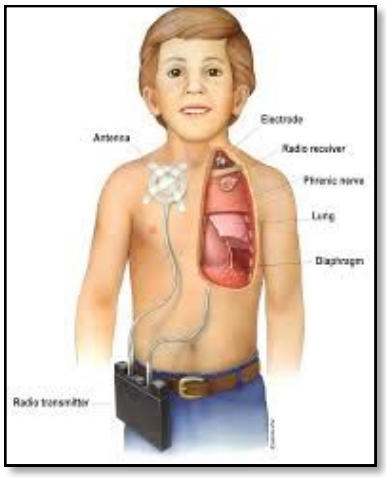
DIAPHRAGMATIC PACER

What is it?



Diaphragm pacing (or phrenic nerve pacing) is a form of ventilation for those previously dependent on traditional mechanical ventilation. The electrical stimulation of the phrenic nerve uses a surgically implanted device to trigger the diaphragm to take a breath.

Dependence on a ventilator can be significantly limiting for people when considering the multitude of equipment, battery life, mobility constraints, and even transportation challenges. A diaphragmatic pacing system is a combination of implantable electrodes and a lightweight, battery-powered electronic device that supports breathing by stimulating the diaphragm to contract, pull air into the lungs, and facilitate breathing. It can possibly eliminate the continuous need of a traditional ventilator. The system can be used part-time or full-time in hopes of helping patients lead more functional and Independent lives. Patients experience a decreased risk of pulmonary infection and secretions and can also regain their sense of smell, taste, and speech with the use of this system.

How does it work?

Diaphragm pacing uses the person's own diaphragms as the "ventilator." During surgery, electrodes are implanted and attached to the phrenic nerve on each side of the neck or in the chest. Receivers are surgically placed under the skin near the abdomen or chest. Wire electrodes or antennae are taped on the chest over the receiver during placing and connected to an external stimulator worn by the patient. This external device is about the size of a remote.

The external transmitter sends an signal for the diaphragm to contract which mimics natural breathing. The diaphragm contracts, imitating the inhalation phase of breathing, allowing the lung to fill with air. When the transmitter stops, it sends a signal allowing the diaphragm to relax and imitate exhalation. This same cycle is automatic and continuous. Since power for the contraction is supplied via this external transmitter, there are no implantable batteries inside the child. The impulse sensation has been described as the "flick of a finger." Programmable settings are patient specific and readjusted as the child grows.

Pacing generally starts at about 1 hour but can progress to 8-12 hours at a time by 3 months. This is the usual maximum time pacers are used. Twenty- four hour diaphragm pacing is not recommended because of diaphragm fatigue. Therefore, for people who depend on full time assisted ventilation, there is a need to have another method of airway support like a tracheostomy and ventilator.

Safety considerations

- Have ventilator and ambu bag available at all times
- Use other cough assisted techniques as no abdominal coughing during first 30 days
- Do not manipulate wires
- Use caution with transfers
- Use abdominal binder to support child's position
- Note battery life and alarms (new battery will last 2-3 weeks at full time rate)

Kennedy Krieger Institute

The **Specialized Health Needs Interagency Collaboration (SHNIC)** program is a collaborative partnership between the Kennedy Krieger Institute and the Maryland State Department of Education.

Specific health issues for Individualized Healthcare Plan

- Diagnosis and date of device implantation
- Baseline respiratory assessment, including pulse oximetry parameters
- Orders for current pacer settings, including current tolerated time increment
- Signs and symptoms of respiratory fatigue while on pacer; use of BORG scale if applicable
- Orders for use of Passy-Muir valve
- Dressing change orders and back up supplies available at school
- Training of staff about device and positioning
- Consideration of team discussion for a possible 504/IEP and Emergency Evacuation Plan
- Safety precautions about exposed wires, alarms, etc.
- Communicate with school staff, parents, and provider any changes or concerns about the student's disease or device
- Medical device information (see SHNICs "Medical Device Information Guide")
- Emergency Care Plan (ECP) and possible Emergency Evacuation Plan (EEP) related to medical needs in the school setting for respiratory distress symptoms and/or event of equipment malfunction, including healthcare provider orders and staff education/training as appropriate for tracheostomy, suctioning, ventilator, and oxygen

Resources & Manuals

American Thoracic Society: Diaphragm Pacing
https://www.thoracic.org/patients/patient-resources/resources/diaphragm-pacing-online.pdf

Sheperd Center: Diaphragm Pacing System Fact Sheet
http://www.myshepherdconnection.org/respiratory/dps/fact-sheet