Defibrillator, External, Manual

Health problem addressed
Defibrillators are lifesaving devices that apply an electric shock to establish a more normal cardiac rhythm in patients who are experiencing ventricular fibrillation (VF) or another shockable rhythm.

Product description
The defibrillator charges with a large capacitor. For external defibrillation, paddles are needed to discharge on the patient’s chest. Disposable defibrillation electrodes may be used as an alternative. For internal defibrillation small concave paddles are used. An ECG monitor included is used to verify a shockable rhythm and the effectiveness of treatment. Many defibrillators can be equipped with optional monitoring capabilities, such as pulse oximetry, end-tidal carbon dioxide and NIBP.

Principles of operation
Defibrillators typically have three basic modes of operation: external defibrillation, internal defibrillation, and synchronized cardioversion. (Sync mode uses a defibrillator discharge to correct certain arrhythmias, such as VT; a shock is delivered only when the control circuits sense the next R wave. The delivery of energy is synchronized with and shortly follows the peak of the R wave, preventing discharge during the vulnerable period of ventricular repolarization.) An audible/visible indicator inform when the capacitor is charged and the device is ready. ECG monitoring can be performed before, during, and after a discharge, usually through ECG electrodes, although most external paddles and disposable electrodes have ECG monitoring capability. Many defibrillators are equipped with optional monitoring capabilities (SpO2, ETCO2, temperature, NIBP).

Operating steps
Apply the paddles to the patient’s chest and discharges the defibrillator. Synchronized cardioversion (sync mode) uses a defibrillator discharge to correct certain arrhythmias, such as VT. After verifying that the sync marker pulse appears reliably on the R wave, the operator presses and holds the paddle discharge buttons; a shock is delivered only when the control circuits sense the next R wave. The delivery of energy is synchronized with and shortly follows the peak of the R wave, preventing discharge during the vulnerable period of ventricular repolarization, which is represented by the T wave.

Reported problems
Failure can be caused by defibrillator malfunction, poor electrode application, inappropriate energy selection, a cardiac physiologic state not conducive to defibrillation, or rechargeable battery issues. First- and second-degree burns are especially likely to occur during repeated defibrillation attempts (which require successively higher energies) at the paddle or electrode sites because a high current flow through a small area and/or increased resistance (due to dried gel).

Use and maintenance
User(s): Physicians, nurses, other medical staff
Maintenance: Biomedical or clinical engineer/technician, medical staff, manufacturer/servicer
Training: Initial training by manufacturer, operator’s manuals, user’s guide

Environment of use
Settings of use: Hospital, emergency transport
Requirements: Fully charged battery/good battery care and maintenance procedures in place, uninterruptible power source (to power and recharge batteries), proper sized shock pads or electrodes, maintenance procedures to monitor shelf life of shock pads or electrodes, as well as errors returned by internal testing trials.

Product specifications
Approx. dimensions (mm): 250 x 300 x 250
Approx. weight (kg): 5.5
Consumables: Batteries, cables, paddles/electrodes, gel
Price range (USD): 1,000 - 25,000
Typical product life time (years): 6-7
Shelf life (consumables): 1-2 years for disposable electrodes/pads

Types and variations
Cart mounted, carry case