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CASE REPORT

Multiple system atrophy as a cause of upper airway obstruction

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Summary

A patient presented to the ear, nose and throat department with inspiratory stridor, dysphagia and a sore throat. Clinical and radiological examination was normal. During induction of anaesthesia for a planned microlaryngoscopy, the patient developed complete upper airway obstruction that was overcome by applying positive pressure via a facepiece until awake. He subsequently developed respiratory failure, requiring mechanical ventilatory support. An elective tracheostomy was inserted for his symptoms. Neurological opinion confirmed the diagnosis of multiple system atrophy with akinetic rigid syndrome. We review this obscure condition and how it may occasionally present to anaesthetists.

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The causes of stridor can be broadly divided into age specific or categorised into anatomical, biochemical and neurological. There are many documented causes of stridor in children [1], whilst in adults consideration of other factors such as tumours and neurological disease is necessary. We describe a patient with stridor who developed upper airway obstruction during induction and emergence from anaesthesia that was easily overcome by applying minimal positive pressure to his airway, suggesting a glottic cause for stridor. He was subsequently diagnosed with vocal cord paresis secondary to multiple system atrophy.

Case report

A 40-year-old male presented to the ear, nose and throat department with a 3-day history of progressive stridor, dysphagia and a sore throat. A similar episode, 4 weeks previously, had resolved spontaneously. There was no history of a foreign body, hoarseness or gastro-oesophageal reflux disease. His past medical history was unremarkable except for a road traffic accident 13 years ago in which he had sustained fractures of his skull and left elbow, and a haemopneumothorax requiring ventilatory support and tracheostomy, requiring a 2-week admission to the ICU.

On examination, he was stridulous with a respiratory rate of 22 breaths.min^{-1} and an arterial oxygen saturation on air of 95%, improving to 99% with 6 l.min^{-1} supplementary oxygen. He was cardiovascularly stable and examination of his other systems was otherwise unremarkable. Nasendoscopy showed reduced mobility of his vocal cords but his larynx appeared otherwise normal. Due to the severity of symptoms, he was treated empirically for an upper respiratory tract infection and accompanying subglottic stenosis with humidified air, 5 ml nebulised adrenaline 1 : 1000, and 100 mg hydrocortisone and 1.2 g co-amoxiclav intravenously. A subsequent nasendoscopy revealed erythematous vocal cords with mild collapse of his posterior larynx, and paradoxical movements of the arytenoids and vocal cords.

The patient had two further episodes of stridor during his hospital stay, each resolving spontaneously. Magnetic resonance imaging of his head and airway was normal. He was then listed for microlaryngoscopy and further examination under anaesthesia. At pre-anaesthetic assessment, the patient was drowsy, lethargic and unable to remember exact details regarding his previous accident and hospital

stay. Blood gas analysis was not done at this stage and the decision was made to proceed with the procedure to secure a diagnosis. Airway assessment did not suggest a difficult airway.

In view of his symptoms it was decided to proceed with inhalational induction of anaesthesia using an oxygen-sevoflurane mixture via a Bain breathing system. Shortly after induction, the patient developed stridor progressing to complete upper airway obstruction, with paradoxical breathing movements. This was despite various airway opening manoeuvres including jaw thrust and the use of airway adjuncts. The obstruction was easily overcome by applying minimal positive pressure to the reservoir bag in the manner of assisted spontaneous ventilation. Once control of the airway was secured, laryngoscopy and intubation proceeded. The patient had a grade-1 Cormack-Lehane view of his larynx and the vocal cords were in the fully adducted position. Intubation was easy using a 5.5-mm cuffed orotracheal microlaryngeal tube. No neuromuscular blocking drugs were used throughout the entire procedure. Anaesthesia was maintained with an oxygen-sevoflurane mixture via a circle system. A rigid endoscope was used to examine his larynx, hypopharynx, trachea and upper oesophagus, all of which were structurally normal in appearance, suggesting a neurological origin for his symptoms. At the end of the procedure, spontaneous ventilation was established and the patient's trachea was extubated whilst deeply anaesthetised. Laryngoscopy at this stage did not reveal any gross pathology of his vocal cords. During emergence from anaesthesia he again developed upper airway obstruction, which was easy to overcome by applying gentle positive pressure and assisted ventilation as before. To exclude hypocalcaemia as a cause of laryngospasm [2], 1 g calcium gluconate was given intravenously with no effect. Doxapram 0.5 $mg.kg^{-1}$was also given intravenously in an attempt to abolish postextubation laryngospasm [3]. Gentle positive pressure was applied until the patient awoke.

