SUPPLMENTAL MATERIAL

Figure 1. Search Algorithm

PubMed / MEDLINE Search Algorithm:

((heart-assist devices* OR left ventricular assist device[tiab] OR lvad[tiab] OR mechanical circulatory support[tiab])

AND

(destination therapy[tiab] OR continuous flow[tiab] OR nonpulsatile[tiab] OR axial flow[tiab] OR heartmate ii[tiab] OR thoratec[tiab] OR heartware[tiab] OR hvad[tiab])

AND

(clinical trial[tiab] OR benefit[tiab] OR risk[tiab] OR survival[tiab] OR death[tiab] OR quality of life[tiab] OR complication[tiab] OR bleeding[tiab] OR stroke[tiab] OR infection[tiab] OR sepsis[tiab] OR renal failure[tiab] OR right ventricular assist device[tiab] OR hospitalization[tiab] OR readmission[tiab] OR device malfunction[tiab] OR pump replacement[tiab] OR reoperation[tiab] OR cardiac arrhythmia[tiab] OR arrhythmia[tiab] OR defibrillator shock[tiab])) AND "humans"[Filter] AND "english"[Filter] AND (2007[pdat] OR 2008[pdat] OR 2009[pdat] OR 2010[pdat] OR 2011[pdat] OR 2012[pdat] OR 2013[pdat] OR 2014[pdat])

Figure 2. Adverse Event Definitions

Term	Definition
HeartMate II Trial[1-3]	
Localized Non-Device Infection	Infection localized to any organ system or region without evidence of systemic involvement which requires treatment or is ascertained by standard clinical methods and either associated with evidence or bacterial, viral, fungal, and protozoal infection, by standard clinical pathologic/laboratory methods. This definition includes positive blood cultures that are not considered to be septic in etiology.
Percutaneous Site Infection	Infection of the percutaneous drive line site evidenced by the need to treat with antimicrobial therapy, when there is clinical evidence of infection such as pain, fever, drainage, and or leukocytosis. This definition includes any positive cultures identified at the time of pump explant.
Pump Pocket Infection	Infection of the pump pocket area evidence by the need to treat with antimicrobial therapy, when there is clinical evidence of infection such as pain, fever, drainage, and or leukocytosis. This definition includes any positive cultures identified at the times of pump explant.
Sepsis	A systematic response to a serious infection, usually manifested by fever, tachycardia, tachypnea, leukocytosis and vasodilation requiring use of IV antimicrobial therapy. It may or may or may not be associated with a localized site of infection. It may of or may not be accompanied by a positive microbiological culture from the blood, the localized site of infection, or other evidence of bacterial, viral, fungal, or protozoal infection using standard clinical pathologic/ laboratory methods. This definition excludes routine prophylactic treatment with IV antimicrobial therapy.
Bleeding	An episode of internal of external bleeding that causes death, re-operation, permanent injury, or necessitates transfusion of > 2 units of red blood cells within 24 hours.
Neurologic Event	Any new, temporary or permanent, focal or global, neurological deficit including TIA, metabolic encephalopathy, seizure, etc. The event must be sub-catagorized to document the type of neurologic event.
Stroke	A neurologic deficit lasting more than 24 hours, or lasting 24 hours or less with a brain imaging study showing new infarction. A TIA is a neurological deficit lasing 24 hours and if an imaging study is performed, shows no evidence of new infarction. Each stroke must be subcategorized as either ischemic or hemorrhagic.
RHF	Symptoms of RHF (e.g. drop in right ventricular ejection associated with right sided congestion including hepatic congestion, peripheral edema, jugular venous distension, etc. requiring either RVAD implantation at any time, or inotropic therapy > 14 days following implant.
Cardiac Arrhythmias	Any symptomatic or asymptomatic arrhythmia that requires intervention. The investigator should distinguish four types of events: 1) cardiac arrest, 2) VA, 3) supraventricular arrhythmia, 4) atrial arrhythmia.
Renal Failure	Abnormal kidney function requiring dialysis in patients who did not require this procedure prior to the implant.
Respiratory Failure	Impairment of respiratory function requiring reintubation and/or tracheostomy at any time or the inability to discontinue ventilator support after six days (144 hours) of device support.

