

Le nuove tecnologie nelle Linee Guida 2015

LVAD e arresto cardiaco

Alessandro Verde, MD

U.O. Cardiologia
Ospedale Civile "G. da Saliceto"
Piacenza

Premessa e disclosure

- 2006-2009 specializzando c/o Cardiologia Trapianti dell'Ospedale Niguarda Ca' Granda (63 LVAD dal 2010 al 2014)
- 2009-2010 c/o Centro Cuore Berlino (DHZB), circa 150 VAD/anno
- 2011-2015 VAD-coordinator c/o Cardiologia Trapianti dell'Ospedale Niguarda Ca' Granda
- Non ho mai ricevuto compensi né sponsorizzazioni dalle aziende produttrici di VAD

L-VAD / Left-Ventricular Assist Device (dispositivi di assistenza al ventricolo sinistro) ...

- Vengono utilizzati in caso di Insufficienza Cardiaca avanzata (scompenso cardiaco), refrattaria alla terapia medica ed elettrica
 - “Ponte” al Trapianto di cuore
 - Alternativa al Trapianto (per i pazienti non trapiantabili)
- forniscono un supporto meccanico che sostituisce in parte, o totalmente, la funzione del cuore per assicurare la corretta perfusione degli organi periferici

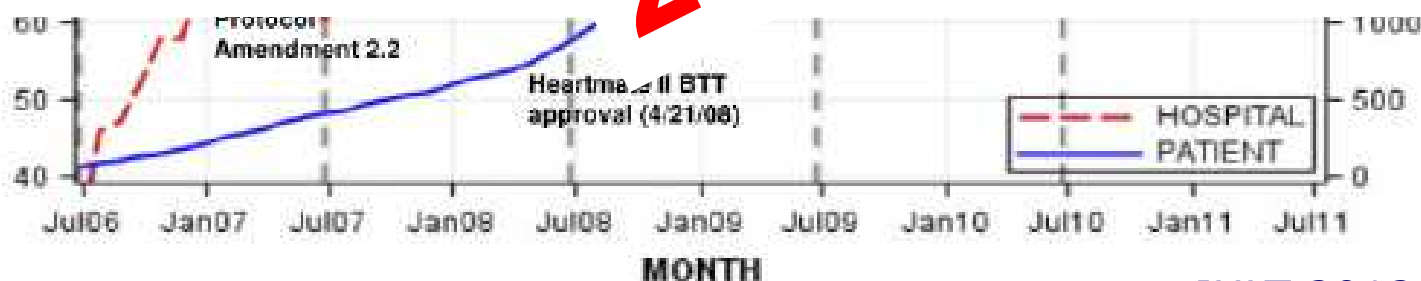
Trend degli impianti negli USA

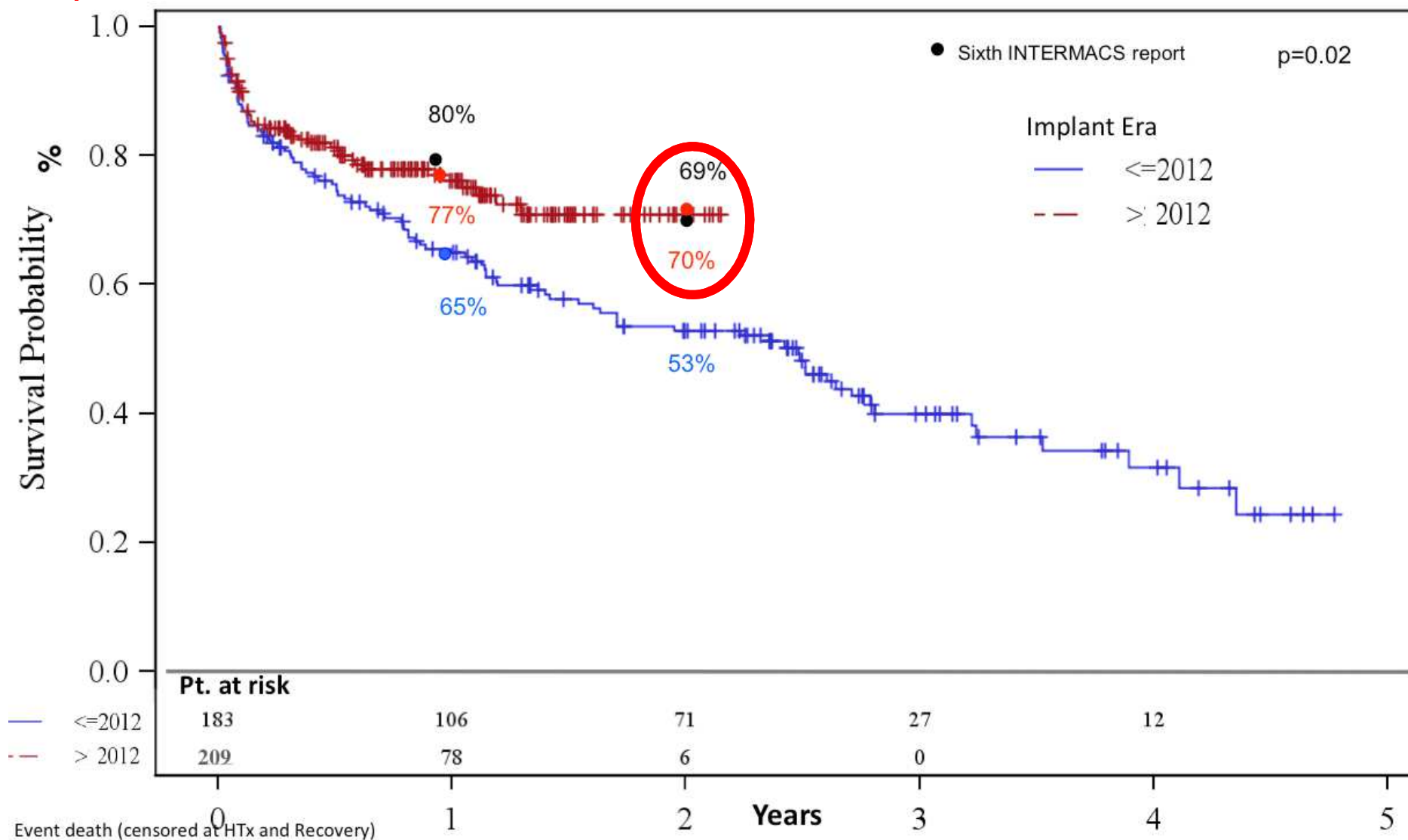
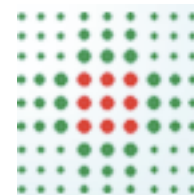
Hospital and Patient Accrual
June 2006 - June 2011

