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Letter to the Editor

Atypical patterns of breathing in critically ill: adjuncts to prognostication?

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To the editor,

We present a case of an uncommon type of breathing witnessed in a mechanically ventilated 11-year-old child who presented following sudden loss of consciousness. He was found to have a large diffuse sub-arachnoid haemorrhage which was not amenable to surgical intervention. Thus, neuroprotective ventilation was continued. Sedation was withheld 48 hours later, to assess the Glasgow coma scale (GCS). His arterial O_2 and CO_2 tensions, acid-base status, electrolytes, glycaemic levels and other metabolic parameters were optimized. Another 72 hours later, with a respiratory trigger of 1 l/min, on synchronized-intermittent mandatory ventilatory mode, a peculiar type of spontaneous breathing was noticed (Figure 1).

Figure 1: Capnography trace (Last row in white) during spontaneous breathing showing hyperpnoea with regular cluster of breaths of 3 to 4 of equal tidal volumes with apnoea in between.

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The pattern consisted of regular clusters of three to four (hyperventilatory) breaths followed by periods of apnoea of 5 to 6 seconds. The breaths were of equal tidal volume. The patient's GCS was persistently low throughout and pupils were dilated and non-reactive to light. All the brain stem reflexes were conclusive of brain death. Electro-brain silence was noticed in the electroencephalogram. With the background history, breathing pattern was attributed to a type of 'cluster breathing'. The child succumbed to his illness soon after with multi-organ failure.

Historically, cluster type breathing in critically ill patients has been associated with poor prognosis. There is still some confusion on the different sub-types of cluster breathing. A variant of cluster type is described as 'biot' breathing. This pattern was first described by Camille Biot, in 1876. This is characterized by deep respirations with periods of apnoea in-between, which is associated with damage to the pons following stroke, trauma, or uncal herniation and opiate overdose as well [1,2,3,4]. Initially described in a young male with tuberculous meningitis, this was called as "rhythme meningitique" and was utilized as a diagnostic tool of the former by contemporary physicians [5]. Both biot and cluster types are considered as agonal types of breathing. The difference between the two is still widely disputed. One school of thought is that the latter is an irregular, deep breathing with varying tidal volumes and irregular apnoeic episodes [6]. On the other hand, clusters of hyperventilatory spontaneous breaths with regularity, equal tidal volumes and regular phases of apnoae are attributed to biot type by another group [2,3]. Irrespective of the categorization, the biot type could progress into ataxic type of breathing which is of complete irregularity, with deterioration of the underlying cerebral condition.

The importance of identifying these uncommon patterns is multifold to a clinician. The type of such abnormal breathing patterns could pinpoint a certain anatomical location contributory to the clinical picture [6]. For example, biot pattern could result subsequent to pontine problems. Likewise, cluster type could be due to pontine or upper medullary lesions or Shy-Drager syndrome. Secondly, such patterns generally predict a poorer prognosis and may suggest urgent intervention depending on the particular clinical state [5]. A group of authors suggests that abnormal breathing patterns in critical care patients, specially, the neuro-critical group, could suggest extubation failure provided other criteria for extubation are met [4]. With the current evidence reinforcing increased incidence of ventilatory associated complications such as pneumoniae, increased duration of mechanical ventilation and prolonged time for decannulations, they recommend early tracheostomy for such patients. But more convincing evidence is needed for universal clinical application of this proposition. More importantly, the effects of hyperventilatory or hypoventilatory episodes could have significant effects on the cerebral perfusion and intracerebral pressures by way of hypo- or hypercarbia, especially in traumatic brain injured subjects [2]. Urgent interventions and/ or cautious monitoring of vitals including intracerebral pressure (as indicated) would be required in such instances.

In summary, clinicians should have a comprehensive understanding on different breathing patterns. This could be decisive specially in an intensive care patient with dynamic physiology, where minutes count.

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