

## Leadless Pacemaker Implantation for Asystole in Cervical Spinal Cord Injury: A Case Report

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### ABSTRACT

Cervical spinal cord injury can result in impairment of the sympathetic nervous system with a risk for developing bradyarrhythmia and asystole due to overactivation of the parasympathetic nervous system. Such patients may need frequent interventions for arrhythmias and may be candidates for permanent pacemakers. There is no clear consensus regarding the management of these patients and long-term outcomes in these patients are not well characterized. Here we describe the case of a 77-year-old male with cervical spinal cord injury and after a motor vehicle accident who was referred for pacemaker implantation due to frequent long sinus pauses requiring multiple resuscitation attempts. A leadless permanent pacemaker (Micra) was implanted, which successfully reduced the need for medical interventions during episodes of asystole.

**Keywords:** Spinal cord; Micra; Asystole

### CASE PRESENTATION

A 77-year-old African American male with a past medical history of hypertension and diabetes was admitted after a cervical spinal cord injury following a motor vehicle injury. He was noted to have quadriplegia and respiratory failure requiring mechanical ventilation. He had sustained an injury at C2- C3 and C3-C4 spinal cord levels, causing central cord syndrome requiring cervical fusion surgery. He also underwent several surgical interventions including tracheostomy, PEG (Percutaneous Endoscopic Gastrostomy) tube placement, and exploratory laparotomy with bowel resection for small bowel obstruction. On the 10th day following admission, he had an episode of sinus bradycardia and sinus pause lasting 10 seconds that progressed to asystole requiring Cardiopulmonary Resuscitation

(CPR) and atropine. This was thought to be secondary to autonomic dysfunction and vagal stimulation. Cardiology was consulted, and he was monitored on continuous telemetry. Baseline electrocardiograms did not reveal any evidence of tachy-arrhythmias or AV node conduction disease (Figure 1). An echocardiogram was performed that revealed preserved systolic function with an ejection fraction of 55% and no significant wall motion or valvular abnormalities. He was started on theophylline but continued to have frequent episodes of sinus bradycardia leading to cardiac pause/arrest (Figure 2) requiring multiple rounds of CPR and atropine over the next four days. These episodes were triggered by minor interventions such as tracheal suctioning and repositioning. A temporary transvenous pacemaker was placed to reduce the need for resuscitation attempts, and to monitor for recovery. Eventually, due to ongoing systemic infection and persistent symptomatic bradycardia, a leadless pacemaker (Micra) was implanted successfully on day 16 (Figure 3).

### Follow up

Patient did not have any episodes of cardiac arrest over the two months following the implantation of micra, and the frequency of bradycardic episodes reduced. He suffered from multiple complications including severe encephalopathy, renal failure and, chronic respiratory failure, and passed away after a prolonged hospitalization of 60 days.

This case is unique as leadless pacemaker has not been used in patients with cervical spinal cord injury, to the best of our knowledge.

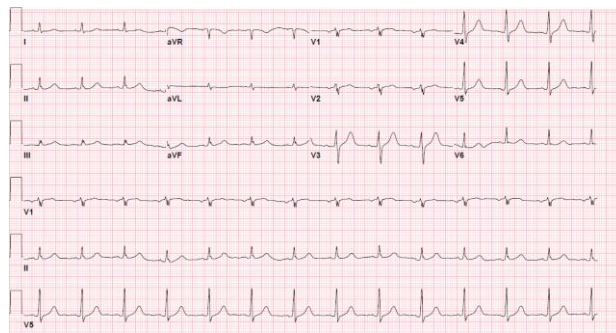


Figure 1: Baseline EKG revealing normal sinus rhythm without evidence of conduction abnormalities.