Suspected Device Malfunction/Failure	An instance when any component of the system fails to perform its intended function. Losses of the display, inability to operate on batteries, or pump stoppage are examples. Event consequences can be captured on the case report form and will include: hemodynamic compromise, re-operation, death, urgent transplant or initiation of inotropes.
INTERMACS[4]	
Localized Non-Device Infection	Infection localized to any organ system or region (e.g. mediastinitis) without evidence of systemic involvement (see sepsis definition), ascertained by standard clinical methods and either associated with evidence of bacterial, viral, fungal or protozoal infection, and/or requiring empirical treatment.
Percutaneous Site and/or Pocket Infection	A positive culture from the skin and/or tissue surrounding the drive line or from the tissue surrounding the external housing of a pump implanted within the body, coupled with the need to treat with antimicrobial therapy, when there is clinical evidence of infection such as pain, fever, drainage, or leukocytosis.
Internal Pump Component or Outflow Tract Infection	Infection of blood-contacting surfaces of the LVAD documented by positive site culture.
Sepsis	Evidence of systemic involvement by infection, manifested by positive blood cultures and/or hypotension.
Major Bleeding	An episode of suspectived internal or external bleeding that results in one or more of the following: death, re-operation, hospitalization, transfusion of PRBCs as follows: 1) during first 7 days post implant = $\geq$ 4 units PRBC within any 24 hour period or 2) after 7 days post implant any transfusion of PRBCs
Neurological Dysfunction	Any new, temporary or permanent, focal or global neurologic deficit, including TIA that resolves within 24 hours, and ischemic or hemorrhagic intracranial CVA that persists beyond 24 hours or less than 24 hours with infarction on an image study.
Right Heart Failure	Symptoms and signs of persistent right ventricular dysfunction [central venous pressure > 18 mmHg with a cardiac index <2.3 L/min/m2 in the absence of elevated left atrial/pulmonary capillary wedge pressure (greater than 18 mmhg), tamponade, ventricular arrhythmias or pneumothorax] requiring RVAD; implantation; or requiring inhaled nitric oxide or inotropic therapy for a duration of more than 1 week at any time after LVAD implantation.
Device Malfunction	Denotes a failure of one or more of the components of the device system which either directly causes or could potentially induce a state of inadequate circulatory support (low cardiac output state) or death.
Cardiac Arrhythmia	Any documented arrhythmia that results in clinical compromise (e.g., diminished LVAD flow, oliguria, pre-syncope or syncope) that requires hospitalization or occurs during a hospital stay.
American College of Chest Physicians and Society of Critical Care Medicine (ACCP/SCCM)[5]	
Sepsis	Defined as a systemic inflammatory response syndrome (two or more of: 1) temperature 38°C or 36°C; 2) heart rate 90 beats/min; 3) respiratory rate 20 breaths/min or PaCO2 32 mm Hg; or 4) white blood cell count 12,000 cells/mm3, 4,000 cells/mm3 or 10% immature bands) resulting from a confirmed infectious process.
Schmid et al., 2008[6]	
Stroke	Stroke was a clinical diagnosis, defined as cerebral ischemia with consecutive neurologic symptoms persisting for 24 hours, irrespective of findings in cranial CT.
Cerebral Bleeding	Cerebral bleeding, caused either by spontaneous rupture of a blood vessel within the head or after stroke, mandated confirmation by CT scan, regardless of present symptoms.
Lahpor et al., 2009[7]	

