The MEDOS VAD System

- On the market since 1994
- more than 500 operations in about 80 heart centres
- short and medium term use
- one of the leading systems in Europe
- Application field not as a matter of routine, therefore simplicity and efficiency is of particular importance

Katrin Rohde, MEDOS Medizintechnik AG
Indications

- Short to midterm circulation assistance for patients with myocardial failure of circulation and failure in conventional therapy
- Postcardiotomy
- Cardiogenic shock
- DCM
- Myocarditis
- Myocardial infarct
- Acute rejection after TX
- Acute left and right heart failure
Components

- MEDOS-VAD cannulae
- MEDOS-VAD ventricles
- MEDOS-VAD driving
The ventricle family

- LVAD 10 ml
- LVAD 25 ml
- LVAD 60 ml
- LVAD 80 ml
- RVAD 9 ml
- RVAD 22.5 ml
- RVAD 54 ml
- RVAD 72 ml
Description of the MEDOS-VAD ventricles

sterile disposable pneumatic bloodpump in the following sizes

**adults**
- RVAD (72 ml; 1/2"")
- LVAD (80 ml; 1/2"")

**children**
- RVAD (54 ml; 1/2"")
- LVAD (60 ml; 1/2"")

**infants**
- RVAD (22,5 ml; 3/8"")
- LVAD (25 ml; 3/8"")

**infants**
- RVAD (9 ml; 1/4"")
- LVAD (10 ml; 1/4"")
Essential characteristics of the pump I

- Displacement pump
  - extracorporeal
  - pulsatile

- Volume flow via enlargement resp.
  Reduction of the workspace volume

- the bloodstream is straightened by using a three leaflet bulb valve for inlet and outlet
Essential characteristics of the pump II

- Optimal outwash of the pumping body and the valves only possible via taking the advantage of using the whole discharge volume

- Therefore the Full-/Empty-Mode has to be controlled and eventually set by medical personnel
The conventional drive

- very stable and solid
- battery supply 45 minutes for BiVAD Use
- flow measuring for patients monitoring
- very large and heavy
- complicated data acquisition
- small touch screen
- EKG triggered mode

Katrin Rohde, MEDOS Medizintechnik AG
The Driving-System

- Programming via Touch Screen Monitor
- Monitoring of all user instructions on dialogue menu
- Use very safe by easy handling of the system
Frontview of the Driving Pump

Touch screen monitor

display Alarm

Display operation

Mains operation

Battery Operation

Internal pressure and vacuum supply

general failure

Failure in pressure Supply

Failure in vacuum supply

Failure in battery supply

external pressure and vacuum supply

VAD System / Driving

MEDOS Medizintechnik AG
The Supply System

- Internal Akku (2 hrs)
- Internal Compressor
- Injection of pressure and vacuum possible
- Noisless operation
Frontview of the Supply

- Operating switch
- Operating indicator
- Indicator for mains operating
- Failure of supply
- Battery full
- Battery charging
- Low battery
Display after starting the System

Left pump selection

Interlock of the system

Right pump selection

Software version of the safety computing device

Software version

LVAD
- AUS
- 10ccm
- 25ccm
- 60ccm
- 80ccm

LOCKED

RVAD
- AUS
- 9ccm
- 22ccm
- 54ccm
- 72ccm

FERTIG
The pressure – setting - menu

- Precalculated ideal value for cardiac output of the left pump
- Alarm limit of cardiac output left pump
- Cardiac output actual value (prediction) left Pump
- Systolic pressure
- Diastolic pressure
- Systolic time in %
- Return to starting monitor and pump selection
- Pause left pump
- Change to monitor for ECG trigger
- Change to monitor for setting the alarm limit
- Setting of choosen values
- Bar graph display for cardiac output
- Display of the choosen pumps
- Pause right pump
- Precalculated ideal value for cardiac output of the right pump
- Alarm limit of cardiac output right pump
- Cardiac output actual value (prediction) right Pump
- Systolic pressure
- Diastolic pressure
- Diastolic time in %
- Change to monitor for setting the alarm limit
- Frequency
The MEDOS VAD System

support mode

- RVAD: 9%
- LVAD: 36%
- BiVAD: 42%
- Not specified: 13%

Katrin Rohde, MEDOS Medizintechnik AG
Patients n=502
  321 male
  181 female

Age average
42,196 yrs
(0,01 – 67 yrs)

