Severe Cheyne-Stokes Respiration In An Awake Patient After Stroke

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Citation

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Abstract

Cheyne-Stokes respiration (CSR), a disorder characterised by recurrent central apnoeas alternating with a crescendo-decrescendo pattern of tidal volume, is relatively frequent in conscious patients after stroke. However, this respiratory disorder is, in general, not clinically detected probably due to slight intensity and scant clinical consequence. We report the case of a 70-year-old-woman who experienced severe CSR after a stroke with severe desaturation during the apnoeic periods. Treatment with oxygen, continuous positive airways pressure and noninvasive ventilation was unsuccessful. With pharmacological therapy (acetazolamide, medroxyprogresterone and theophylline) the CSR resolved.

INTRODUCTION

Stroke may disrupt breathing either by causing a disturbance of central rhythm generation, interrupting the descending respiratory pathways and leading to a reduced respiratory drive, or by causing bulbar weakness leading to aspiration [1]. Cheyne-Stokes respiration (CSR), a disorder characterised by recurrent central apnoeas alternating with a crescendo-decrescendo pattern of tidal volume [2], is relatively frequent in conscious patients after stroke and is unrelated to infarct location [3,4]. It seems that CSR represents a relatively uniform response to CNS injury regardless of infarct size or location [1]. However, this respiratory disorder is, in general, not clinically detected probably due to slight intensity and scant clinical consequence.

We report the case of a patient who experienced severe CSR after a stroke with severe desaturation during the apnoeic periods, and comment on therapeutic options and results.

CASE REPORT

A 70-year-old woman was admitted to hospital with right hemiplegia and aphasia due to a left hemispheric stroke. The CT scan showed signs of an ischaemic lesion (middle cerebral artery) and did not show evidence of haemorrhage or raised intracraneal pressure. The patient had a history of hypercholesterolemia, ischaemic heart disease and atrial fibrillation treated with digoxine and cumarine. Two days after admission alteration of her breathing pattern was evident. On examination the patient showed a typical crescendo-decrescendo pattern of tidal volume with apnoeas of 18 seconds. Oxygen saturation was measured with a finger pulse oxymeter and the values ranged from 84% (at the end of the apnoeic period) to 97% (at the end of the tachypnoeic period). A sample for arterial blood gas analysis was obtained during the apnoeic period showing hypoventilation and a second arterial sample after the tachypnoeic period had started with correction of blood gas alterations. With oxygen (3 L by nasal cannula) and continuous positive airway pressure at 7 cmH20, the patient continued with the same pattern of breathing. A trial of non-invasive ventilation was initiated with 4 cmH20 of expiratory pressure and 9.5 cmH20 of inspiratory pressure and, during ventilation, the pattern of breathing was completely normal and the oxygen saturation normalised. However, the use of continuous noninvasive ventilation was not tolerated. Oral medroxyprogesterone (50 mg once a day), acetazolamide (250 mg bid) and theophylline (200 mg bid) was commenced in addition to oxygen therapy. Within days the patient had normal breathing and oxygen saturation when breathing room air.

The patient was discharged on the three drugs, but two weeks later she was attended in the emergency department for menorrhagia. Medroxyprogresterone was discontinued and the patient was then discharged, receiving only acetazolamide and theophylline, without modification of the normal pattern of breathing. A week later the patient was

attended in another department for urinary tract infection and the treatment with respiratory stimulants was stopped. After 48 hours the patient again experienced CSR that reversed after the reintroduction of treatment. In view of the potential side effects of theophylline in patients with stroke (see below), we decided, three months after the stroke, to continue treatment with acetazolamide only. However, new nocturnal desaturations were documented and it was necessary to re-introduce theophylline.

