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Intra-corporeal Biventricular Assist Devices using the HVAD in Children

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Background

We investigated the use of biventricular support with two HVADs in the pediatric population (age ≤18 yrs) (see Figure 1).

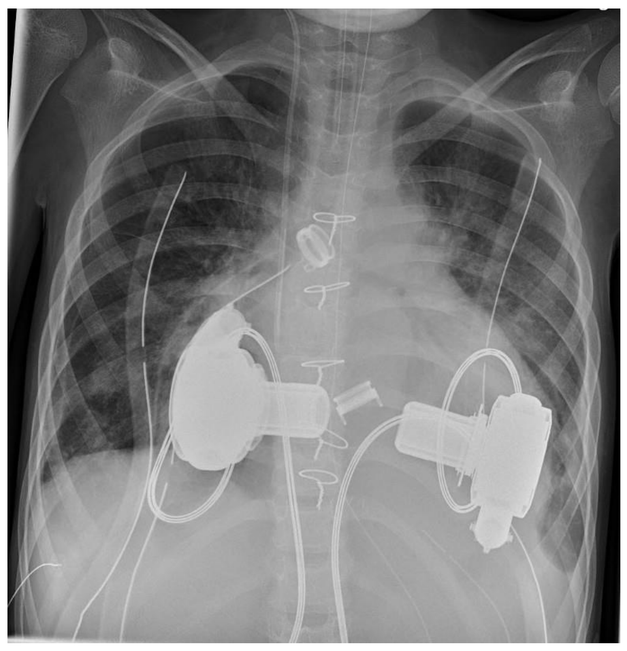

Figure 1. Two intra-corporeal VADs for biventricular support in a ten year old child (Body surface area 1.02 m², 27 kg) ➔

Conclusion

BVAD HVAD implantation in children seems to be feasible down to 0.6 m² BSA but remains rare. Postoperative bleeding requiring re-operation seems to be the major challenge for these patients.

Methods

As of May 2017, using the Heartware database, 10 centres were identified and contacted. There was a positive response from 7 centres (5 US, 1 Australian and 1 European) including 10 pts. Data completion was done from 6 centres (4 US, 1 Australian, 1 European) for 9 pts (see Table 1).

Children's Hospital of Philadelphia, USA
Emory University School of Medicine, Atlanta, USA
Cardiothoracic Surgical Unit The Alfred, Australia
Children`s Hospital Zurich, Switzerland
Washington University in St. Louis and St. Louis Children's Hospital, USA
Division of Pediatric Cardiothoracic Surgery, Charleston, USA

Table 1. Participating centre submitting data of children on BiVAD support. ➔

Results

Mean age at time of implantation was 12.4 ±1.5 yrs. [5.3-16.9], mean BSA was 1.3 ±0.1 [0.6-1.9]. None of the subjects suffered from CHD, myocarditis (n:1), cardiomyopathy (n:7; 2 dilative, 2 restrictive, 1 HCM, 1 postpartum, 1 toxic) and 1 unknown (post-transplant failure unkown ethiology). Three pts. had prior sternotomy. Six patients had a primary BVAD implantation whereas 3 pts. had a primary LVAD placement and received the intra-corporeal RVAD/HVAD 4 - 26 days later (4, 9, 26 days). Only one patient was discharge from hospital before transplant, none were weaned from devices. Mean support time was 50.3 days ±11.9 [16-117]. 55% survived to transplant (mean support time: 55.8 days); no child is currently on support. Reasons for death included bleeding (n:2), intracerebral hemorrhage (n:1) and MSOF (n:1). Complication rates included major bleeding requiring re-operation (n:6) and device exchange due to thrombus (n:2).

Pat. Nr.	Primary BiVAD	Support time (days)	Heart Transplan-tation	Died on support	Discharged home
1	Yes	51	Yes	No	No
2	No	117	Yes	No	No
3	No	17	Yes	No	No
4	Yes	16	No	Yes	No
5	Yes	53	No	Yes	No
6	Yes	19	Yes	No	No
7	Yes	21	No	Yes	No
8	No	84	No	Yes	No
9	Yes	75	Yes	No	Yes

Table 3. Outcome of children on intracorporeal BiVAD support.

Pat.Nr.	Age at implantation (years)	Weight at implantation (kgKG)	Diagnosis	Congenital Heart Disease	Previous Sternotomy
1	14.5	58.60	DCMP	No	No
2	16.0	72.00	Post Partum CMP	No	Yes
3	6.0	13.50	RCMP	No	No
4	8.8	21.40	RCMP	No	No
5	16.7	81.20	DCMP	No	No
6	10.9	26.00	Toxic CMP	No	Yes
7	5.4	19.50	DCMP	No	Yes
8	16.8	49.50	HCMP	No	No
9	16.9	54.00	Myocarditis	No	No

Table 2. Children on intracorporeal BiVAD support. DCMP: Dilated Cardiomyopathy, CMP: Cardiomyopathy, RCMP. Restrictive Cardiomyopathy, HCMP: Hypertrophic Cardiomyopathy.

Pat.Nr.	Support time (days)	Reason for death	Other severe complications*
1	51	N.a.	Reoperation for postoperative bleeding
2	117	N.a.	No
3	17	N.a.	No
4	16	Cerebral haemorrhage	No
5	53	Postoperative bleeding	Reoperation for postoperative bleeding
6	19	N.a.	Reoperation for postoperative bleeding
7	21	Postoperative bleeding	Reoperation for postoperative bleeding
8	84	Multi-organ failure	Reoperation for postoperative bleeding
9	75	N.a.	Reoperation for postoperative bleeding

Table 4. Reasons of death and severe complications.* Complications include requirement for reoperations, cerebral stroke or major infections.

Disclosure: The HVAD Heartware device was used off-lable in children and was used off-lable as biventricular support system.None of the authors has any conflict of interest concerning this work.