Health problem addressed

Devices that provide suction to evacuate body fluids and/or air that can accumulate between the lung and chest wall following thoracic surgery, penetrating chest wounds, barotrauma, or tracheal or bronchial rupture or as a result of disease or congenital defects. Purulent effusions must be drained to prevent serious infections. They can also be used to evacuate blood from the mediastinal space following cardiac bypass surgery.

Product description

A typical thoracic aspiration system consists of a high-volume, low-vacuum pump; a multiple-container and water-seal collection system; and a pressure gauge, all mounted on a chassis with casters. They are either motor driven with variable speeds or thermotic (based on the principle that air expands upon heating and contracts upon cooling). Motor-driven pumps usually aspirate at higher maximum airflow (i.e., >20 L/min) than thermotic pumps and are therefore suitable for either liquid or air removal. Thermotic pumps, with a lower maximum airflow (i.e., approximately 2.5 L/min), are suitable only for liquid removal because air leakage into the pleural cavity of a ventilated patient may exceed 16 L/min.

Principles of operation

The devices evacuate accumulated fluids through tubes inserted surgically in the chest wall. The open ends of the drainage tubes empty into a collection system in which a water seal is formed by submerging the tubes in a few milliliters of sterile water at the bottom of the collection unit. If the unit is positioned far enough below the patient, the water seal maintains the vacuum in the system and prevents aspirate from reentering the pleural cavity if the motor is turned off or accidentally loses power. A second collection bottle is often placed between the primary collection bottle and the pump to protect against overflow. Some units have an automatic safety cutoff feature for the pump.

Operating steps

- Insert two separate chest tubes surgically in the chest wall.
- Connect chest tubes to drainage tubes that empty into a collection system.
- Collection canisters should be monitored and emptied if they come close to capacity.

Reported problems

Clots in the chest tubing or drainage tubing can seriously impair, or even stop, aspiration. A kink in the tubing can have the same effect. Users may be exposed to infectious material during cleaning or in the event of an overflow, and should follow universal precautions, including wearing gloves, face shields or masks, and gowns. Some models operate at high noise levels that can eclipse the volume of alarms for other devices.

Use and maintenance

User(s): Surgeons, assisting surgeons, nurses, respiratory therapists, other medical staff
Maintenance: Biomedical or clinical engineer
Training: Initial training by manufacturer and manuals

Environment of use

Settings of use: Operating room, emergency room, patient bedside, home, long-term care
Requirements: Line power, biohazard disposal

Product specifications

Approx. dimensions (mm): 400 x 400 x 400
Approx. weight (kg): 15
Consumables: Tubing, collection canisters, liners, batteries
Price range (USD): 600-7,300 (1,400 typical); price covers all types and variations
Typical product life time: 10 years
Shelf life (consumables): 10 years for rubber tubing

Types and variations

- Disposable or reusable canisters. The two types of vacuum pumps used for thoracic aspiration are motor driven and thermotic