Fifth INTERMACS annual report: A **6,000**-patient database
more than **6,000** mechanical circulatory support patients



Sixth INTERMACS annual report: A **10,000**-patient database



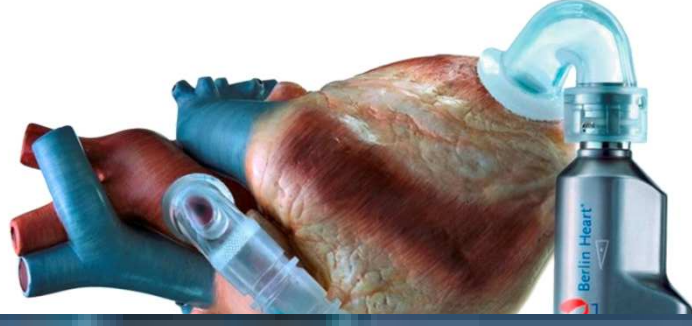
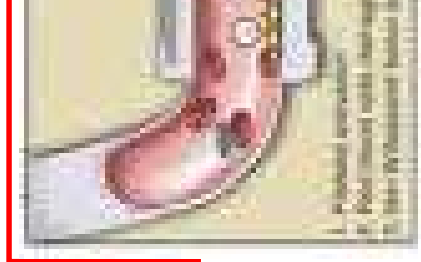




OSPEDALE NIGUARDA
CA' GRANDA

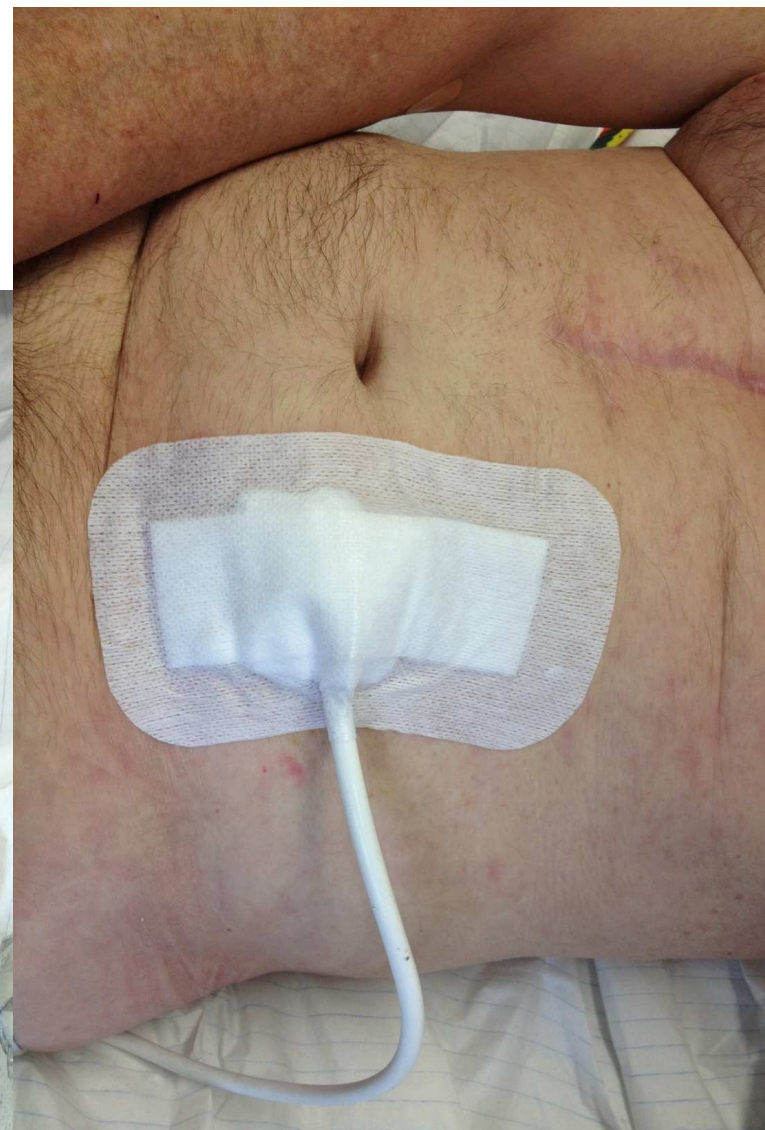


Azienda Unità Sanitaria Locale
Piacenza



Driveline

- cavo elettrico collegato da un lato alla pompa, dall'altro ad un controller

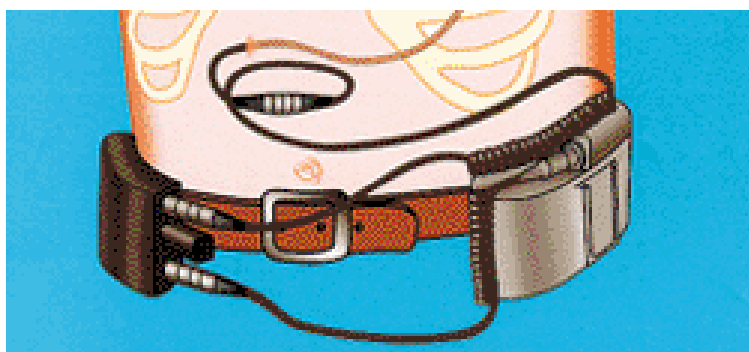


Controller

- Computer per la gestione della pompa

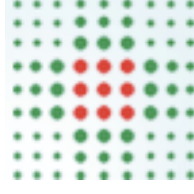


Batterie





**OSPEDALE NIGUARDA
CA' GRANDA**



**Azienda Unità Sanitaria Locale
Piacenza**



Domande:

1. Posso agire in sicurezza quando mi accingo all'assistenza ad un paziente portatore di VAD
2. Posso defibrillare in sicurezza?
3. Posso eseguire il massaggio cardiaco?