Indications
- cardiogenic shock
- cardiogenic Shock and postcard
- dcm
- myocarditis
- other/not specified
- postcardiotomy
Patients n=502

Purpose:
- Transplantation: 123
- Weaning: 230
- Not specified: 121

Outcome:
- Death: 216
- Weaning: 150
- Transplantation: 135

Brain death, MOF, sepsis, not specified, other
the new arterial VAD cannulae

cannula with ePTFE graft

cannula with gelatine coated graft
Characteristics of the new arterial cannulae

- material: PVC (Polyvinylchlorid)
- Graft of high flexibility by expanded PTFE (Polytetraflouräthylene) and ring amplification
- Different length and diameters
- Lower end of the cannula closed with lead-through-assistance
- Dacron tissue in lead through area
clinical experiences

- already routinely use for dialysis AV shunts
- artificial substitution of peripheral vessels

animal experiments show the following conclusions:

- the graft has optimal flexibility
- Optimal density also at stitch ducts by using stitching material recommended by the manufacturer
- soft material
- handling very easy

Katrin Rohde, MEDOS Medizintechnik AG
Characteristics of the venous cannulae

- material: PVC (Polyvinylchlorid)
- Wire reinforced upper third
- Different length, diameter and angles (Standard 135°)
- Upper end with blood taking basket as well as seam elevation for fixation by double pursestring suture
- Lower end of the cannula closed with lead-through-assistance
- Dacron tissue in lead through area
# Availability

Arterial Cannula with ePTFE Graft

<table>
<thead>
<tr>
<th>Inner Diameter [mm]</th>
<th>Article Number</th>
<th>Connection</th>
<th>For VAD Ventricle</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,0</td>
<td>ME 656 B0053</td>
<td>1/4“</td>
<td>9/10 ml</td>
</tr>
<tr>
<td>6,0</td>
<td>ME 656 B0063</td>
<td>1/4“</td>
<td>9/10 ml</td>
</tr>
<tr>
<td>8,0</td>
<td>ME 656 B0083</td>
<td>1/4“</td>
<td>9/10 ml</td>
</tr>
<tr>
<td>8,0</td>
<td>ME 656 B0084</td>
<td>3/8“</td>
<td>22,5/25 ml</td>
</tr>
<tr>
<td>10,0</td>
<td>ME 656 B0104</td>
<td>3/8“</td>
<td>22,5/25 ml</td>
</tr>
<tr>
<td>10,0</td>
<td>ME 656 B0105</td>
<td>1/2“</td>
<td>54/60 ml 72/80 ml</td>
</tr>
<tr>
<td>13,0</td>
<td>ME 656 B0135</td>
<td>1/2“</td>
<td>54/60 ml 72/80 ml</td>
</tr>
</tbody>
</table>
### Availability

**arterial cannula with gelatine coated graft**

<table>
<thead>
<tr>
<th>inner diameter [mm]</th>
<th>article number</th>
<th>connection</th>
<th>for VAD ventricle</th>
</tr>
</thead>
<tbody>
<tr>
<td>6,0</td>
<td>ME 6560S 0063</td>
<td>1/4“</td>
<td>9/10 ml</td>
</tr>
<tr>
<td>8,0</td>
<td>ME 6560S 0083</td>
<td>1/4“</td>
<td>9/10 ml</td>
</tr>
<tr>
<td>8,0</td>
<td>ME 6560S 0084</td>
<td>3/8“</td>
<td>22,5/25 ml</td>
</tr>
<tr>
<td>10,0</td>
<td>ME 6560S 0104</td>
<td>3/8“</td>
<td>22,5/25 ml</td>
</tr>
<tr>
<td>12,0</td>
<td>ME 6560S 0125</td>
<td>1/2“</td>
<td>54/60 ml</td>
</tr>
<tr>
<td>14,0</td>
<td>ME 6560S 0145</td>
<td>1/2“</td>
<td>54/60 ml</td>
</tr>
</tbody>
</table>
Our Future: The MEDOS $H_{D_eight}$