RHF	The post-operative need for temporary right ventricular mechanical support or inotropic support for more than 14 days following the implantation.
Starling et al., 2013[8]	
Confirmed Pump Thrombosis	Confirmed pump thrombosis was defined as a thrombus found on the blood-contacting surfaces of the HeartMate II, its inflow cannula, or its outflow conduit at pump replacement, urgent transplantation, or autopsy.
Suspected Pump Thrombosis	Suspected pump thrombosis was defined as a clinical diagnosis of pump-related malfunction in which the clinical or device variables suggested a thrombus on the blood-contacting surfaces of the pump, cannulae, or grafts.
Crow et al., 2009[9]	
GI Bleeding	Defined as a guaiac-positive stool and a hemoglobin drop requiring transfusion of at least 2 units of PRBCs.
Martin et al., 2010[10]	
Infection	Defined as 1) a positive bacterial or fungal culture taken from the bloodstream attributable to the device, andyor from the driveline site, andyor the operative bed, that was treated with antimicrobial agents by the clinicians caring for the patient, or 2) a clinically suspected infection of the device that was surgically debrided and treated with antimicrobial therapy regardless of culture data.
Topkara et al., 2010[11]	
veline/Pump Pocket Infect	Defined as those that required treatment with antimicrobial therapy, when there is clinical evidence of infection such as pain, fever, drainage, and or leukocytosis.
Local Infections	Defined as those limited to any organ system or region without evidence of systemic involvement that requires treatment or is ascertained by standard clinical method.
Uriel et al., 2010[12]	
Minor Bleeding	Defined as observable blood loss without the need for transfusion.
Major Bleeding	Defined as need for blood transfusion 7 days after device insertion.
Stroke	Defined as any neurologic event lasting 24 hours and categorized as having a hemorrhagic or thromboembolic etiology according to the results of intracrantial imaging.
Pump Thrombosis	Pump thrombosis was defined as any thrombus within the device or its conduits associated with clinical signs of impaired pump performance
Demirozu et al., 2011[13]	
GI Bleeding	Patients were considered to have GI bleeding if they had 1 or more of the following symptoms: guaiac-positive stool; hematemesis; melena; active bleeding at the time of endoscopy or colonoscopy; and blood within the stomach at endoscopy or colonoscopy. The symptom(s) had to be accompanied by a decrease of 1 g/dl in the patient's hemoglobin level, which was considered to necessitate the transfusion of 2 units PRBCs.
Schaffer et al., 2011[14]	
Driveline/Pump Pocket Infection	Defined as either: 1) purulent drainage from the drive-line exit site (or device pocket); 2) organisms isolated from an aseptically obtained culture of fluid or tissue from the driveline exit site (or device pocket); or 3) an abscess or other evidence of infection involving the drive-line tract (or device pocket) found on direct examination, during re operation or by histopathologic or radiologic examination.
Schaffer et al., 2011[15]	
GI Bleeding	Defined as bleeding with an identifiable GI source by esophagogastroduodenoscopy, colonoscopy, or tagged red blood cell scan.
Aggarwal et al., 2012[16]	
GI Bleeding	Defined as bleeding above the ligament of Treitz and bleeding from the GI tract distal to the ligament of Treitz, respectively.

