follow up evaluation showed no significant overall time effect ($F(7,56)=1.01$; NS). There was a significant time effect for the Perdue pegboard test ($F(1,14)=30.9$; $p<0.0001$), with a significant improvement in manipulative dexterity over time. A repeated measures MANOVA for the neuropsychological variables comparing patients with either a left ($n=7$) or right ($n=9$) pallidotomy showed no significant group effect ($F(1,7)=0.05$; NS), time effect ($F(1,7)=1.03$; NS), or group $\times$ time interaction ($F(8,56)=0.22$; NS).

A repeated measures MANOVA for the neuropsychological variables for the 10 patients who had undergone pallidotomy (six right, four left) with a 12 month follow up and the 20 non-operated patients with Parkinson's disease did not show a significant group effect ($F(1,23)=0.29$; NS), time effect ($F(1,23)=0.43$; NS), or group $\times$ time interaction ($F(7,161)=0.18$; NS). On the other hand, there was a significant group $\times$ time interaction for the Perdue pegboard test ($F(1,28)=8.84$; $p<0.01$): the pallidotomy group showed a significant improvement during the follow up period, whereas the control group had a slight decline.

Most studies on the cognitive sequelae of pallidotomy could not show significant neuropsychological deficits after surgery,³ and the only studies that to our knowledge included a non-operated Parkinson's disease control group (Perrine *et al*⁸ and the present one) confirmed this finding. On the other hand, Lang *et al*⁹ reported some cognitive impairments after ventral pallidotomy; and differences in neuropsychological outcome measures may account for this discrepancy. We examined the neuropsychological sequelae of pallidotomy in a consecutive series of 16 patients with Parkinson's disease, 10 of whom had a 1 year follow up evaluation. When compared with a group of 20 patients with Parkinson's disease matched for MMSE scores and age who did not receive a pallidotomy, no significant between group differences were found in the rate of cognitive changes. On the other hand, the pallidotomy group showed a significant improvement on a task measuring manual dexterity compared with the control Parkinson's disease group. The question now arises as to why pallidotomy in Parkinson's disease does not produce significant cognitive deficits, given that some case reports described various intellectual problems after spontaneous pallidal lesions. Firstly, most lesion studies included patients with bilateral lesions, whereas pallidotomy is usually performed on one side only. The few reports of bilateral pallidotomy in Parkinson's disease described important cognitive sequelae in some of the patients. Secondly, pallidotomy usually produces a small and localised lesion, whereas

spontaneous pallidal lesions are usually larger and often involve white matter tracts next to the pallidum. Finally, some of our pallidotomy patients were tested three or four times, compared with only two neuropsychological evaluations for the control group, which may have produced some learning effects.

This study was partially supported by a grant from the Raul Carrea Institute of Neurological Research-FLENI and the Fundación Perez Companc. We thank Fred Bylsma PhD for his useful suggestions.

G KUZIS

L SABE

C TIBERTI

F DORREGO

S STARKSTEIN

Department of Neuropsychiatry, Raúl Carrea Institute of Neurological Research FLENI, Montañeses 2325, 1428 Buenos Aires, Argentina

M MERELLO

S STARKSTEIN

Department of Clinical Neurology

Correspondence to: Dr G Kuzis
ses@fleni.org.ar

1 Scott RB. Cognitive function and pallidotomy. *J Neurol Neurosurg Psychiatry* 1998;65:148.

2 Merello M, Nouzeilles M, Kuzis G, *et al*. Unilateral radiofrequency lesion versus electrostimulation of posteroventral pallidum: a prospective randomized comparison. *Mov Disord* 1999;14:50-6.

3 Lund-Johansen M, Hugdahl K, Wester K. Cognitive function in patients with Parkinson's disease undergoing stereotaxic thalamotomy. *J Neurol Neurosurg Psychiatry* 1996;60:564-71.

4 Perrine K, Dogali M, Fazzini E, *et al*. Cognitive functioning after pallidotomy for refractory Parkinson's disease. *J Neurol Neurosurg Psychiatry* 1998;65:150-4.

5 Lang AE, Lozano A, Tasker R, *et al*. Neuropsychological and behavioral changes and weight gain after medial pallidotomy. *Ann Neurol* 1997;41:834-5.