The patient's stay in the postanaesthesia care unit was uneventful over the next few hours. There was no clinical evidence of pulmonary oedema. During the night, however, he developed worsening type-2 hypercapnoeic respiratory failure. He had a respiratory rate of 40 $breaths.min^{-1}$, fluctuating arterial oxygen saturations of 88–98% on humidified oxygen via a Fisher-Paykel humidification system, and he was now rousable only to pain. Arterial blood gas analysis showed a pH of 7.26, pCO_2 9.2 kPa and pO_2 of 10.4 kPa, which improved to a pH of 7.34, pCO_2 7.3 kPa and pO_2 of 15.8 kPa. He was then transferred to the ICU for mechanical ventilatory support. A tracheostomy was inserted the next day and the patient was woken up afterwards. It was noted that during his stay in ICU the patient's bladder required catheterisation to relieve urinary retention.

He was subsequently discharged back to the ward under the care of the ENT surgeons. At this stage, his laryngospasm was thought to result from abnormal pharyngeal muscle tone or deranged co-ordination. A neurological opinion was sought and the patient revealed a past history suggestive of a progressive bulbar palsy with respiratory symptoms. The results of magnetic resonance imaging, Tensilon® test (Hoffman-LaRoche Inc., Nutley, NJ, USA), acetylcholine receptor antibodies, lumbar puncture, neurophysiology and nerve conduction studies were normal. The patient was subsequently discharged with a long-term tracheostomy and is currently being followed-up regularly at clinic. A diagnosis of akinetic rigid syndrome from probable multiple system atrophy was made on the retrospective history and clinical presentation.

Discussion

Multiple system atrophy presents with motor and autonomic deficits and was first described by Gram and Oppenheimer in 1969 [4]. It was redefined in the late 1990s as a progressive neurodegenerative disease of undetermined cause, occurring sporadically and causing parkinsonism and cerebellar, pyramidal, autonomic and urological dysfunction in any combination. At post mortem, the presence of glial cytoplasmic inclusions is characteristic [5].

Parkinsonism in multiple system atrophy consists of akinesia with rigidity, postural instability, hypokinetic speech and an atypical tremor. The other recognised symptoms of multiple system atrophy are dysarthria, dysphonia, dysphagia, stridor, snoring, vocal cord palsy, obstructive sleep apnoea, dystonia, postural instability, absent or atypical levodopa-induced dyskinesia and Raynaud's phenomenon [6]. Bilateral vocal cord paresis is well documented in multiple system atrophy and many patients ultimately die of respiratory complications as a result of airway compromise secondary to this. The pathology is related to a selective abductor paresis and tends to be worse during sleep. Patients with symptoms of airway obstruction should receive a tracheostomy to bypass the level of obstruction. These tracheostomies are rarely removed because of the progressive nature of the disease process [7].