Aggarwal et al., 2012[17]	
Device Infection	Defined as a culture-positive specimen obtained from any part of the device, including driveline or pocket infections.
Bloodstream Infection	Must meet at least 1 of the following criteria: 1) a recognized pathogen cultured from 1 or more blood cultures and organism cultured from blood is not related to an infection at another site, 2) at least 1 of the following signs or symptoms: fever (>38°C), chills, or hypotension and signs and symptoms and positive laboratory results are not related to an infection at another site and common skin contaminant is cultured from 2 or more blood cultures drawn on separate occasions
Brenyo et al., 2012[18]	
VA	Defined as the first ICD therapy for VA after the start of follow-up.
Morgan et al., 2012[19]	
GI Bleeding	Defined as melena, hematochezia or hematemesis along with a drop in hemoglobin requiring transfusion.
Raasch et al., 2012[20]	
Sustained VA Event	Defined as a single episode of ventricular tachycardia lasting at least 30 seconds or a VA necessitating termination via antitachycardia pacing or defibrillation.
Yuan et al., 2012[21]	
RHF	Symptoms of RHF requiring RVAD implantation at any time or inotropic support ≥14 days following LVAD implantation
Device Failure	All types of device malfunction, including mechanical failure, electrical failure, and device thrombosis
Borgi et al., 2013[22]	
RHF	Defined as the need for inotropic support for more than 1 week or the need for RVAD support
Deo et al., 2013[23]	
RVF	Defined as the need for IV inotropes for more than 168 hours after the intial surgery
Garan et al., 2013[24]	
VA	Defined as ventricular tachyarrhythmia (ventricular tachycardia or ventricular fibrillation) that received appropriate therapy (antitachycardia pacing or shock) from an ICD or was sustained for >30 s in the absence of effective treatment.
Morgan et al., 2013[25]	
RVF	Defined as the need for IV inotropes for >14 days post-operatively or an RVAD
Mulloy et al., 2013[26]	
VA	Defined as more than 30 seconds of documented ventricular tachycardia or ventricular fibrillation as seen on a rhythm strip, electrocardiographic tracing, or implantable cardiac defibrillator readout.
Sarosiek et al., 2013[27]	
GI Bleeding	Defined as heme-positive stool or hematemesis and a decrease in hemoglobin >1 g/dl.
Wever-Pinzon et al., 2013[28]	
GI Bleeding	Defined by clinical evidence of bleeding (guaiac-positive stool, melena, hematochezia, hematemesis, or the presence of blood in the GI tract on endoscopic evaluation) and a decrease in hemoglobin ≥2g/dL.
Major Bleeding	Defined as an episode of suspected internal or external bleeding resulting in 1 of the following: death, surgical intervention, hospitalization, or transfusion of PRBCs as well as a documented decrease in hemoglobin ≥2g/dL.

