muscle showing lipid droplets between myofibrils and beneath sarcolemmal membrane. ($\times 5957$.)

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crystalline pattern. The particles measured 17 nm in diameter and were situated between myofibrils. There were no appreciable degenerative changes in neighbouring myofibrils and there was no cellular reaction. An increase in lipid particles was, however, seen in the vicinity of the particles in one case, and in another the adjacent mitochondria were swollen and seemed degenerate (figs 3 and 4).

Details of four patients in whom virus-like particles were found in muscle fibres

Case No	Age (years)	Sex	Type of scoliosis	Operation
1	12	F	Adolescent idiopathic	Revision of spinal fusion
2	13	F	Adolescent idiopathic	Revision of spinal fusion
3	10	F	Congenital	Spinal fusion
4	10	M	Infantile idiopathic	Spinal fusion

FIG 2—Case 1. Electron micrograph of skeletal muscle showing aggregate of electron-dense virus-like particles with a crystalline structure. (× 39 067.)

FIG 3—Case 2. Electron micrograph showing virus-like particles (P) between myofibrils. Note swollen mitochondrion (M) and lipid droplets (L). (× 19 090.)

These particles were not seen anywhere else and were not observed in any extracellular site. Serological studies in these four patients failed to show raised antibody titres to the following: influenza A and B viruses, *Brucella*, *Leptospira*, adenovirus, *Chlamydia psittaci*, lymphogranuloma venereum virus, *Coxiella burnetii*, respiratory syncytial virus, *Mycoplasma pneumoniae*, mumps virus, herpes simplex virus, varicella zoster virus, measles virus, and Coxsackie B1-5 viruses. All attempts to isolate virus from biopsy specimens from two of the patients, in cell culture and in suckling mice, failed.

FIG 4—Case 3. Electron micrograph showing many small aggregates of virus-like particles (P) in skeletal muscle, swollen degenerate-looking mitochondria (M), and vesicular bodies (Ves). (× 21 538.)

Discussion

The virus-like particles within the skeletal muscle fibres of these patients with idiopathic scoliosis were remarkably similar to virus particles described in a child with a chronic myopathy.⁵ The virus was thought to be a picornavirus, and Coxsackie type A9 virus was isolated from this patient. Identical particles have also been described in the skeletal muscle fibres of a patient with Reye's syndrome.⁶ In an earlier report virus particles were observed in apparently normal eye muscles.⁷ Virus particles of different structure have also been reported in a case of chronic polymyositis.⁸

The implications of our findings are uncertain and our failure to isolate or implicate a virus from any of these four patients is puzzling. We cannot assess the importance of the apparent increase in intracellular lipid in the skeletal muscle in the absence of any comparable control biopsies. We are currently investigating in greater detail the histochemistry and ultrastructure of the paraxial muscles of scoliotic and control patients.

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