



USZ Universitäts
Spital Zürich



Pacemaker lead extraction and percutaneous vegetation aspiration

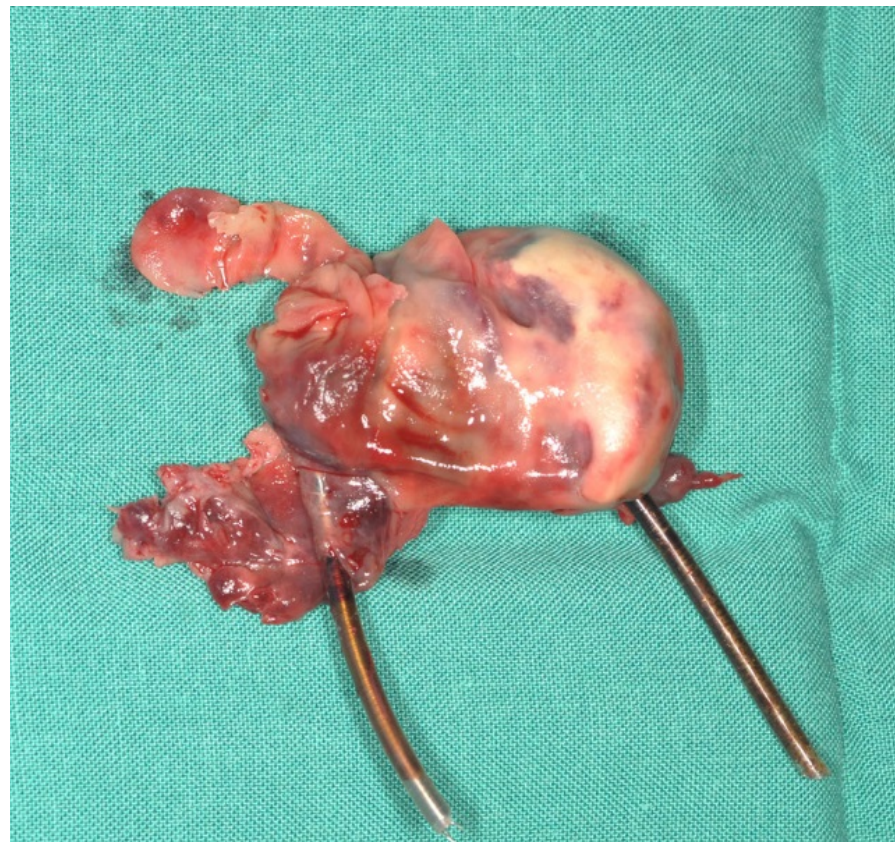
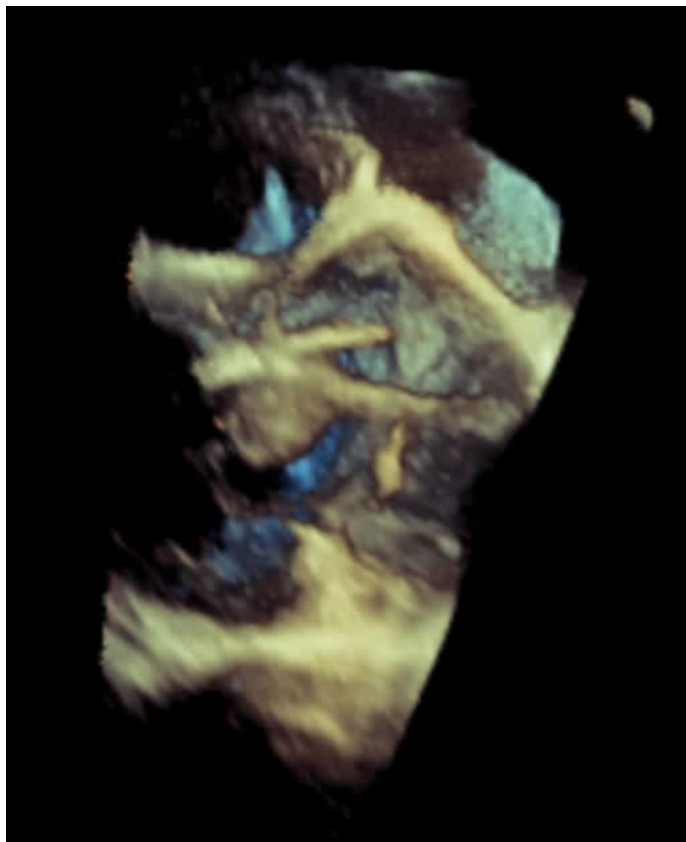
Prof. Dr. Christoph Starck, FEHRA
PD Dr. Alexander Breitenstein