Table 1. Summary of Evidence Sources

					Indication				Device Type: Continuous Flow							Device Type: Pulsatile Flow							
Abbreviation	First Author	Year	Total Pts	Total CF Pts	BTT	DT	Other*	Unreported	HMII	HVAD	VentrAssist	MicroMed DeBakey	DuraHeart	Jarvik 2000	INCOR	HM-XVE	IVAD	EXCOR	NOVACOR	ABIOMED	LionHeart	CardioWest	Unreported
Industry-Funded Trials and Related Registries																							
HMII BTT Trial[1]	Miller	2007	133	133	133	-	-	-	133	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMII BTT Trial Registry[2]	Pagani	2009	281	281	281	-	-	-	281	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMII DT Trial[3]	Slaughter	2009	200	134	0	200	-	-	134	-	-	-	-	-	-	66	-	-	-	-	-	-	-
HMII BTT Trial Registry RVF[29]	Kormos	2010	484	484	484	-	-	-	484	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMII BTT DT Trial Registry[30]	Rogers	2010	655	655	281	374	-	-	655	-	-	-	-	-	-	-	-	-	-	-	-	-	-
International HVAD Trial[31]	Strueber	2011	50	50	50	-	-	-	-	50	-	-	-	-	-	-	-	-	-	-	-	-	-
ADVANCE: HVAD BTT Trial[32]	Aaronson	2012	140	140	140	-	-	-	-	140	-	-	-	-	-	-	-	-	-	-	-	-	-
HMII DT Trial NC[33] †	Petrucci	2012	126	96	0	126	-	-	96	-	-	-	-	-	-	30	-	-	-	-	-	-	-
HMII BTT DT Trial Replacement[34]	Moazami	2013	1128	1128	490	638	-	-	1128	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ADVANCE: HVAD BTT Trial CAP[35]	Slaughter	2013	332	332	332	-	-	-	-	332	-	-	-	-	-	-	-	-	-	-	-	-	-
Multicenter Registries																							
INCOR Analysis[6]	Schmid	2008	216	216	0	-	-	216	-	-	-	-	-	-	216	-	-	-	-	-	-	-	-
64 European Institutions[7]	Lahpor	2009	411	411	300	86	25	-	411	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U of Minnesota, Pittsburgh, & Columbia[36]	Boyle	2011	101	101	86	15	-	-	74	-	27	-	-	-	-	-	-	-	-	-	-	-	-
John INTERMACS[37]	John	2011	1496	1496	1496	-	-	-	1496	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Goldstein INTERMACS[38]	Goldstein	2012	2006	2006	830	291	854	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2006
Holman INTERMACS[39]	Holman	2013	3302	2816	-	-	-	3302	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3302
INTERMACS 2013[4]	Kirklin	2013	6561	5515	3742	1694	-	79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6561
INTERMACS Thrombosis[40]	Kirklin	2013	6910	6910	-	-	-	6910	6910	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Najjar ADVANCE BTT & CAP[41]	Najjar	2013	382	382	382	-	-	-	-	382	-	-	-	-	-	-	-	-	-	-	-	-	-
Cleveland Clinic, Barnes-Jewish, & Duke[8]	Starling	2013	837	837	-	-	-	837	837	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Single Center Reports and Case Series																							
University of Minnesota[9]	Crow	2009	101	55	84	17	-	-	38	-	9	8	-	-	-	46	-	-	-	-	-	-	-
Medical University of Vienna[42]	Sandner	2009	86	86	86	0	-	-	-	6	-	75	5	-	-	-	-	-	-	-	-	-	-
University of Michigan[43] †	Cowger	2010	78	53	69	9	-	-	53	-	-	-	-	-	-	25	-	-	-	-	-	-	-
The Ohio State University[10]	Martin	2010	145	64	-	-	-	64	52	-	10	2	-	-	-	64	13	-	-	4	-	-	-
Washington University[11]	Topkara	2010	81	81	57	24	-	-	64	-	17	-	-	-	-	-	-	-	-	-	-	-	-
Columbia University[12]	Uriel	2010	79	79	64	15	-	-	79	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Texas Heart Institute[13]	Demirozu	2011	172	172	-	-	-	172	172	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Texas Heart Institute[44] †	Demirozu	2011	107	107	-	-	-	107	107	-	-	-	-	-	-	-	-	-	-	-	-	-	-
German Heart Institute Berlin[45]	Drews	2011	198	111	-	-	-	111	33	-	1	2	7	8	60	1	-	49	23	-	2	12	-
University of Minnesota[46]	John	2011	130	130	102	17	-	11	130	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Johns Hopkins[14]	Schaffer	2011	133	86	93	40	-	-	86	-	-	-	-	-	-	47	-	-	-	-	-	-	-
Johns Hopkins[15]	Schaffer	2011	86	86	57	29	-	-	86	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Advocate Christ Medical Center[16]	Aggarwal	2012	101	101	7	94	-	-	101	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Advocate Christ Medical Center[17]	Aggarwal	2012	87	87	-	-	-	87	87	-	-	-	-	-	-	-	-	-	-	-	-	-	-
University of Rochester[18]	Brenyo	2012	61	61	44	17	-	-	58	-	-	-	-	3	-	-	-	-	-	-	-	-	-
Columbia University[47]	Kato	2012	307	140	-	-	-	307	140	-	-	-	-	-	-	167	-	-	-	-	-	-	-
Henry Ford[19]	Morgan	2012	86	86	54	32	-	-	86	-	-	-	-	-	-	-	-	-	-	-	-	-	-
University of North Carolina[20]	Raasch	2012	61	61	27	34	-	-	47	-	-	-	-	14	-	-	-	-	-	-	-	-	-
University of Minnesota[48]	Sharma	2012	143	143	56	87	-	-	143	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Johns Hopkins[21]	Yuan	2012	182	133	98	46	38	-	133	-	-	-	-	-	-	49	-	-	-	-	-	-	-
Henry Ford[22]	Borgi	2013	100	100	68	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100
Cleveland Clinic[49]	Bunte	2013	139	139	55	31	53	-	139	-	-	-	-	-	-	-	-	-	-	-	-	-	-
University of Münster[50]	Dell' Aquila	2013	50	50	-	-	-	-	50	50	-	-	-	-	-	-	-	-	-	-	-	-	-
University of Minnesota[23]	Deo	2013	126	126	55	71	-	-	126	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Montefiore Medical Center[51]	Forest	2013	71	71	19	27	25	-	58	9	4	-	-	-	-	-	-	-	-	-	-	-	-
Columbia University[24]	Garan	2013	94	94	46	48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	94
University of Minnesota[52]	Hasin	2013	115	115	42	73	-	-	115	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Henry Ford[25]	Morgan	2013	130	130	76	54	-	-	122	8	-	-	-	-	-	-	-	-	-	-	-	-	-
University of Virginia[26]	Mulloy	2013	50	50	-	-	-	50	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
German Heart Institute Berlin[53]	Potapov	2013	225	225	-	-	-	225	-	225	-	-	-	-	-	-	-	-	-	-	-	-	-
Thomas Jefferson University[27]	Sarosiek	2013	84	59	54	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Utah Transplant Affiliated Hospitals[28]	Wever-Pinzon	2013	134	134	68	52	14	-	134	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* includes bridge to recovery, bridge to decision, and bridge to candidacy †Study not included in Tables. BTT=bridge to transplant; CAP=continued access protocol; CF=continuous-flow; DT=destination therapy; GI=gastrointestinal; HM-XVE=HeartMate XVE ventricular assist device; HMII= HeartMate II; HVAD=HeartWare ventricular assist device; INTERMACS=Interagency Registry for Mechanically Assisted Circulatory Support; IVAD=implantable ventricular assist device; LVAD=left ventricular assist device; mo=month; NC=neurocognition; PVAD=Paracorporeal ventricular assist device; RRT=renal replacement therapy; RVF=right ventricular failure

