Locked-in syndrome: a critical and time-dependent diagnosis

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ABSTRACT

Locked-in syndrome (LIS) is the combination of quadriplegia and anarthria (inability to speak), with the preservation of consciousness. The majority of cases are caused by basilar artery occlusion leading to brainstem infarction in the ventral pons, yet numerous other etiologies have been described. The diagnosis of LIS is completely dependent on the physician's ability to know that these manifestations originate in the brainstem and the posterior circulation that supplies it. This knowledge hinges on the ability of the examining physician to conduct a rapid, yet appropriately thorough neurologic examination. With recent advances in interventional neuroradiology leading to improved patient outcomes, LIS has evolved into a critical, time-dependent diagnosis. Herein, we present the case of a male patient who initially presented to the emergency department of a community hospital with coma of unknown cause. By presenting this case and focusing on the importance of the occulomotor exam, we hope to help in the rapid identification and treatment of patients with LIS in the emergency room and avoid outcomes similar to that of our patient.

RÉSUMÉ

Le syndrome de déafférentation motrice est la combinaison de la tétraplégie et de l'anarthrie (incapacité de parler), mais sans perte de conscience. La plupart des cas sont causés par une occlusion du tronc oculaire, entraînant un infarctus du tronc cérébral dans la protubérance ventrale, même si de nombreux autres causes ont été rapportées. Le diagnostic du syndrome de déafférentation motrice repose entièrement sur la capacité du médecin à savoir que ces manifestations prennent naissance dans le tronc cérébral et dans la circulation postérieure qui l'alimente. Cette connaissance dépend de la capacité du médecin traitant à effectuer un examen neurologique complet rapidement, mais de manière appropriée. Grâce aux récentes avancées dans le domaine de la neuroradiologie interventionnelle, laquelle a permis d'améliorer les résultats pour les patients, le syndrome de déafférentation motrice est devenu un diagnostic critique et subordonné au temps. Dans ce document, nous présentons le cas d'un patient qui s'est présenté au service des urgences d'un hôpital communautaire dans un coma de cause inconnue. En présentant ce cas et en mettant l'accent sur l'importance de l'examen oculomoteur, nous espérons faciliter l'identification rapide et le traitement des patients atteints du syndrome de déafférentation motrice en salle d'urgence et éviter des résultats similaires à celui de ce patient.

Keywords: basilar artery, critical illness, emergency medicine, locked-in syndrome, thrombosis

Locked-in syndrome (LIS) is defined as the combination of quadriplegia and anarthria (inability to speak) with the preservation of consciousness and was first described in the medical literature in 1875.[1,2] Most cases are caused by basilar artery occlusion leading to brainstem infarction in the ventral pons; however, numerous other etiologies exist.[3] We report a case of LIS presenting to an emergency department (ED) that may have been preventable with earlier detection and definitive management.

CASE REPORT

A 51-year-old man was brought by paramedics to the ED of a community hospital at 5:30 am with a depressed level of consciousness. He had last been seen healthy at 10:30 pm the night before and was found unresponsive at 4:30 am by a family member.

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A physical examination was immediately performed and revealed that the patient's pupils were equal and reactive to light, he was localizing to pain bilaterally, and he had a Glasgow Coma Scale (GCS) score of 6 of 15. His blood pressure, pulse, respiratory rate, and temperature were all within normal limits.

The patient was intubated for airway protection immediately following the initial ED assessment. An electrocardiogram (ECG), urinalysis, and routine bloodwork were all normal. Serum toxicologic screening was positive for cannabis. Computed tomography (CT) of the head was performed and interpreted as normal by Radiology at the community hospital; however, this interpretation was made difficult by motion artifact.