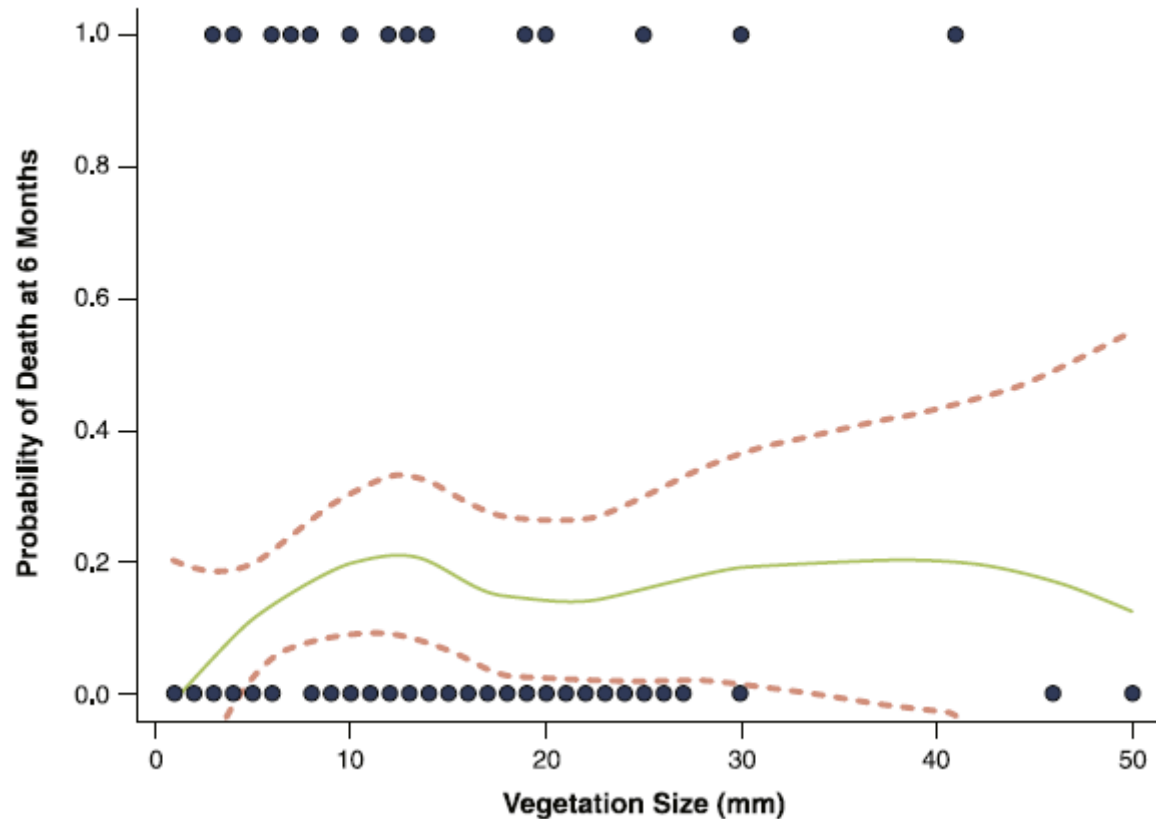
Disclosures...

- **Consulting fees from Bayer Health Care, Biotronik, BMS/Pfizer, Boston Scientific, Daiichi Sankyo and Medtronic**
- **Educational grants from Biosense Webster, Biotronik and Actelion.**
- **Presenter fees from Abott, Biotronik, Bayer Health Care, BMS/Pfizer, Medtronic and Philipps/Spectranetics**

The problem...



