

ACADEMY OF SPINAL CORD INJURY PROFESSIONALS



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A Shocking Cause of Autonomic Dysreflexia: A Case Report on Diaphragmatic Pacer Induced Dysreflexia

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Objectives

Readers should be able to:

- 1) Articulate how to work up autonomic dysreflexia when the typical causes are negative.
- 2) Recognize diaphragmatic pacers as a trigger for autonomic dysreflexia in patients with spinal cord injury/
- 3) Formulate a plan to adjust pacer settings to minimize discomfort and optimize respiratory parameters.

Background

Since its introduction in the 1980s, diaphragmatic pacing has been a useful tool in helping ventilator dependent patients spend time off the ventilator¹. This tool has been particularly useful to patients with high cervical spinal cord injuries as they tend to have the greatest respiratory dysfunction²⁻⁴. After the implantation, infection and procedure related complications are the most reported complications⁵.

Case Description

A 42-year-old male with C2-AIS-A ventilator-dependent tetraplegia from a gunshot injury (1998) presented to clinic (2021) with complications from his diaphragmatic pacer. He initially had a phrenic nerve pacing system and was switched to a diaphragm pacer in 2010.

Months after placement, the patient began to experience right sided chest pain and autonomic dysreflexia while using it. The workup was negative for acute processes, and the symptoms consistently resolved when he was returned to the ventilator. Since no other triggers were identified, a decision needed to be made about the pacing system. He expressed a desire to continue his independence from the ventilator but knew that it was not safe nor possible with the pacer at this time. Therefore, the team offered the patient the opportunity to adjust the pacer settings, with the risk of potential decreased efficacy.

Timeline

- 6/2010: Pacer Interrogation of the device revealed that Leads 3 & 4 (Right sided leads) were antagonistic and likely contributing to his symptoms
- 7/2010-10/2011: Attempted conservative changes to the amplitude, pulse width, pulse ramp, and turning off lead #3 with varying success
- 11/2011: No correctable problem seen on return to operating
- 7/2012: Transferred care to Cleveland
- 5/2017: Returns to Chicago, noted one pacer (P1) with leads #1 and #3 turned off and another (P2) with low parameters on leads #1 and #3.
 - Tolerating P1 only limited amount of time due to dysreflexia and pain
 - Vital Capacity (VC) ~800cc
- 3/2022: Returns to clinic, for repair of wire and reports minimal pacer use
 - VC ~400cc with reduced parameters on leads 1 & 3 (Only P2 available)
- 6/2022: Returns to pacer use (1-2x/week) for 5-20min intervals
 - VC ~550cc

Conclusion

The risk of autonomic dysreflexia (AD) is always considered when placing a diaphragmatic pacer⁷⁻⁹, but the post-surgical risk for it is often overlooked. Though pacing works through sending small shocks (noxious stimuli) and AD has an incidence of ~91% in patients with complete injuries, there have been no reported cases of patients with pacers experience this phenomena⁶.

This case demonstrates that a diaphragmatic pacer must be on the differential for AD if there is a clear pattern and no other attributable sources. However, as adjustments are made to the pacing system, the balance of AD control with device functionality must be weighed. Consideration must also be made considering the longitudinal impacts of these changes.

Pacer Settings (Units)	Impact on Stimulation	Impact on Pain*
Amplitude (mA)	Strength of Impulse	1
Pulse Width (µsec)	Duration of Impulse	2
Pulse Ramp (mA/µsec)	Rate to Max Impulse	3

Table 1: Summary of modifiable pacer settings and impact on pain.

*Impact of pain based on clinical practice with 1 being most pain inducing

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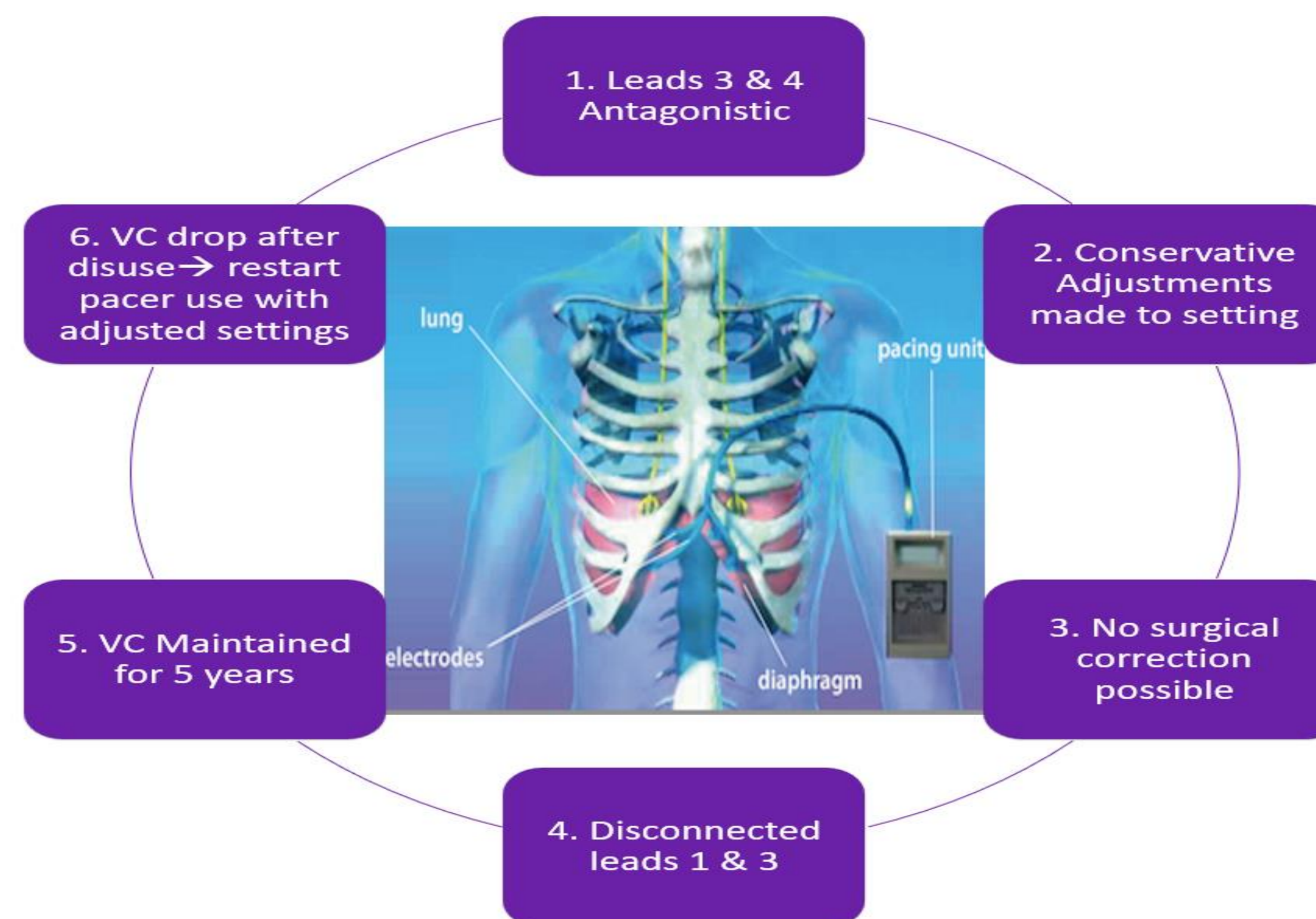


Figure 1: Labeled photo of patient pacer system annotated with changes made to pacer. Photo va ALS WorldWide