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Is There Adequate Knowledge about LVAD Patients among First Responders? A Survey from North Western Italy

*A. Municinò, A. Torriglia, On Behalf of Rete per l'Emergenza-Urgenza.
Dept. of Cardiology, Ospedale A. Gallino ASL3 Genovese, Genova,
Italy.*

The Journal of Heart and Lung Transplantation, Vol 31, No 4S, April 2012

The present Survey shows that first responders and EMD personnel are not aware of basic concepts about CF LVAD pts. Their key role in case of emergency in the outpatient setting makes highly urgent to instruct them with ACLS guidelines specifically addressing CF LVAD pts.

European Resuscitation Council Guidelines for Resuscitation 2015

Section 4. Cardiac arrest in special circumstances

pag 183

Introduction. All clinicians caring for patients with ventricular assist devices (VADs) should have received full training in the procedures for equipment failure and the cardiac arrest situation. The

reversible causes of asthma-related cardiac arrest. Tension pneumothorax can be difficult to diagnose in cardiac arrest; it may be indicated by unilateral expansion of the chest wall, shifting of the trachea and subcutaneous emphysema. Manual airway to

resection or extracorporeal membrane oxygenation (ECMO) is a reasonable option.

Patients with ventricular assist devices

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Diagnosis of cardiac arrest. Confirming cardiac arrest in these patients may be difficult. A patient with invasive monitoring should be considered to have arrested if the arterial line reads the same as the central venous pressure (CVP) line. In patients without invasive monitoring, if the patient has no signs of life and is not breathing, then they should be considered to have suffered a cardiac arrest. Trans-thoracic/transoesophageal echocardiography

hage.
• Sudden unexpected death in epilepsy (SUDEP) affects about 1 in every 3000 people with epilepsy.¹⁰³

Neurological symptoms. Patients can have prodromal signs suggesting a neurological cause before cardiac arrest such as headache, seizures, impaired consciousness, and focal signs,¹⁰⁴ but these are often non-specific and can include syncope, shortness of breath and chest pain. Cardiac or respiratory arrest occurs in between 3 and 11% of patients with subarachnoid haemorrhage,¹⁰⁵ and the initial rhythm is usually non-shockable.

Treatment. Preventive measures for cardiac or respiratory arrest should be aimed at treating the underlying cause. Once cardiac arrest occurs, follow standard BLS and ALS guidelines. If ROSC is achieved, address the underlying cause in addition to standard post resuscitation care.

Patients with subarachnoid haemorrhage may have ECG changes that suggest an acute coronary syndrome.^{106,107} Certain features such as a young age, female gender, non-shockable initial rhythm and neurological antecedents (e.g. headache, seizures,

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always be performed.

It is possible for a patient to have asystole or VF, but still have adequate cerebral blood flow due to adequate and continued pump flow. If the patient is conscious and responding then you will have more time in which to resolve this arrhythmia and external chest compressions will not be needed.

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Incidente al pronto soccorso, muore un 69enne

un'infermiera ha accidentalmente tagliato il cavo del cuore artificiale che teneva in vita l'uomo. La donna è ora indagata



FOTO ANSA

20:07 - La Procura ha iscritto nel registro degli indagati l'infermiera del pronto soccorso dell'ospedale che, tagliando accidentalmente il cavo di alimentazione del cuore artificiale di un cardiopatico di 69 anni, ne ha provocato la morte. L'incidente si è verificato mentre i soccorritori agivano con celerità per salvare il paziente colpito da una grave crisi cardiaca. Fonti di polizia spiegano che si tratta di un atto dovuto.

L'anziano cardiopatico è arrivato nella tarda serata di ieri al pronto soccorso con difficoltà respiratorie e scompenso cardiaco. Come previsto dal protocollo, gli è stato inserito un catetere: durante questa operazione l'infermiera, che stava tagliando i pantaloni con le forbici, ha

accidentalmente reciso anche il cavo che alimenta il dispositivo di supporto ventricolare Vad (Ventricular assist device, impiantato al paziente tempo fa al San Raffaele di Milano) e che veniva tenuto proprio all'interno dei pantaloni

L'inchiesta della Procura è scaturita da una denuncia alla polizia presentata dalla figlia dell'uomo: gli agenti hanno sequestrato il dispositivo e verbalizzato le testimonianze dei presenti, tra cui anche il personale dell'ospedale.

Domande:

1. Posso agire in sicurezza quando mi accingo all'assistenza ad un paziente portatore di VAD
 - Solo se presto attenzione a non eseguire manovre che possano alterare il funzionamento del VAD (tagliare o scollegare i cavi)
2. Posso defibrillare in sicurezza?
3. Posso eseguire il massaggio cardiaco?