DISCUSSION

CSR is mainly seen in severe heart failure, but it is also seen in preterm infants and may occur in normal persons during sleep and at high altitudes. Neurologic causes include stroke, tumours, meningitis, encephalitis and trauma [5]. In the series reported by Nachtmann et al [4] CRS was detected in half of 32 patients with supratentorial and infratentorial acute stroke. The prevalence of CSR is expected to be lower during the stable phase after a stroke. This pattern of breathing was observed during sleep in 42 of 161 patients in the acute phase after stroke or transient ischaemic attack, but in only 6 of 86 patients in the stable phase [6]. The clinical importance of CSR after stroke is unknown, but during the apneoic period there are concomitant periodic drops in arterial oxygen saturation compromising the vulnerable hypoperfused peri-infarct tissue of the ischaemic penumbra [1]. Franklin et al [7] reported that cerebral blood flow velocity, blood pressure, and heart rate had a minimum occurrence in apnoea and a maximum occurrence during hyperpnoea.

In our patient, we observed episodes of severe desaturation, and blood gas analyses showed hypoxaemia and hypercapnia in the apnoeic period and almost normal values during the tachypnoeic period. Although controversial, for some authors the presence of diurnal hypercarbia suggests a more global deficiency in central respiratory control rather than typical CSR [8,9]. However, cases with CSR and hypercapnia have been reported previously [10]. Logically, arterial blood gas values are different depending on the phase of CSR at which they are obtained.

In our patient, we started pharmacological (with respiratory stimulants) and non-pharmacological therapy in view of the evident prolonged apnoeas and the results of the arterial blood gas analysis. A number of studies have shown that the short-term application of supplemental oxygen can attenuate CSR [2]. Nevertheless, although the apnoea-induced oxygen desaturations diminish during oxygen administration, the hemodynamic alterations persist [7]. Oxygen reduces CSR by only about 50%. More complete suppression may be achieved by adding C02, but this treatment has adverse effects on the sequel of CSR, namely sympathetic activation [11]. Also, alleviation of CSR has been observed with continuous positive airway pressure in patients with congestive heart failure [2]. However in our patient neither oxygen nor continuous positive airway pressure modified the breathing pattern. Willson et al [12] stated that noninvasive ventilation should be considered a potential therapy for CSR in those patients who do not respond or fail to tolerate nasal continuous positive airway pressure. Our patient achieved normal breathing with noninvasive ventilation, but she did not tolerate this therapy for long periods.

In this case theophylline, acetazolamide and medroxyprogesterone were started simultaneously with the non-pharmacological therapy, and the patient normalised her breathing pattern within a few days. Recently, three patients with chronic respiratory failure (one secondary to stroke and two owing to central hypoventilation) that resolved with respiratory stimulants have been reported [13,14]. Theophylline has been suggested as a possible therapy for Cheyne-Stokes respiration. Javaheri et al [15] showed that oral theopylline decreased nocturnal apnoeas and attenuated oxygen desaturation in patients with congestive heart failure; and rapid, sustained resolution of profound, near-fatal CSR was achieved in an awake patient without congestive heart failure [5]. Theophylline and simple oxygen application normalised the respiratory pattern and arterial oxygen saturation in all neurological patients treated in one series [4]. However, the use of theophylline is associated with a lowering of the threshold for seizures [16], and theophylline-induced cerebral vasoconstriction and associated decrease in oxygen delivery should be considered in these patients [17,18]. Acetazolamide, another respiratory stimulant, does not change the sensitivity of peripheral and central chemoreflex, but its use increases resting ventilation, probably as a result of metabolic acidosis [19]. Medroxyprogesterone, an analogue of progesterone, has been recognised as a respiratory stimulant for some time. It has been shown to benefit patients with respiratory failure resulting from obstructive sleep apnoea, chronic obstructive pulmonary disease and obesity hypoventilation syndrome [13] and was used successfully in three recent cases of hypoventilation, one after stroke [13,14]. In patients with chronic obstructive pulmonary disease, both acetazolamide and medroxyprogresterone acetate have favourable effects on

blood gas parameters. However, acetazolamide showed extra effects on nocturnal saturation [$_{20}$]. In the case reported herein we initially stopped medroxyprotesterone (due to menorrhagia associated with cumarine). The patient was able to continue with a normal breathing pattern with only low doses of acetazolamide and theophylline.

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