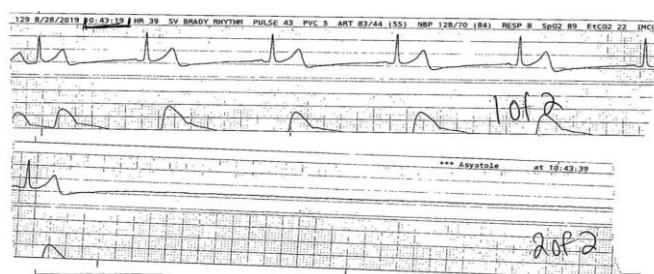
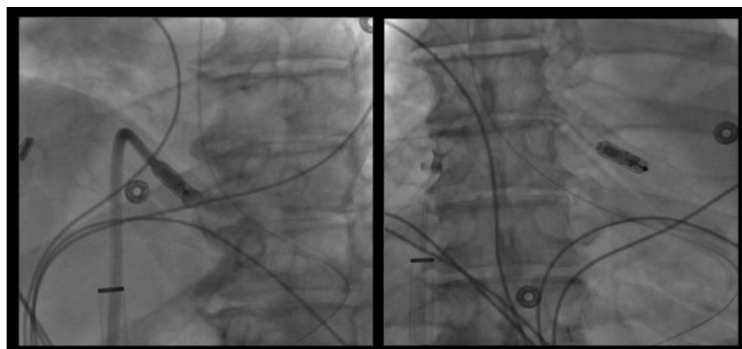


Figure 2: Telemetry strip from the patient showing sinus bradycardia and subsequent at least 6 second sinus pause.



**Figure 3:** Fluoroscopic images of the delivery catheter and final position of the leadless pacemaker.

## DISCUSSION

Cervical spinal cord injury (CSCI) is a highly morbid condition, usually associated with cardiovascular instability.<sup>[1]</sup> Bradycardia is the most common manifestation, and can have fatal consequences like cardiac arrest in up to 15% of the patients.<sup>[2]</sup> Cardiovascular events are the main cause of mortality in the first year following the spinal cord injury. Frequency and degree of bradycardia is associated with the severity of the CSCI. It frequently occurs within 3-5 days of the injury and mostly resolves by 2 weeks, however, some patients can have persistent symptoms requiring pacemaker in about 6%.<sup>[3]</sup>

Bradycardia develops due to the disruption of supra-spinal sympathetic pathways leading to parasympathetic dominance; vagal stimulation can exacerbate this underlying sinus bradycardia.<sup>[4]</sup>

High level of spinal injury, above C5 is more frequently associated with worse outcomes. Severe bradycardic episodes and asystole are unpredictable and may be triggered by physical stimuli such as hypoxia or tracheal suctioning. Initial treatment for symptomatic bradycardia includes atropine, inotropes and aminophylline, however, the response maybe unpredictable. Urgent transvenous pacing is most often life-saving for these patients.<sup>[5]</sup> Patients who typically require pacemakers include those with high cervical injuries, motor loss, requiring mechanical ventilation and tracheostomy, suffering from prolonged bradycardia over longer period (>2 weeks).<sup>[6]</sup> Early stabilization and pacemaker implantation in unstable patients may lead to better outcomes. Pacemaker in these circumstances are lifesaving however, do come at the cost of complications, mostly commonly infections.

Micra is a leadless pacemaker, developed in efforts to eliminate hardware and reduce the risk of complications and improve clinical outcomes.<sup>[7]</sup> Studies have reported minimal risk of infections, lesser procedure related complications, improved quality of life with lesser restrictions and preoccupation with leadless pacemakers in comparison to conventional pacemakers.<sup>[8]</sup> A smaller surface area of the device, its location in the right ventricle (where blood flow is less stagnant), and device encapsulation are some of the factors making leadless pacemaker more resistant to bacterial seeding.<sup>[9]</sup>

Common indications include atrial fibrillation with high degree AV blocks, sinus node dysfunction, similar to those requiring conventional pacemakers, however can be used in patients with conditions precluding transvenous pacemaker implantation such as infection history and thrombosis.<sup>[10]</sup> They have also been used in patients with significant comorbidities and those expected to be poor candidates for conventional pacemakers, and high risk for complications.

## CONCLUSION

Leadless pacemaker is a safe and effective option for patients with high spinal cord injuries suffering from recurrent symptomatic bradycardia, especially for those who are prone to infectious complications.

## LEARNING OBJECTIVES

1. Conservative and invasive management options for patients with sinus arrest post high spinal cord injury.
2. Identifying patients at high risk of infections and choosing type and timing of pacemaker placement.

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