Table 2. Estimated Actuarial Survival of CF Devices - Single Center Studies or Those with Less Than 100 Continuous Flow Patients

Study	First Author	Year	Total CF	BTT	DT		1 Mo	6 Mo	12 Mo	24 Mo	36 Mo	48 Mo
Industry-Funded Trials and Related Registries												
International HVAD Trial[31]	Strueber	2011	50	50	0		-	90%	84%	79%	-	-
Single Center Reports and Case Series												
Medical University of Vienna[42]	Sandner	2009	86	86	0		92%	61%	-	-	-	-
German Heart Institute Berlin[45]	Drews	2011	111	0	111		-	-	71%	70%	49%	-
University of Minnesota[46]	John	2011	102	102	0		95%	84%	79%	-	-	-
Johns Hopkins[15]	Schaffer	2011	86	57	29		-	-	72%	-	-	-
Henry Ford[19]	Morgan	2012	86	54	32		-	-	87%	83%	-	-
University of North Carolina[20]	Raasch	2012	61	27	34		-	87%	-	-	-	-
University of Münster[50]	Dell'Aquila	2013	50	-	-		82%	-	78%	76%	-	-
University of Minnesota[23]	Deo	2013	126	55	71		-	88%	-	-	-	-
University of Virginia[26]	Mulloy	2013	50	-	-		98%	-	-	-	-	-

BTT=bridge to transplant; CF=continuous-flow; DT=destination therapy; HVAD=HeartWare ventricular assist device; mo=month

Table 3. Common Adverse Events of CF LVAD – Single Center Studies or Those with Less Than 100 CF Patients