Katrin Rohde, MEDOS Medizintechnik AG
specifications of the MEDOS $HDeight$

✓ mobile drive
✓ battery supply up to 4 hours plus emergency energy (about 1 hour)
✓ automatic mode via flow measurement
✓ improved flow measurement
✓ **size:** 340x315x134 (BTH)  **weight:** 9.8 kg
✓ easy data acquisition
✓ large touch screen 640x480 integrated into the console

Katrin Rohde, MEDOS Medizintechnik AG
## Conventional drive vs. $HD_{eight}$

<table>
<thead>
<tr>
<th></th>
<th>Conventional drive</th>
<th>$HD_{eight}$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Application</strong></td>
<td>- LVAD, RVAD, BiVAD - Ventricle Size 9 ml to 80/72 ml</td>
<td>- LVAD, RVAD, BiVAD - Ventricle Size 9 ml to 80/72 ml</td>
</tr>
<tr>
<td><strong>Operating Mode</strong></td>
<td>- Fixed-rate mode - EKG mode</td>
<td>- Fixed-rate mode - Automatic modus = first fill then empty -&gt; var. rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Biventricular mode</strong></td>
<td>- push – push operation</td>
<td>- push – push operation - alternating operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Portability</strong></td>
<td>- emergency battery supply up to 45 minutes - size: 1150x700x750 mm - weight: 115 kg</td>
<td>- battery supplied up to 4 h plus emergency energy &gt;= 1h - size: 340x315x134 (BxTxH) mm - weight: 9,8 kg - environmental fit: explosion proof - waterproof</td>
</tr>
</tbody>
</table>

Katrin Rohde, MEDOS Medizintechnik AG
## Conventional drive vs. $HD_{eight}$

<table>
<thead>
<tr>
<th>Securities</th>
<th>Conventional drive</th>
<th>$HD_{eight}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>- processor controlled security system with integrated emergency power</td>
<td>- Integrated autonomous backups</td>
<td></td>
</tr>
<tr>
<td>- optic and acoustic warning signals on fail of functions</td>
<td>Monitoring and alarm possibilities: flow, pressure incl. tube buckling</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- minimal false handling because of user guide and integrated ventricle typing</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technical Data</th>
<th>Conventional drive</th>
<th>$HD_{eight}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>- beating frequency: 40 to 180 BPM</td>
<td>- beating frequency: 35 to 130 BPM</td>
<td></td>
</tr>
<tr>
<td>- beating volume:</td>
<td>- beating volume: 160 ml max.</td>
<td></td>
</tr>
<tr>
<td>- pressure left/right: 300 mmHg max</td>
<td>- pressure left/right: 400 mmHg max</td>
<td></td>
</tr>
<tr>
<td>- vacuum left/right: -99 mmHg max</td>
<td>- vacuum left/right: -200 mmHg max</td>
<td></td>
</tr>
<tr>
<td>- battery supplied mode: emergency 45 min max</td>
<td>- battery supplied mode: 4 h max plus 1h memergency energy</td>
<td></td>
</tr>
<tr>
<td>- operating voltage: 2 x 12V intern, DC 24V/ 230 V, others available</td>
<td>- operating voltage: 12V intern, DC 12V / 110-240 VAC extern</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>User interface</th>
<th>Conventional drive</th>
<th>$HD_{eight}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>- push – push operation</td>
<td>- push – push operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- alternating operation</td>
<td></td>
</tr>
</tbody>
</table>
Patient 1:
43 years
cardiogenic shock
60 min. reanimation
Implantation of LVAD
transplantation after 57 days
Patient 2:
15 years
DCM
Implantation of LVAD (60ml)
Transplantation after 14 days