Response to botulinum toxin in a case of rigid spine syndrome

First described by Dubowitz in 1965,¹ rigid spine syndrome represents an axial congenital merosin positive muscular dystrophy with early, predominant rigidity of the spine as its main characteristic trait. The illness begins at an early age with a delay in motor development, and affects more boys than girls; however, in some cases onset occurs slightly later when weakness of proximal limb muscles appears in a previously otherwise asymptomatic child. In all cases a limitation of neck and trunk flexion develops and scoliosis appears either simultaneously or in the ensuing years; later on the disease may progress slowly or tend to stabilise. Other features that accompany the musculoskeletal signs are respiratory disturbances and cardiac changes.² Recently, a first locus for this syndrome has

been identified on chromosome 1p.³ In laboratory studies serum creatine kinase concentrations can be raised. Electromyographic studies of paracervical musculature, trapezius, deltoid, biceps, and quadriceps show a myopathic pattern with normal nerve conduction velocities. Biopsy findings disclose non-specific myopathic changes with descriptions of type I fibre predominance, type II fibre predominance and fibre type disproportion; electron microscopic studies have detected the presence of Z band streaming.

It is important to distinguish rigid spine syndrome from other diseases in which rigidity of the spine can appear, such as Duchenne and Becker's muscular dystrophies, and principally from Emery-Dreifuss muscular dystrophy and from early onset ankylosing spondylitis, as prognoses are different. The rigid spine sign has also been reported in Bethlem myopathy and congenital myopathies such as nemaline myopathy. As in other muscular dystrophies, no more than supportive care can be offered to patients with rigid spine syndrome; surgical correction has been attempted on one occasion with success.⁴ Here we report a good response to botulinum toxin type A (BOTOX) treatment in a young man with rigid spine syndrome.

A 15 year old boy born at term, with congenital hypospadias surgically corrected and normal psychomotor development, was being studied by an endocrinologist because of short stature (mother's stature 145 cm, father's stature 169 cm) who noticed progressive neck flexion limitation and referred him to our institution. At admission on 8 July 1996, he complained of back pain since the previous year, which was more severe at rest; his mother had noticed a gait disturbance and that his back was progressively bending forward. General examination was normal; neurological examination showed no abnormal findings, and strength was completely preserved in all four limbs. He had marked postural kyphosis and contracture of neck extensors severely limiting movement in the anterior and lateral senses; hip flexion was severely affected (below 30°); no pain was produced by sacral manoeuvres. Radiological examination of the cervicothoracic spine showed scoliosis without vertebral malformations, 65° cervical lordosis involving C2 to C7, and a 55° thoracic kyphosis involving T3 to T12. Routine blood testing showed no abnormalities and creatine kinase concentrations were normal; autoantibodies routinely tested were negative. Complete spine MRI studies ruled out vertebral malformations. An ECG and radiography of the chest were normal. Radiological study of sacral joints was normal and the patient was not HLA-B27 positive. An EMG study showed a myopathic pattern (paraspinal musculature, periscapular musculature, and right quadriceps) with

Table 1 Schedule, place, and amount of botulinum toxin injection

Injected muscle	1996		1997			1998
	July	October	January	May	September	January
Trapezius	50 UI BOTOX® (each trapezius)	30 UI BOTOX® (right trapezius)	30 UI BOTOX® (each trapezius)	20 UI BOTOX® (each trapezius)	20 UI BOTOX® (each trapezius)	10 UI BOTOX® (each trapezius)
Esternocleidomastoid (ECM)		30 UI BOTOX® (each ECM)	30 UI BOTOX® (Each ECM)			
Paracervical musculature					20 UI BOTOX® (each side)	15 UI BOTOX® (each side)

The patient received 50 IU BOTOX® (Allergan) in three different locations of each trapezius on 17 July 1996; on 24 October 1996, 30 IU BOTOX were administered in each esternocleidomastoid and 30 IU in right trapezius; on 22 January 1997 30 IU BOTOX were given in each esternocleidomastoid and trapezius; on 21 May 1997 20 IU BOTOX were given in each trapezius; on 25 September 1997 40 IU BOTOX were given in each trapezius and bilateral paracervical musculature (total 80 IU); on 15 January 1998 10 IU BOTOX were given in each trapezius and 30 IU in paracervical musculature bilaterally.