							Bleeding			Neurological Event				Infection				
Study	First Author	Year	Total CF	BTT	DT	Defined Time at Risk#	Early ≤30 days	Late > 30 days	GI	Ischemic	Hemorrhagic	TIA	Other	Local	Driveline	Pocket	Sepsis	Other
Industry-Funded Trials and Related Registries																		
International HVAD Trial[31]*	Strueber	2011	50	50	0	24 mo	20%	12%	-	4%	8%	4%	-	14%	18%	-	10%	-
HMII BTT DT Trial Replacement[34]†	Moazami	2013	72	-	-	19±18 mo	9%	-	-	6%		-	-	-	-	-	3%	-
Single Center Reports and Case Series																		
University of Minnesota[9]	Crow	2009	55	46	9	36 mo	-	-	22%	-	-	-	-	-	-	-	-	-
Medical University of Vienna[42]	Sandner	2009	86	86	0	6 mo	26%		-	10%	12%	-	-	-	-	-	-	-
The Ohio State University[10]	Martin	2010	64	-	-	18 mo	-	-	-	-	-	-	-	22%				
Washington University[11]§	Topkara	2010	81	57	24	9±9 mo	-	-	-	-	-	-	-	37%	17%	5%	19%	-
Columbia University[12]	Uriel	2010	79	64	15	12±16 mo	44%		30%	3%		-	-	-	-	-	-	
Texas Heart Institute[13]	Demirozu	2011	172	-	-	2±2 mo	-	-	19%	-	-	-	-	-	-	-	-	-
University of Minnesota[46]	John	2011	102	102	0	11±10 mo	17%	-	18%	10%				-	22%	0%	-	-
Johns Hopkins[14]§	Schaffer	2011	86	57	29	12 mo	-	-	-	-	-	-	-	-	26%	9%	64%	-
Johns Hopkins[15]	Schaffer	2011	86	57	29	12 mo	23%	-	28%	-	-	-	-	-	-	-	-	-
Advocate Christ Medical Center[16]	Aggarwal	2012	101	7	94	0-70 mo	-	-	23%	-	-	-	-	-	-	-	-	-
Advocate Christ Medical Center[17]	Aggarwal	2012	87	-	-	19±14 mo	-	-	-	9%	11%	-	-	-	-	-	-	34%
University of Rochester[18]	Brenyo	2012	61	44	17	21 mo (m)	18%			11%		-	-	-	-	-	-	-
Columbia University[47]*	Kato	2012	140	-	-	9±11 mo	-	-	-	10%		4%	-	-	-	-	-	-
Henry Ford[19]	Morgan	2012	86	54	32	0-15 mo	-	-	22%	-	-	-	-	-	-	-	-	-
University of Minnesota[48]‡	Sharma	2012	143	56	87	11±11 mo	-	-	-	-	-	-	-	-	12%	6%	-	-
Henry Ford[22]	Borgi	2013	100	68	32	0-12 mo	8%	-	22%	9%	9%	-	-	10%	6%	1%	-	10%
Cleveland Clinic[49]*‖	Bunte	2013	139	55	31	16 mo(m)	58%			-	-	-	-	-	-	-	-	-
University of Münster[50]*	Dell'Aquila	2013	50	-	-	9 mo(m)	36%	20%	26%	26%	4%	-	-	-	14%	-	-	28%
University of Virginia[26]	Mulloy	2013	50	-	-	5-13 mo	-	-	-	8%		-	-	-	-	2%	14%	-
Thomas Jefferson University[27]	Sarosiek	2013	59	-	-	34±19 mo	-	-	24%	-	-	-	-	-	-	-	-	-
Utah Transplant Affiliated Hospitals[28]*‖	Wever-Pinzon	2013	134	68	52	3 mo	25%		17%	-	-	-	-	-	-	-	-	-

Adverse events definitions in Appendix 2.

* Study uses INTERMACS definitions for adverse events.

† Study uses HeartMate II definitions for adverse events.

‡ Study uses ISHLT consensus statement definitions for adverse events.

§ Study uses ACCP/SCCM consensus definition of sepsis.

‖ Study includes alternative indications for implant (i.e. bridge to decision, bridge to candidacy).

Time at risk was variable among studies: truncated time point (x mo), mean/SD (x ± mo), range (x-y mo).

ACCP/SCCM=American College of Chest Physicians and Society of Critical Care Medicine; BTT=bridge to transplant; CF=continuous-flow; DT=destination therapy; GI=gastrointestinal; HMII= HeartMate II; HVAD=HeartWare ventricular assist device; INTERMACS=Interagency Registry for Mechanically Assisted Circulatory Support; ISHLT=International Society of Heart and Lung Transplant; mo=month; TIA=transient ischemic attack.