European Resuscitation Council Guidelines for Resuscitation 2015

Section 4. Cardiac arrest in special circumstances

(LUSA) device should have the same algorithm followed as the algorithm for arrest after cardiac surgery (see cardiac arrest following cardiac surgery). Check the rhythm; perform defibrillation for shockable rhythms (VF/pVT), start pacing for asystole. In pulseless electrical activity (PEA), turn the pacing off and verify there is no underlying VF, which must be treated by defibrillation. External

reversible causes of asthma-related cardiac arrest. Tension pneumothorax can be difficult to diagnose in cardiac arrest; it may be indicated by unilateral expansion of the chest wall, shifting of the trachea and subcutaneous emphysema. Pleural ultrasound in skilled hands is faster and more sensitive than chest X-ray for the

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Cardiac arrest associated with neurological disease
Causes of cardiac arrest. Cardiac arrest associated with acute neu-

not breathing, then they should be considered to have suffered a cardiac arrest. Transthoracic/transoesophageal echocardiography (TTE/TOE), capnography or Doppler flow readings in a major artery may assist in the diagnosis of whether there is meaningful perfusion. These devices also display pump flow and this should be used to assist in a diagnosis of whether there has been a genuine loss of blood flow, or whether there is just a low flow situation with reduced conscious level.

Management of cardiac arrest. Patients with an implantable left ventricular assist devices (LVAD) such as a HeartMate (Thoratec, Pleasanton, CA, USA) or HeartWare (HeartWare, Framingham, MA, USA) device should have the same algorithm followed as the algorithm for arrest after cardiac surgery (see cardiac arrest following cardiac surgery). Check the rhythm; perform defibrillation for shockable rhythms (VF/pVT); start pacing for asystole. In pulseless electrical activity (PEA), turn the pacing off and verify there is no underlying VF, which must be treated by defibrillation. External chest compressions should be performed if immediate resuscitative efforts fail. Importantly, the airway and breathing checks should always be performed.

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Resternotomy should be performed in an established cardiac arrest within 10 days of surgery and after this time, either

changes that suggest an acute coronary syndrome.^{104,105} Certain features such as a young age, female gender, non-shockable initial rhythm and neurological antecedents (e.g. headache, seizures, neurological deficits) are common but non-specific for neurological cause.¹⁰³ Individuals with neurological prodromal symptoms who achieve ROSC may be considered for CT brain scan. Whether this is done before or after coronary angiography will depend on clinical judgement regarding the likelihood of a subarachnoid haemorrhage versus acute coronary syndrome.

Outcome. Survival depends on the underlying cause and traditional factors (e.g. witnessed, bystander CPR) associated with survival.¹⁰² Prognosis is poor in those with ROSC after a subarachnoid haemorrhage.^{104,106,108} Individuals who achieve ROSC after a primary neurological cause of cardiac arrest will often fulfil neurological criteria for death and should be considered as potential organ donors.¹⁰³

Obesity
Introduction. Worldwide obesity has more than doubled since 1980. In 2014, more than 1.9 billion (39%) adults were overweight, and of these over 600 million (13%) were obese.

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1. Posso defibrillare in sicurezza?
 - Sì, ma... fai attenzione! nel caso del modello INCOR (Berlin-heart) è "consigliato" prima scollegare il controller
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European Resuscitation Council Guidelines for Resuscitation 2015

Section 4. Cardiac arrest in special circumstances

Diagnosis of cardiac arrest.

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ECLS can ensure both organ perfusion and gas exchange in cases of otherwise refractory respiratory and circulatory failure. Cases of successful treatment of asthma-related cardiac arrest in adults using ECLS have been reported^{699,701}; however, the role of ECLS in cardiac arrest caused by asthma has never been investigated in controlled studies. The use of ECLS requires appropriate skills and equipment that may not be available in all hospitals.

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Diagnosis of cardiac arrest. Confirming cardiac arrest in these patients may be difficult. A patient with invasive monitoring should be considered to have arrested if the arterial line reads the same as the central venous pressure (CVP) line. In patients without invasive monitoring, if the patient has no signs of life and is not breathing, then they should be considered to have suffered a cardiac arrest. Transthoracic/transoesophageal echocardiography (TTE/TOE), capnography or Doppler flow readings in a major artery may assist in the diagnosis of whether there is meaningful perfusion. These devices also display pump flow and this should be used to assist in a diagnosis of whether there has been a genuine loss of blood flow, or whether there is just a low flow situation with reduced conscious level.

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It is possible for a patient to have asystole or VF, but still have adequate cerebral blood flow due to adequate and continuous pump flow. If the patient is conscious and responding then you will have more time in which to resolve this arrhythmia and external chest compressions will not be needed.

Resternotomy should be performed in an established cardiac arrest within 10 days of surgery and after this time, either

resternotomy or extracorporeal membrane oxygenation (ECMO) is a reasonable option.

Cardiac arrest associated with neurological disease

Causes of cardiac arrest. Cardiac arrest associated with acute neurological disease is relatively uncommon and can occur with subarachnoid haemorrhage, intracerebral haemorrhage, epileptic seizures, and ischaemic stroke.⁷⁰³ In addition brain injury associated with trauma can cause cardiac arrest.

Cardiac arrest associated with neurological disease can be due to:

- Loss of consciousness, causing airway obstruction, hypoxaemia and respiratory arrest followed by cardiac arrest. Loss of consciousness is also associated with an increased risk of aspiration of gastric contents into the lungs.
- Respiratory and cardiac depression caused by compression of the brain stem.
- Arrhythmias and myocardial dysfunction associated with acute neurological injury and in particular sub-arachnoid haemorrhage.
- Sudden unexpected death in epilepsy (SUDEP) affects about 1 in every 3000 people with epilepsy.⁷⁰⁴

Neurological symptoms. Patients can have prodromal signs suggesting a neurological cause before cardiac arrest such as headache, seizures, impaired consciousness, and focal signs,⁷⁰⁴ but these are often non-specific and can include syncope, shortness of breath and chest pain. Cardiac or respiratory arrest occurs in between 3 and 11% of patients with subarachnoid haemorrhage,⁷⁰⁵ and the initial rhythm is usually non-shockable.

Treatment. Preventive measures for cardiac or respiratory arrest should be aimed at treating the underlying cause. Once cardiac arrest occurs, follow standard BLS and ALS guidelines. If ROSC is achieved, address the underlying cause in addition to standard post resuscitation care.