Given the patient's condition and the lack of critical care facilities at the institution to which he presented, the patient was transferred to a nearby tertiary care centre for further investigation and management. He arrived at the referral institution approximately 5 hours after his initial ED presentation, and on his arrival at 12:15 pm, he was promptly seen by the resident on the neurology service. The patient was subsequently seen by the attending neurointensivist at 2 pm and found to have eye opening to pain but not to voice and no response to threat. Decerebration occurred spontaneously and with the application of central pain. A cranial nerve examination revealed 2.5 mm reactive pupils, normal ciliary and corneal responses, a right lower motor seventh nerve paresis when facial pain was inflicted (Marie-Foix manoeuvre), a good swallowing reflex, and abnormal extraocular movements during oculocephalic testing with an absence of movement of either eye to the left (left gaze palsy), an internuclear ophthalmoplegia on right lateral gaze (right eye abducts but the left eye did not adduct), and absent upward gaze but preserved downward gaze. With peripheral pain, the patient was noted to have a triple flexion reflex withdrawal on the right (arm stronger than leg) in contrast to a stronger withdrawal flexion response on the left (again the arm more than the leg). The tone was found to be increased in both lower extremities, the right more than the left, and the toes were upgoing bilaterally. His GCS score was now calculated at 4T of 10 (E1M2VT; the verbal component eliminated due to the patient being intubated). A presumptive diagnosis of basilar artery thrombosis with lesions in the left more than the right pons was made, and repeat CT was performed. This second CT scan was originally interpreted as normal by the staff radiologist at the receiving hospital; however, on subsequent review by the neuroradiologist, it was found to have evidence of a left pontine hypodensity along with a hyperdense basilar artery, compatible with a basilar artery thrombosis.

The patient was taken to angiography for an intra-arterial thrombectomy, and a 2 cm basilar artery thrombus was removed at 4:40 pm, approximately 12 hours after his initial presentation to medical care.

On subsequent discussion with the patient's family, it was revealed that he had presented to the community hospital several times in the previous week with dysarthria, headache, and ataxia and had been repeatedly discharged home with a diagnosis of alcohol intoxication, despite reportedly being a nondrinker. No further information was available regarding the history or physical examination findings of these previous ED presentations.

Over the next 4 days in the neurointensive care unit, the patient regained normal consciousness and was able to communicate through eye blinking. He regained a small amount of movement in his left upper extremity (1+/5 flexion of the biceps, 2/5 flexion and 1+/5 extension of the left fingers) but otherwise remained quadriplegic. His cranial nerve function remained severely affected. Magnetic resonance imaging (MRI) showed bilateral infarctions of the ventral pons, more pronounced on the left, with markedly diminished perfusion of the pons (Figure 1). After consultation with the patient and his family, the decision was made to withdraw care, and the patient died 2 days later.

DISCUSSION

LIS is a devastating condition, the signs and symptoms of which can mimic other urgent and nonurgent diagnoses. It has a mean age at onset of 52 (range 16–90) years and an all-cause mortality of over 60%.[3] It is defined as the combination of quadriplegia and anarthria with the preservation of consciousness.[2] The most common neurologic findings in LIS are quadriplegia, decerebrate posturing on painful stimulation, normal pupillary light reflexes, abnormal eye movements, abnormal facial movement, and anarthria. There is often some preservation of cutaneous sensation. LIS is the result of an insult to the ventral aspect of the brainstem, in particular the pons.[4] Numerous mechanisms of injury have been described, including hemorrhage, trauma,

