Anaesthesia for a patient with Friedreich's ataxia and cardiomyopathy

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Friedreich's ataxia is an inherited neuromuscular disorder often associated with significant cardiac disease. We report a case of Friedreich's ataxia in a 13-year-old girl with ulcerative colitis and hypertrophic cardiomyopathy who was successfully managed for subtotal colectomy with general anaesthesia and epidural narcotic. Anaesthetic considerations included the maintenance of fluid volume and stable cardiovascular variables in the intra- and postoperative periods.

Friedreich's ataxia is a familial neuromuscular disorder, transmitted in an autosomal recessive manner. It occurs equally in males and females[1,2] and is characterized by degeneration of the posterior columns and the corticospinal and spinocerebellar tracts. The main complaint is of ataxia, which is most marked in the lower limbs and often accompanied by dysarthria, nystagmus, and skeletal muscle weakness.[2] Cardiac involvement, not necessarily symptomatic, is found in over 90 per cent of subjects.[3]

The disease is usually steadily progressive and few patients survive more than twenty years after the onset of symptoms. Death, which is often sudden, is usually due to heart disease. The most commonly described abnormality is hypertrophic cardiomyopathy,[4] with histological changes consisting mainly of diffuse myocardial fibrosis, cellular hypertrophy, and necrosis of cardiac muscle fibres. It is not known why Friedreich's ataxia is accompanied by cardiac involvement, while phenotypically similar disorders (Charcot-Marie-Tooth disease, the cerebellar ataxias, Roussy-Levy syndrome) are seldom, if ever, associated with heart disease.

We report a patient with Friedreich's ataxia and cardiomyopathy who underwent anaesthesia for major bowel surgery under general anaesthesia supplemented by epidural narcotic. To our knowledge this is the first reported case of the use of epidural narcotic in a patient with this disease.

Keywords
ANAESTHESIA: general; ANAESTHETIC TECHNIQUES, REGIONAL: epidural, epidural narcotics; COMPLICATIONS: Friedreich's ataxia, cardiomyopathy; GENETIC FACTORS: Friedreich's ataxia; NEUROMUSCULAR RELAXANTS: vecuronium.

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Case report

A 13-year-old girl was first diagnosed as having Friedreich's ataxia at the age of 12 after presenting with a two-year history of abnormal gait. Apart from two affected cousins, the family history was negative.

Physical examination at the time of diagnosis revealed an ataxic gait with hyporeflexia, good muscle strength, and no scoliosis. She did not have any signs or symptoms of cardiovascular disease, although an electrocardiogram (ECG) and echocardiogram demonstrated mild left ventricular hypertrophy involving the interventricular septum (Table I).

Four months later the patient developed ulcerative colitis. A histological diagnosis was made following sigmoidoscopy and rectal biopsy under an uneventful general anaesthetic using oxygen, nitrous oxide, and halothane. An exacerbation of ulcerative colitis necessitated a further hospital admission two months after its onset, at which time a 2/6 systolic ejection murmur was noted. In addition to sulfasalazine (Salazopyrin) and hydrocortisone enemas, treatment with prednisone 35 mg daily was begun.

Ten days after discharge, she was re-admitted with a seven-day history of retrosternal chest pain. The pain, which occurred two to three times each day, was precipitated by effort and was associated with dyspnoea, but not with palpitations. Her ECG revealed deep Q-waves in the left precordial leads suggesting septal hypertrophy. Echocardiography showed a concentric hypertrophy: the interventricular septum was 20 mm thick (normal: 9–10 mm) and the left ventricular wall 19 mm thick (normal: 8–10 mm). There was mild aortic insufficiency and no evidence of left ventricular outflow obstruction.

TABLE I Cardiac history

11 months pre-op	*5 months pre-op*	*1 week pre-op*
Symptoms/signs		
No cardiac symptoms	Crushing chest pain, dyspnoea, palpitations; systolic murmur	No cardiac symptoms; systolic murmur
ECG		
Abnormal T-waves left chest	Deep Q-waves left chest → septal hypertrophy	Mild T-wave flattening V_5/V_6 → essentially normal
Echo		
Mild LV and septal thickening, posterior LV wall 11–14 mm.	Septal thickness 20 mm, posterior LV wall 19 mm. Thickened aortic valve leaflets.	Septum 17 mm, posterior wall 19 mm. Mild aortic and mitral insufficiency.
Normal function, no LV outflow obstruction.	No LV outflow obstruction. Shortening fraction 43%. Ejection fraction 75% (upper limit of normal).	Shortening fraction 37%. Ejection fraction 69%.
Enzymes		
	CK normal	
ECG stress test		
	#1: Stopped due to chest pain at 1.5 minutes (equivocal ECG changes) → β-blocker begun #2: Stopped at 3 minutes due to fatigue; no defects seen with Thallium-201 scan	
Cardiac catheterization		
	Asymmetrical aortic valve. Mild AI. Normal coronary arteries	

The shortening fraction was 43 per cent and the ejection fraction 75 per cent, both of which are at the upper limit of the normal range. The patient underwent a standard ECG stress test, but developed fatigue, chest pain, and non-specific ST/T-wave changes after only 1½ minutes. At cardiac catheterization she had an elevated left ventricular end–diastolic pressure and normal coronary arteries. After treatment with propranolol 30 mg daily, she had improved performance on a second ECG stress test, and a thallium scan showed no areas of myocardial ischaemia.