Patients with subarachnoid haemorrhage may have ECG changes that suggest an acute coronary syndrome.^{706,707} Certain features such as a young age, female gender, non-shockable initial rhythm and neurological antecedents (e.g. headache, seizures, neurological deficits) are common but non-specific for neurological cause.⁷⁰⁸ Individuals with neurological prodromal symptoms who achieve ROSC may be considered for CT brain scan. Whether this is done before or after coronary angiography will depend on clinical judgement regarding the likelihood of a subarachnoid haemorrhage versus acute coronary syndrome.

Outcome. Survival depends on the underlying cause and traditional factors (e.g. witnessed, bystander CPR) associated with survival.⁷⁰⁹ Prognosis is poor in those with ROSC after a subarachnoid haemorrhage.^{704,706,709} Individuals who achieve ROSC after a primary neurological cause of cardiac arrest will often fulfil neurological criteria for death and should be considered as potential organ donors.⁷⁰⁹

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Pulsatilità

I pazienti con LVAD a flusso continuo abitualmente non hanno polso apprezzabile alla palpazione

- La pulsatilità richiede l'apertura della valvola aortica
- Un adeguato volume di sangue nel ventricolo (precarico) e la capacità di contrarsi, intrinseca al muscolo cardiaco, sono condizioni necessarie a far aprire la valvola aortica.
- se il lavoro del ventricolo è completamente vicariato dal VAD, il cuore nativo in sistole sarà “vuoto” e, contraendosi, non sarà in grado di aprire la valvola aortica.
- La pressione arteriosa non invasiva può essere quindi misurata accuratamente solo con metodica Doppler unita al manicotto standard poiché, a causa della tecnologia a flusso continuo, viene a mancare la fisiologica pulsatilità che normalmente permette sia di percepire il polso del paziente che la misurazione della pressione arteriosa.

How to face emergencies in heart failure patients with ventricular assist device

Massimo Pistono ^a, Ugo Corrà ^{a,*}, Marco Gnemmi ^a, Alessandro Imparato ^a, Pier Luigi Temporelli ^a, Franco Tarro Genta ^b, Pantaleo Giannuzzi ^a

Table 2

Main clinical features of patients with ventricular assist device (VAD). The clinical presentation of a VAD patient depends, in part, on the type of device used and operating modality, pulsatile vs. continuous flow (see also text).

1. Heart auscultation: heart sounds may be partially concealed by the running noise of the device.
2. The patient may be pulseless on a continuous flow device.
3. The patient's ECG heart rate will differ from the pulse rate (if it is palpable) since the VAD is not synchronized with the native heart rate.
4. Pulse oximetry may not be measurable or accurate (see text for details).
5. A patient may not have a systolic and diastolic blood pressure. Automatic blood pressures are not accurate and usually cannot be obtained. A “mean” blood pressure is typically ranging between 70 and 100 mm Hg.

European Resuscitation Council Guidelines for Resuscitation 2015

Section 4. Cardiac arrest in special circumstances

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ventricular in the situation. The in that a car- this situation required. The ricular assist reports of in the VAD. it to decem- and often

est in these ring should ds the same nts without f life and is ve suffered a iography major artery nging pres- is should be n a genuine uation with

fantable left te (Thoracic, ingham, MA, owed as the e arrest fol- defibrillation ile. In pulse- rify there is ion. External resuscitative ecks should

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Introduction. All clinicians caring for patients with ventricular assist devices (VADs) should have received full training in the procedures for equipment failure and the cardiac arrest situation. The management of patients with VADs is more complex, in that a cardiac arrest may be due to mechanical failure and in this situation there may be actions specific to the device that are required. The use of external chest compression in patients with ventricular assist devices has been reviewed.⁷⁰² There are isolated case reports of successful external chest compression without damage to the VAD. External chest compression may be particularly useful to decompress a non-functional right ventricle in cardiac arrests and often the right ventricle may be the cause of the loss of output.

Diagnosis of cardiac arrest. Confirming cardiac arrest in these patients may be difficult. A patient with invasive monitoring should be considered to have arrested if the arterial line reads the same as the central venous pressure (CVP) line. In patients without invasive monitoring, if the patient has no signs of life and is not breathing, then they should be considered to have suffered a cardiac arrest. Transthoracic/transoesophageal echocardiography (TTE/TOE), capnography or Doppler flow readings in a major artery may assist in the diagnosis of whether there is meaningful perfusion. These devices also display pump flow and this should be used to assist in a diagnosis of whether there has been a genuine loss of blood flow, or whether there is just a low flow situation with reduced conscious level.

Management of cardiac arrest. Patients with an implantable left ventricular assist devices (LVAD) such as a HeartMate (Thoratec, Pleasanton, CA, USA) or HeartWare (HeartWare, Framingham, MA, USA) device should have the same algorithm followed as the algorithm for arrest after cardiac surgery (see cardiac arrest following cardiac surgery). Check the rhythm, perform defibrillation for shockable rhythms (VF/pVT), start pacing for asystole. In pulseless electrical activity (PEA), turn the pacing off and verify there is no underlying VF, which must be treated by defibrillation. External chest compressions should be performed if immediate resuscitative efforts fail. Importantly, the airway and breathing checks should always be performed.

It is possible for a patient to have asystole or VF, but still have adequate cerebral blood flow due to adequate and continuous pump flow. If the patient is conscious and responding then you will have more time in which to resolve this arrhythmia and external chest compressions will not be needed.

Resternotomy should be performed in an established cardiac arrest within 10 days of surgery and after this time, either

resternotomy or extracorporeal membrane oxygenation (ECMO) is a reasonable option.

Cardiac arrest associated with neurological disease

Causes of cardiac arrest. Cardiac arrest associated with acute neurological disease is relatively uncommon and can occur with subarachnoid haemorrhage, intracerebral haemorrhage, epileptic seizures, and ischaemic stroke.⁷⁰³ In addition brain injury associated with trauma can cause cardiac arrest.