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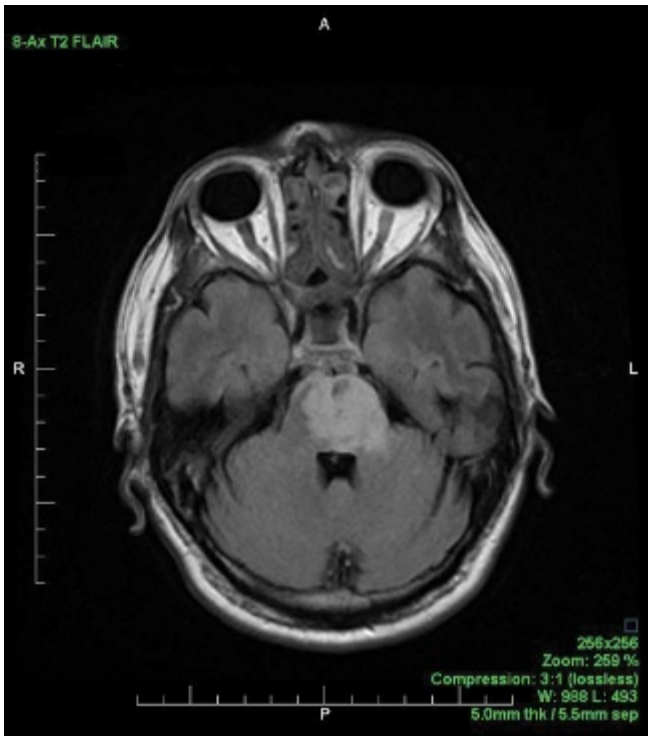

Figure 1. Magnetic resonance image showing bilateral infarctions of the ventral pons, more pronounced on the left, with markedly diminished perfusion of the pons.

tumors, metabolic insults, demyelination, and infection, but 65% of cases of LIS are attributable to ischemic stroke from basilar artery occlusion.[3]

Patients presenting with acute LIS frequently present with symptoms that are also common to other, less urgent diagnoses. This can make the diagnosis a challenge. In a recent case series of 139 patients with LIS, 53% of patients presented with premonitory symptoms, the most common being dizziness or vertigo, hemiparesis, headache, numbness, slurred speech, and dysarthria.[3]

The diagnosis of impending or established LIS relies on the physician's ability to realize that the patient's manifestations originate in the brainstem and there is a problem with the posterior circulation that supplies this area. It further hinges on the ability of the examining physician to conduct an appropriately thorough neurologic examination because diagnostic testing in acute LIS is frequently normal. Lumbar puncture is usually normal, and CT may also be normal, although focal lesions are sometimes found.[5–8]

Eye movements are characteristically abnormal in acute LIS and are best considered as a "window to the brainstem." In any patient where a suspicion of a brainstem lesion such as LIS exists, eye movements must be tested. This can be done through voluntary following of a finger or, if the patient is unable to cooperate, through testing of the oculocephalic reflex (doll's eye manoeuvre). In most cases, the horizontal eye movements will be severely abnormal with absent unilateral or bilateral conjugate gaze and/or absent abduction (sixth nerve palsy) on one or both sides. Vertical eye movements can also be affected, with upward gaze more affected than downward gaze—a finding that indicates that the lesion producing LIS includes the pons.[9,10]

Any suspicion of LIS warrants immediate neurologic and neuroradiologic consultation. There have been tremendous advances in the capabilities of interventional neuroradiology in recent years, and there are several published reports in both adults and children of successful endovascular thrombectomy or coiling of LIS lesions caused by basilar artery thrombosis.[11–13] Current evidence suggests that thrombectomy resulting in recanalization is 100% successful at 6 hours and approaches 80% success at 8 hours. These interventions have led to a 40% absolute reduction in mortality, and, currently, 25% of patients treated in such fashion have a good neurologic outcome at 90 days.[14,15] Thrombectomy is contraindicated in coma lasting more than 8 hours, in acute intracerebral hematoma, or when evidence of extensive irreversible damage exists on CT or MRI.[16]

CONCLUSIONS

With the advent of new therapeutic modalities that can change outcome, nihilism in the face of LIS is unacceptable. Good outcomes in the face of coma or paraplegia of unknown cause hinge on the ability to rapidly suspect and diagnose LIS. Because of this, and as our case illustrates, it is imperative that emergency physicians perform a proper and focused neurologic examination in potential LIS cases and, in particular, assess oculomotor function.

Competing interests: None declared.

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