Figure 1 Three different photographs in which progressive amelioration in neck flexion is seen. To make this change objective, we measured the angle between a line joining nasion and tragus and another prolonging the sternum surface. (A) Photograph taken on 22 January 1997. (B) Photograph taken on 24 September 1997. (C) Photograph taken on 15 January 1998.

no abnormalities in nerve conduction. A biopsy of paraspinal musculature was performed and the neuropathological study of the muscle showed non-specific myopathic changes, including slight variability in muscle fibre size, occasional moth eaten fibres, and dilatations of the smooth endoplasmic reticulum, which were filled with fine granular material. The distribution and percentage of fibre types was preserved and no abnormalities in mitochondria and myofibres were seen. Immunohistochemistry to dystrophins, utrophin, and spectrin was normal. A diagnosis of rigid spine syndrome was made and botulinum toxin therapy was begun; with the aim of diminishing the imbalance between the neck flexor and extensor muscular groups to avoid fixed neck extension; for this reason we targeted muscles involved in head extension, principally the trapezius and secondly the sternocleidomastoid and the paracervical musculature (table 1). During BOTOX therapy continuous improvement in neck flexion was seen, which was also perceived by

the patient (fig 1). The radiological and functional measurements confirmed this assertion: in January 1996 the distance from chin to sternum was 10 cm in maximum neck flexion, in December 1997 this distance was 3 cm and in June 1999 the patient was able to touch his sternum with his chin. In March 1999 the patient developed myocarditis, with acute thoracic pain two weeks after a sore throat, increased creatine kinase concentrations, and electrocardiographic changes, with good recovery in 1 week. An echocardiogram performed 3 months later was normal and serology for Coxsackie virus was positive.

BOTOX is the trade mark of the commercialised type A toxin of *Clostridium botulinum*; BOTOX causes muscle paralysis by acting at nerve endings and blocking presynaptically the release of quanta of acetylcholine³; this muscular paralysis is reversible and can ameliorate symptoms in patients with muscle spasms appearing as a manifestation of multiple neurological disturbances,⁶⁻⁸ including myopathies.^{9,10} In some situations this amelioration may become long lasting, and patients will not require further injections.¹¹ The American Academy of Neurology recommends its therapeutic use in blepharospasm as a primary form of therapy; its use is accepted in cervical dystonia, adductor spasmodic dysphonia, jaw closing dystonia, and in hyperkinesis of hemifacial spasm; its use is considered promising in jaw opening and deviation dystonia, abductor spasmodic dysphonia, and in other focal dystonias.

The origin of spine stiffness in rigid spine syndrome is not well understood. Shortening of paraspinal ligaments or shortening of muscle fibres due to myofibrillar disorganisation have been invoked as possible origins of stiffness¹²; weakness of neck flexors can make this group of muscles incapable of counteracting extensor strength, finally causing spinal rigidity and cervical lordosis. Botulinum toxin may have an important part to play in preventing development of contractures and avoiding stiffness, not only in a symptomatic way, but also in a curative manner, as in our patient.

We thank Ms Julie Myers and Mr Josep Graells for linguistic assessment.

J SASTRE-GARRIGA
M TINTORÉ
X MONTALBAN

Unitat de Neuroimmunologia Clínica, Servei de Neurologia, Escola d'Infermeria, 2^a planta, Hospital Vall d'Hebron, Passeig de la Vall d'Hebron 119-129, Barcelona 08035, Spain

J BAGÓ
Servei de Cirurgia Ortopèdica i Traumatologia

I FERRER
Unidad de Neuropatología, Hospital Príncipes de España, Hospitalet de Llobregat, Spain