Table 4. Other Adverse Events of CF Devices - Single Center Studies or Those with Less Than 100 Continuous Flow Patients

							Device Malfunction		Right Heart Failure		Arrhythmia		
Study	**First Author**	**Year**	**Total CF**	**BTT**	**DT**	**Defined Time at Risk§**	**Thrombosis Requiring Exchange**	**Other Requiring Exchange**	**Inotropic Support**	**RVAD**	**VA**	**Other**	**Rehospitalization**
Industry-Funded Trials and Related Registries													
International HVAD Trial[31]*	Strueber	2011	50	50	0	24 mo	8%	6%	6%	6%	4%	-	1.2 adm/pt-yr
HMII BTT DT Trial Replacement[34]†	Moazami	2013	72	-	-	19±18 mo	2%	4%	9%	2%	-	-	-
Single Center Reports and Case Series													
Medical University of Vienna[42]	Sandner	2009	86	86	0	6 mo	-	-	-	6%	-	-	-
German Heart Institute Berlin[45]	Drews	2011	111	0	111	23±8 mo	-	6%	-	-	-	-	2.8 adm/pt-yr
University of Minnesota[46]	John	2011	102	102	0	11±10 mo	1%	2%	-	5%	-	-	-
University of Rochester[18]	Brenyo	2012	61	44	17	21 mo(m)	11%		-	-	31%	-	-
University of North Carolina[20]	Raasch	2012	61	27	34	0-12 mo	-	-	-	-	43%	-	20%
Johns Hopkins[21]‡	Yuan	2012	133	68	40	13±13 mo	12%		22%		-	-	-
Henry Ford[22]	Borgi	2013	100	68	32	0-12 mo	-	-	11%	5%	-	-	24%
University of Münster[50]*	Dell'Aquila	2013	50	-	-	9 mo(m)	-	-	24%		4%		1.8 adm/pt-year
University of Minnesota[23]	Deo	2013	126	55	71	15 mo(m)	-	-	25%	3%	-	-	-
Montefiore Medical Center[51]‡	Forest	2013	71	19	27	2±4 mo	-	-	-	-	-	-	79%
Columbia University[24]	Garan	2013	94	46	48	4 mo(m)	-	-	-	-	23%	-	-
University of Minnesota[52]	Hasin	2013	115	42	73	13±11 mo	-	-	-	-	-	-	1.6 adm/pt-yr
Henry Ford[25]	Morgan	2013	130	76	54	13 mo(m)	-	-	5%	4%	-	-	-
University of Virginia[26]	Mulloy	2013	50	-	-	5-13 mo	-	-	-	-	32%	-	20%
German Heart Institute Berlin[53]	Potapov	2013	225	-	-	8 mo(m)	5%	1%	-	-	-	-	-

Adverse events definitions in Supplemental Methods: Figure 2.

* Study uses INTERMACS definitions for adverse events.

† Study uses HeartMate II definitions for adverse events.

‡ Study includes alternative indications for implant (i.e. bridge to decision, bridge to candidacy)

§ Time at risk was variable among studies: truncated time point (x mo), mean/SD (x ± y mo), range (x-y mo), mean (x mo(m))

adm=admission; BTT=bridge to transplant; CF=continuous-flow; DT=destination therapy; HMII= HeartMate II; HVAD=HeartWare ventricular assist device; INTERMACS=Interagency Registry for Mechanically Assisted Circulatory Support; mo=month; pt=patient; RVAD=right ventricular assist device; RVF=right ventricular failure; VA=ventricular arrhythmia; yr=year.

SUPPLEMENTAL FIGURE LEGENDS

Figure 1. Search Algorithm

Figure 2. Adverse Event Definitions

Abbreviations:

ACCP/SCCM=American College of Chest Physicians and Society of Critical Care Medicine; CT=computed tomography; CVA=cerebrovascular accident; GI=gastrointestinal; ICD=internal cardioverter defibrillator; INTERMACS=Interagency Registry for Mechanically Assisted Circulatory Support; IV=intravenous; LVAD=left ventricular assist device; PRBC=packed red blood cell; RHF=right heart failure; RVAD=right ventricular assist device; TIA=transient ischemic attack; VA=ventricular arrhythmia

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