She remained well for a further four months, then suffered an exacerbation of ulcerative colitis which was resistant to medical treatment. She was scheduled for a subtotal colectomy eight months after developing ulcerative colitis and eleven months after the diagnosis of Friedreich's ataxia.

Preoperative examination showed an intelligent, Cushingoid, 44.5 kg, 13-year-old girl. Her speech was slightly dysarthric and she had an ataxic gait, upper limb ataxia, reduced muscle strength, and absent tendon reflexes. There was a grade 2/6 systolic ejection murmur in the aortic region and no signs of heart failure. Cardiovascular investigations are described in Table I.

Her haemoglobin was 159 $g \cdot L^{-1}$. Blood electrolytes, liver function tests, and blood gas analysis were all within normal limits.

Premedication consisted of diazepam 12.5 mg orally, two hours preoperatively. Anaesthesia was induced with IV thiopentone 150 mg, vecuronium 6 mg, and sufentanil 40 μg, via a 24-gauge peripheral cannula. In addition, hydrocortisone 100 mg and antibiotic prophylaxis were administered. The trachea was intubated and intermittent positive pressure ventilation was initiated with nitrous oxide 66 per cent in oxygen and adjusted to provide an end–tidal carbon dioxide level of 30 mmHg.

A 16-gauge cannula was placed in a peripheral vein and

the right radial artery was cannulated. A 7-FG flow-directed pulmonary artery catheter was inserted via the right internal jugular vein. Monitoring included ECG (leads II and modified V_5), capnography, oxygen saturation, and cardiac output measurements by thermal dilution.

With the patient in the left lateral position, an 18-gauge epidural catheter was inserted without difficulty in the L_{3-4} interspace and an initial dose of preservative-free morphine, 4 mg in 8 mL of physiological saline solution, was injected.

The patient was re-positioned supine on a warming blanket and all monitoring equipment re-calibrated. Anaesthesia was maintained using nitrous oxide in oxygen and increments of sufentanil as judged clinically necessary, and vecuronium when indicated by means of a train-of-four neuromuscular blockade monitor. Halothane was introduced intermittently in concentrations of 0.2–0.5 per cent. A total of 24 mg vecuronium and 150 μg (0.61 $\mu g \cdot kg^{-1} \cdot hour^{-1}$) sufentanil were given. No further doses of epidural morphine were administered.

The total duration of the procedure was 5½ hours and the estimated blood loss 350 mL. During this time fluid was replaced by three litres of crystalloid solutions, 600 mL of plasma, 250 mL of five per cent albumin, and one unit of packed red cells. Urine output for the operative period was 500 mL.

Perioperative haemodynamic variables are described in Table II. Fluctuations in heart rate and blood pressure appeared to be related to volume rather than to stress or light anaesthesia. They responded to fluid replacement and were supported by concurrent CVP and pulmonary artery wedge pressure (PAWP) measurements.

Following surgery the patient was transferred to the intensive care unit and her lungs were ventilated for a further two hours. She then breathed spontaneously on a CPAP circuit until the following morning, when she was extubated. One further dose of epidural morphine, 3 mg, was required on the night of surgery. No analgesia was necessary the following day and the epidural catheter was removed. The patient received meperidine on the third postoperative day.

The patient made an uneventful recovery and was discharged from hospital on the ninth day after surgery. Follow-up visits several months later showed no significant changes in her neurological or cardiac condition.

Discussion

The high incidence of cardiac lesions in Friedreich's ataxia has long been recognized. Indeed, Friedreich, in his first description, recognized an associated involvement of the heart.[5] This has led to the suggestion that Friedreich's ataxia is a "neurocardiac" disease,[6] and that the term Friedreich's ataxia should be replaced by Friedreich's Disease.[7]

The cardiac symptoms are well documented[2,8–11] and consist of palpitations, retrosternal pain, angina, and progressive heart failure. They may be manifested at any time during the course of the neurological disease,[4] and may even be the presenting symptom. Heart disease at presentation of Friedreich's ataxia is evident in 86–95 per cent of patients investigated,[3,4] depending on the diagnostic criteria used, while long-term follow-up shows cardiac involvement in 100 per cent of patients. Cardiomyopathy may be the presenting feature without evidence of ataxia, and a diagnosis of Friedreich's ataxia should be considered in children with unexplained cardiomyopathy.[10] The severity of the cardiomyopathy may not correlate with that of the neurological condition.[11,12]

A small proportion of patients may have a cardiomyopathy with asymmetric septal hypertrophy and left ventricular outflow tract obstruction, characteristic of hypertrophic obstructive cardiomyopathy. However, most workers would agree that this is not typical of the cardiomyopathy in Friedreich's ataxia. The more common echocardiographic finding is of a concentric left ventricular thickening without outflow tract obstruction. This was the case in the patient described.