Cardiac arrest associated with neurological disease can be due to:

- Loss of consciousness, causing airway obstruction, hypoxaemia and respiratory arrest followed by cardiac arrest. Loss of consciousness is also associated with an increased risk of aspiration of gastric contents into the lungs.
- Respiratory and cardiac depression caused by compression of the brain stem.
- Arrhythmias and myocardial dysfunction associated with acute neurological injury and in particular sub-arachnoid haemorrhage.
- Sudden unexpected death in epilepsy (SUDEP) effects about 1 in every 1000 people with epilepsy.⁷⁰⁴

Neurological symptoms. Patients can have prodromal signs suggesting a neurological cause before cardiac arrest such as headache, seizures, impaired consciousness, and focal signs,⁷⁰⁴ but these are often non-specific and can include syncope, shortness of breath and chest pain. Cardiac or respiratory arrest occurs in between 3 and 11% of patients with subarachnoid haemorrhage,⁷⁰⁵ and the initial rhythm is usually non-shockable.

Treatment. Preventive measures for cardiac or respiratory arrest should be aimed at treating the underlying cause. Once cardiac arrest occurs, follow standard BLS and ALS guidelines. If ROSC is achieved, address the underlying cause in addition to standard post resuscitation care.

Patients with subarachnoid haemorrhage may have ECG changes that suggest an acute coronary syndrome.^{706,707} Certain features such as a young age, female gender, non-shockable initial rhythm and neurological antecedents (e.g. headache, seizures, neurological deficits) are common but non-specific for neurological cause.⁷⁰⁸ Individuals with neurological prodromal symptoms who achieve ROSC may be considered for CT brain scan. Whether this is done before or after coronary angiography will depend on clinical judgement regarding the likelihood of a subarachnoid haemorrhage versus acute coronary syndrome.

Outcome. Survival depends on the underlying cause and traditional factors (e.g. witnessed, bystander CPR) associated with survival.⁷⁰⁹ Prognosis is poor in those with ROSC after a subarachnoid haemorrhage.^{704,706,709} Individuals who achieve ROSC after a primary neurological cause of cardiac arrest will often fulfil neurological criteria for death and should be considered as potential organ donors.⁷⁰⁹

Obesity

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The World Health Organization (WHO) uses body mass index (BMI; weight in kg divided by height in m²) to define obesity in adults as⁷¹⁰⁻⁷¹²:

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European Resuscitation Council Guidelines for Resuscitation 2015

Section 4. Cardiac arrest in special circumstances

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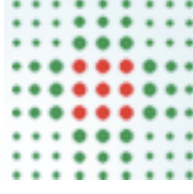
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OSPEDALE NIGUARDA
CA' GRANDA



Azienda Unità Sanitaria Locale
Piacenza

Symptomatic (including altered mental status) VAD patient with/without VAD alarms
A "pulseness" VAD patient

Check the connections

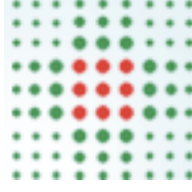
Still symptoms and/or with VAD alarms

Contact VAD
coordinator

No

Yes





Step
3

Patient visit and ECG monitoring

Rhythm instability

Step
4

VAD running/NOT running

Asystole or
non-cardiovertible rhythm

VT, VF or
Cardiovertible rhythm

Step
5

Unconscious

Conscious

Unconscious

Co

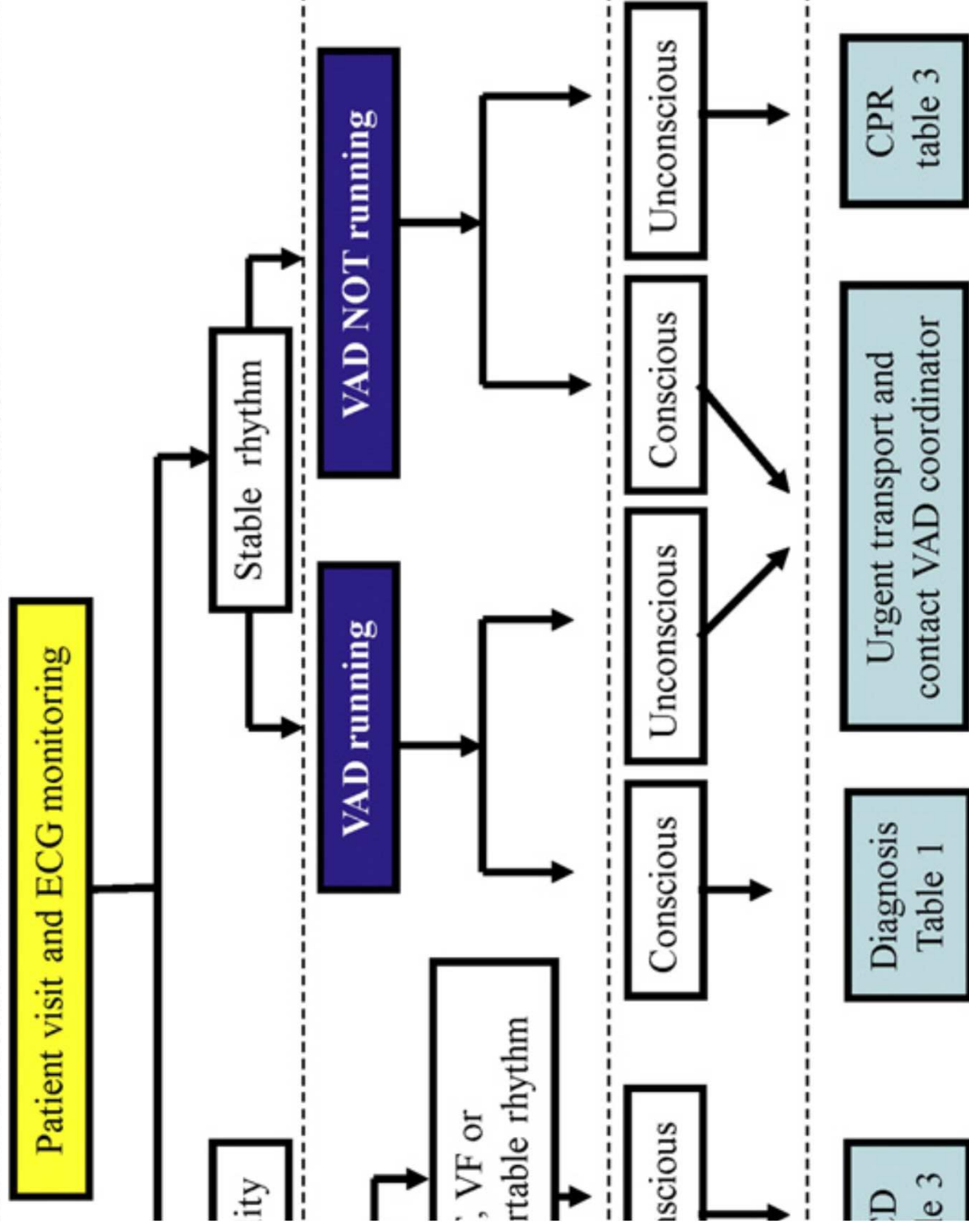
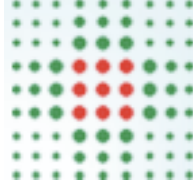
Step
6