In other cases, hypertonicity rather than paresis of the vocal cords has been described using direct electromyography [8]. The cords adopt a paramedian position during episodes of stridor. Because laryngoscopy can only give a static image of the vocal cords, laryngeal electromyography plus the response to botulinum toxin confirms hypertonicity rather than paralysis. The use of botulinum

toxin could potentially improve the symptoms of some patients. Despite this, vocal cord abductor paralysis (VCAP) is well described and may cause nocturnal sudden death in patients with multiple system atrophy. Nocturnal stridor is the sole symptom of VCAP and can make the diagnosis very difficult. Isozaki et al. [9] described four degrees of severity in VCAP, ranging from 0 (normal cord movement during both wakefulness and sleep) to 3 (severe, with an almost midline cord position during both wakefulness and sleep).

The mean age of onset of multiple system atrophy is in the early 50s. Men are more commonly affected than women and 87% of patients have parkinsonism, 74% show some degree of autonomic failure, 54% have cerebellar ataxia and 49% have pyramidal signs in various combinations [10]. Because parkinsonism is the most frequent motor deficit, many patients are regularly misdiagnosed as having Parkinson's disease.

Autonomic dysfunction is usually manifested as orthostatic hypotension and moderate to severe bladder dysfunction. In pure autonomic failure, the lesions are peripheral with no other neurological manifestations [11]. In multiple system atrophy, lesions are mainly central, with preservation of sympathetic ganglia. Hence the basal noradrenaline levels in patients with multiple system atrophy are normal but those in patients with autonomic failure are frequently low [4,6]. In patients with autonomic dysfunction, any structural lesion of the adrenergic pathways can cause orthostatic hypotension. These patients can tolerate lower standing blood pressures without dizziness or collapse, probably because their cerebral blood flow is preserved from local autoregulation. In multiple system atrophy, autoregulation of cerebral blood flow seems to be preserved down to a systolic blood pressure of 60 mmHg, well below the 80 mmHg at which autoregulation fails in normal subjects [12].

Urological symptoms and studies can help to distinguish multiple system atrophy from Parkinson's disease. In multiple system atrophy, urinary symptoms of incontinence result from a combination of detrusor hyperreflexia and urethral sphincter weakness, or chronic retention associated with a hypoactive detrusor and low urethral pressure. In Parkinson's disease, urethral sphincter function is preserved and incontinence is uncommon [11].

The management of multiple system atrophy is largely supportive, and directed mainly at parkinsonism and autonomic symptoms. Ventilatory strategies for respiratory symptoms include nocturnal non-invasive ventilation (continuous positive airway pressure, bilevel positive airway pressure therapy), or tracheostomy for patients with symptoms of airway obstruction [7]. Psychosocial support has been found to help reduce patients' disability and prolong their independent functioning. A variety of drugs are used to reduce orthostatic hypotension, with fludrocortisone and midodrine the first choice [11].

In our patient, the initial presentation of progressive stridor on a background of a previous tracheostomy and lung injury suggested a mechanical cause in the larynx. This was disproved by direct examination together with imaging studies. The gradual progression of his condition to that of one requiring mechanical ventilatory support suggested an irreversible cause. A tracheostomy alleviated his symptoms of stridor and allowed further investigations and follow-up to be carried out. Four months after his initial presentation, the patient developed a resting tremor, bradykinesia, rigid tone and cog-wheeling with blepharoclonus. He did not have any symptoms related to orthostatic hypotension. The possibility of multiple system atrophy and treatment were discussed with him at this stage. Despite the turn of events, the patient refused to commence treatment and continues to receive follow-up support from the local Parkinson's disease nurse specialist.

The retrospective history of our patient suggests a high probability of multiple system atrophy. The history of stridor, dysphagia, sore throat, the episode of urinary retention, upper airway obstruction overcome with minimal positive pressure (suggestive of a vocal cord disorder), and the paradoxical movements of the patient's arytenoids and cords correlate well with the history and presentation of multiple system atrophy.

The diagnosis of multiple system atrophy can be an obscure one, but should be considered in any previously fit and healthy patient who presents with a history of upper airway obstruction, parkinsonism, motor and autonomic deficits. This is especially so if airway obstruction occurs during induction and recovery from anaesthesia for which no other cause can be found.

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