The anaesthetic technique described was chosen to minimize changes in haemodynamic variables. We wished to avoid tachycardia and major alterations in systemic vascular resistance or blood pressure, and to maintain normovolaemia. Nitrous oxide and sufentanil were used to minimize anaesthetic-induced myocardial depression. Vecuronium was chosen as the muscle relaxant since it has no effect on heart rate or blood

TABLE II Perioperative haemodynamic variables

	Induction	*2 hr*	*2½ hr*	*3 hr*	*5 hr*	*ICU*
HR	82	95	95	78	62	75
systolic BP	98	100	78	102	95	120/70
CO		4.9	3.0	3.6	3.5	
CVP		7	2	6	6	
PAWP		13	7	14	15	
S_aO_2	100	100	100	100	100	99

pressure and causes little or no histamine release. Our patient responded normally to vecuronium and increments were necessary at anticipated intervals.

Morphine, administered by the epidural route, provides excellent long-lasting analgesia without the need for further needles or injections. This method of analgesia was employed in an effort to reduce stress-induced tachycardia and hypertension, particularly in the postoperative period. Neurological disease has been stated to be a relative contraindication to epidural analgesia,[13] in that any natural progression of the disease may be attributed to the epidural injection resulting in litigation. No information is currently available on the use of epidural narcotic in Friedreich's ataxia. However, it was felt that the superior analgesia provided by this technique outweighed any theoretical disadvantages.

In order to avoid anxiety and discomfort, pre-induction interventions were kept to a minimum. Therefore, all invasive monitoring devices and the epidural catheter were inserted following the induction of anaesthesia. The epidural space was identified by loss of resistance to saline. No test dose of local anaesthetic or epinephrine was given to establish catheter location for several reasons. Subarachnoid or even epidural injection of local anaesthetic could have resulted in undesirable vasodilatation, whereas intravenous epinephrine would have resulted in a potentially dangerous tachycardia. The planned dose of morphine injected into a vein or the subarachnoid space would have resulted in, respectively, markedly shortened or prolonged effect, but would have had little influence on haemodynamics.

For reasons already stated, the pulmonary artery catheter was inserted following induction of anaesthesia. Therefore, our information on the haemodynamic effects of anaesthesia in Friedreich's ataxia is incomplete. However, it provided valuable intraoperative information on haemodynamic variables. Decreased CVP and PAWP values confirmed the cause of a falling blood pressure and allowed appropriate fluid replacement. Hypotension in this patient occurred quickly and was not accompanied by a compensatory tachycardia, so measurement of cardiac filling pressures was important. Although, in this case, CVP measurements correlated well with PAWP values and provided adequate information on cardiovascular status, we feel that PA line insertion may often be indicated in these patients.

Epidural morphine provided excellent postoperative analgesia and did not have any deleterious effect on cardiovascular variables. There was no respiratory depression and arterial blood gases were consistently good. There were no apparent side effects and no alteration in the neurological state of the patient.

In summary, in patients with Friedreich's ataxia presenting for surgery, myocardial involvement should be sought. Investigation should include ECG and echocardiography, and cardiac catheterization and ECG stress testing may be required.

In those patients with evidence of cardiomyopathy, the management of anaesthesia should be directed towards maintaining a stable haemodynamic profile with the avoidance of tachycardia and the preservation of a normal preload and afterload. Nitrous oxide combined with a non-depolarizing relaxant and a narcotic with minimal effects on the circulation would seem to be appropriate. Invasive monitoring of arterial and cardiac filling pressures is helpful. Prompt replacement of blood loss and generous intravenous fluid administration guided by cardiac filling pressures are essential for maintaining normovolaemia and a normal blood pressure. We found the use of epidural narcotic to be most satisfactory and without untoward effects.

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Résumé

L'ataxie de Friedreich est une maladie neuromusculaire familiale souvent associée à des troubles cardiaques significatifs. On rapporte le cas d'une jeune fille de 13 ans atteinte d'ataxie de Friedreich, de colite ulcéreuse et d'une cardiomyopathie hypertrophique ayant subi avec succès une colectomie sub-totale sous anesthésie générale et analgésie épidurale aux narcotiques. Les considérations anesthésiques comprennent le maintien d'une volémie et d'un état hémodynamique stable dans la période per et postopératoire.