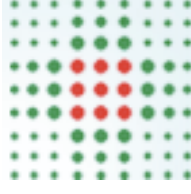
CPR
table 3

ECD (*if possible*)
and urgent transport

ECD
table 3

Di
T





support (ACLS) problematic.⁵ The major manufacturer of current LVAD devices warns “there may be risk associated with performing external chest compressions”.² Consequently, many pre-hospital,

2. Heartmate II. Instructions for use (IFU). Thoratec Corporation; 2010.



is functioning properly. Chest compression may lead to dislodging of the tubing or damage to the device itself.



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October 27, 2009:1647-59



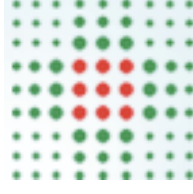


Table 3

Emergency maneuvers that can be applied according to type of VAD used.

	Chest compression	External cardiac defibrillation
HeartMate II	Not recommended	Possible
INCOR-Berlin Heart	Not recommended	Possible ^a
HeartWare	Possible ^b	Possible
Jarvik 2000	Possible ^b	Possible

VAD: ventricular assist device. ECD: external cardiac defibrillation.

^a If VAD controller is disconnected before ECD.

^b If patient is unconscious without arterial pulse and with asystole or non-cardiovertable rhythm.

External cardiac compression during cardiopulmonary resuscitation of patients with left ventricular assist devices

Nigel T. Mabvuure^{a,*} and Jeremy N. Rodrigues^b

The absence of high-quality data precludes definitive recommendation for or against any particular form of CPR in patients with LVADs. However, data presented suggest that chest compression is not as unsafe as previously thought. The efficacy of chest compressions in this patient population has not yet been investigated. Further

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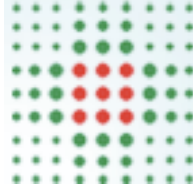
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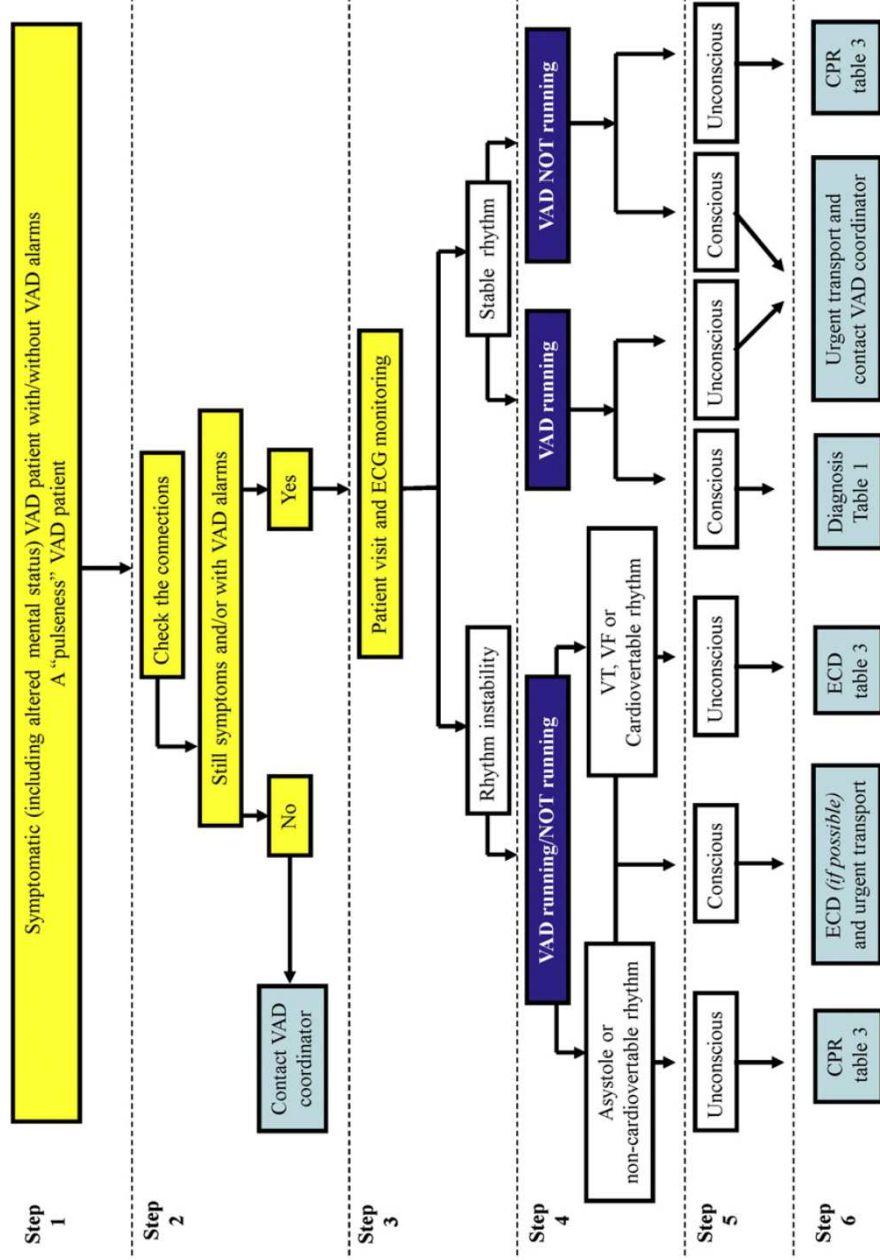
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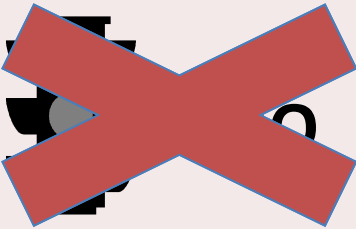
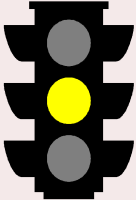
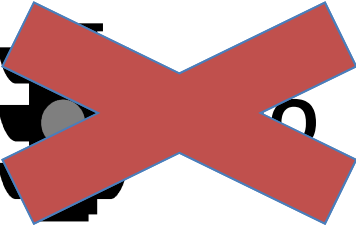
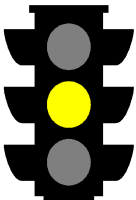
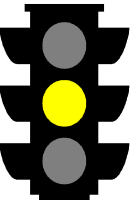