Correspondence to: Dr J Sastre-Garriga
32449jsg@comb.es

- 1 Dubowitz V. "Pseudo" muscular dystrophy. In: Research Committee of the Muscular Dystrophy Group of Great Britain, eds. *Research in muscular dystrophy: Proceedings of the Third Symposium*. London: JB Lippincott, 1965:57-73.
- 2 Poewe W, Willeit H, Sluga E, et al. The rigid spine syndrome—a myopathy of uncertain nosological position. *J Neurol Neurosurg Psychiatry* 1985;19:105-8.
- 3 Moghadaszadeh B, Desguerre I, Topaloglu H, et al. Identification of a new locus for a peculiar form of congenital muscular dystrophy with early rigidity of the spine, on chromosome 1p35-36. *Am J Hum Genet* 1998;62:1439-45.
- 4 Giannini S, Ceccarelli F, Granata C, et al. Surgical correction of cervical hyperextension in rigid spine syndrome. *Neuropediatrics* 1988;19:105-8.

- 5 Brin MF. Botulinum toxin: chemistry, pharmacology, toxicity, and immunology. *Muscle Nerve* 1997;20(suppl 6):146-68.
- 6 Davis D, Jabbari B. Significant improvement of stiff-person syndrome after paraspinal injection of botulinum toxin A. *Mov Disord* 1993;8:371-3.
- 7 Giladi N, Honigman S. Botulinum toxin injections to one leg alleviate freezing of gait in a patient with Parkinson's disease. *Mov Disord* 1997;12:1085-106.
- 8 Grazzini MA, Polo KB, Jabbari B. Botulinum toxin A for spasticity, muscle spasms and rigidity. *Neurology* 1995;45:712-17.
- 9 Doyle M, Jabbari B. Hypertrophic branchial myopathy treated with botulinum toxin type A. *Neurology* 1994;44:1765-6.
- 10 Nix WA, Butler JJ, Roontga S, et al. Persistent unilateral tibialis anterior hypertrophy with complex repetitive discharges and myalgia: report of two unique cases and response to botulinum toxin. *Neurology* 1992;42:602-6.
- 11 Heinen F, Wissel J, Philipsen A, et al. Interventional neuropaediatrics: treatment of dystonic and spastic muscular hyperactivity with botulinum toxin A. *Neuropediatrics* 1997;28:307-13.
- 12 Lotz BP, Stüben JP. The rigid spine syndrome: a vacuolar variant. *Muscle Nerve* 1993;16:530-6.

"Hot cross bun" sign in a patient with parkinsonism secondary to presumed vasculitis

Brain MRI is an important tool in the investigation of patients with unusual parkinsonian syndromes. The "hot cross bun" sign is a radiological sign which has been said to be highly specific for multiple system atrophy.¹ However, we now report on a patient with the hot cross bun sign who presented with parkinsonism secondary to presumed vasculitis.

Our patient was a 31 year old woman who was referred with an 18 month history of double vision, balance problems, and deafness. Brain MRI performed 9 months before this admission had demonstrated a non-enhancing swelling of the pons (fig 1 A). She had not responded to a 4 week course of oral adrenocorticotrophic hormone treatment at that time. On admission to our unit there had been no change in her symptoms. On examination she had mild cognitive impairment (mini mental state score 24/30) and a labile affect. She had a bilateral horizontal supranuclear gaze palsy. In addition she had a right upper motor neuron facial palsy and bilateral sensorineural deafness (confirmed by audiometry). Examination of her limbs showed axial and bilateral limb rigidity. She exhibited bradykinesia but did not have a resting limb tremor. She had signs of cerebellar ataxia in all her limbs and walked with a broad based gait requiring the assistance of another person. Limb power and sensation were normal and her plantars were flexor. There was no evidence of dysautonomia or rheumatological disease.

Blood investigations showed a raised erythrocyte sedimentation rate at 36 mm/hour, raised serum IgG at 21.6 g/l (with a polyclonal pattern on electrophoresis), a positive rheumatoid factor titre (>1:320), a positive speckled ANA titre (>1:640), and positive anti-Ro antibodies (33 units). Schirmer's test, thyroid function tests, copper studies, and manganese were all negative or normal. Brain MRI showed severe atrophy of the medulla, pons, cerebellum, and middle cerebellar peduncles with cross shaped T2 signal hyperintensity within the pons (hot cross bun sign) and high signal change in the middle cerebellar peduncles (fig 1 B). There were no supratentorial lesions. Phase contrast MR angiography of the brain was normal. Examination of CSF showed no increase in cells