How to face emergencies in heart failure patients with ventricular assist device

Massimo Pistono^a, Ugo Corrà^{a,*}, Marco Gnemmi^a, Alessandro Imparato^a, Pier Luigi Temporelli^a, Franco Tarro Genta^b, Pantaleo Giannuzzi^a



PROCEDURE «EMERGENZA» L-VAD

	MASSAGGIO CARDIACO	CARDIO VERSIONE ELETTRICA C.V.E.
HEART MATE II	 	 SI
INCOR	 	 disconnettere il controllore eseguire C.V.E. riconnettere il controllore
HEART WARE	 ATTENZIONE SE paziente privo di coscienza E macchina «ferma» e senza polso ma PRIMA Controllare allarmi verificare connessioni verificare carica delle batterie	 SI
JARVIK	 ATTENZIONE SE paziente privo di coscienza E macchina «ferma» e senza polso ma PRIMA Controllare allarmi verificare connessioni verificare carica delle batterie	 SI

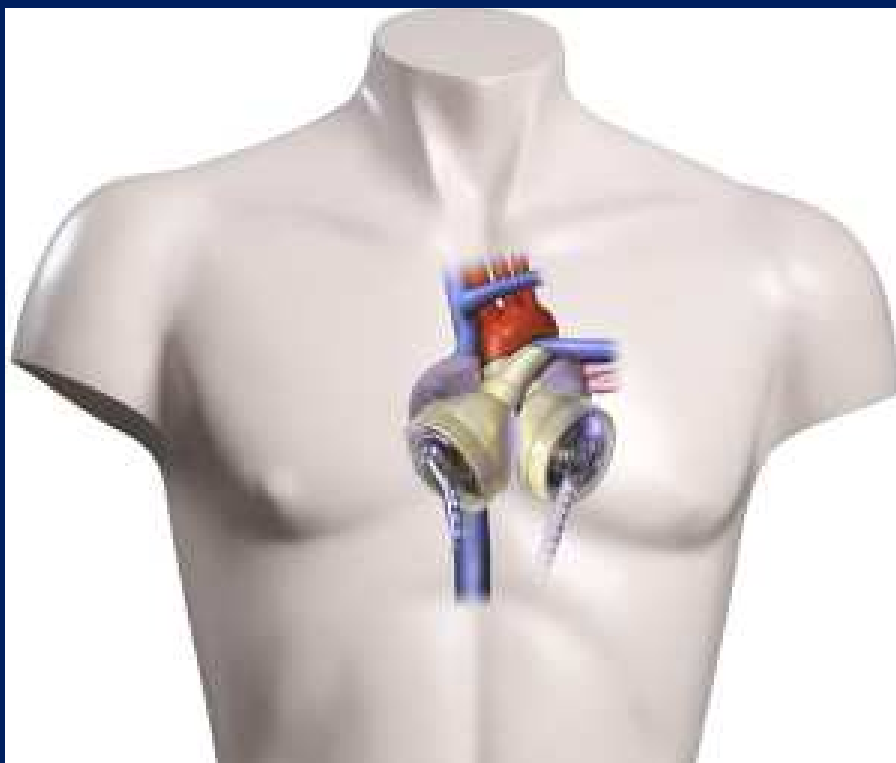
Courtesy of M. Pistono

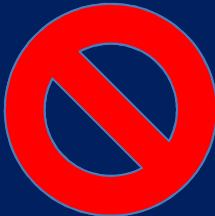
Domande:

1. Posso agire in sicurezza quando mi accingo all'assistenza ad un paziente portatore di VAD
 - Solo se presto attenzione a non eseguire manovre che possano alterare il funzionamento del VAD (tagliare o scollegare i cavi)
2. Posso defibrillare in sicurezza?
 - Sì, ma: in un caso è consigliato prima scollegare il controller
3. Posso eseguire il massaggio cardiaco?
 - Sì, ma devo accertarmi che il paziente sia realmente in arresto di circolo

SYNCARDIA

CUORE ARTIFICIALE TOTALE



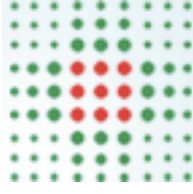
NO! 

MASSAGGIO
CARDIACO
DC/SHOCK

Courtesy of A. Municinò



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CA' GRANDA



Azienda Unità Sanitaria Locale
Piacenza

**Self-made
guidelines**