Larger vegetations = higher mortality

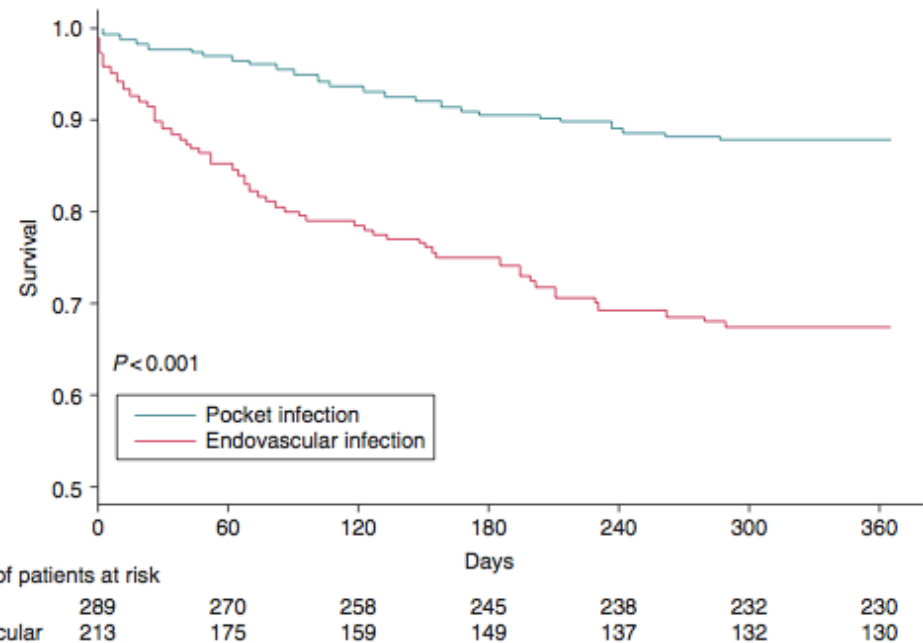


ELECTRA registry

Long-term follow-up

Table 2 Outcomes: patients, procedure, and leads

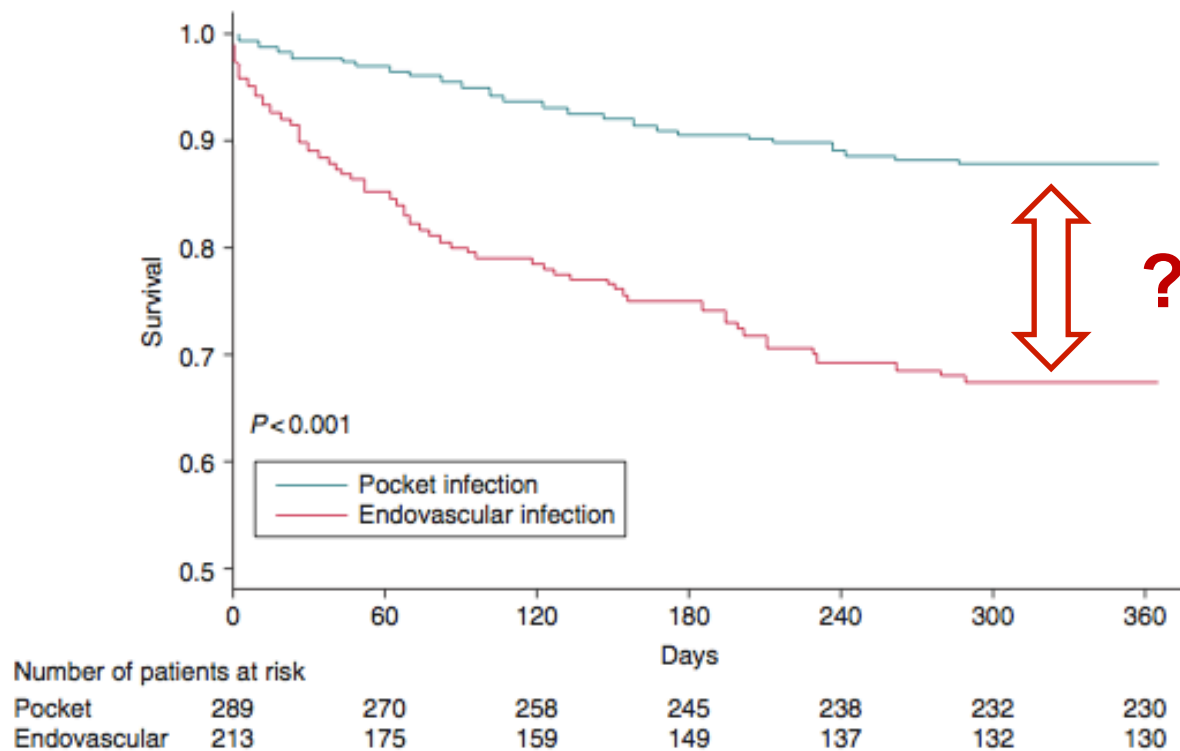
Patients outcomes	All patients (N = 3510)
Clinical success, N/Total N (%), [95% CI]	3395/3510 (96.7) [96.1–97.3]
Complications, N/Total N (%), [95% CI]	
Procedure related major complications including deaths	58/3510 (1.7) [1.3–2.1]
Intra-procedural	37/3510 (1.1) [0.7–1.5]
Post-procedural	21/3510 (0.6) [0.4–0.9]
Details of procedure related major complications including deaths, N/Total N (%), [95% CI]	
Procedure related deaths ^a	17/3510 (0.5) [0.3–0.8]
Intra-procedural	9/3510 (0.3) [0.1–0.5]
Post-procedural	8/3510 (0.2) [0.1–0.5]
All cause in-hospital major complications including deaths, N/Total N (%), [95% CI]	
All cause major complications	95/3510 (2.7) [2.2–3.3]
All cause deaths	50/3510 (1.4) [1.1–1.9]



Low peri-procedural mortality

High mortality after 1 year of f/u

Why is there such a big difference... ?



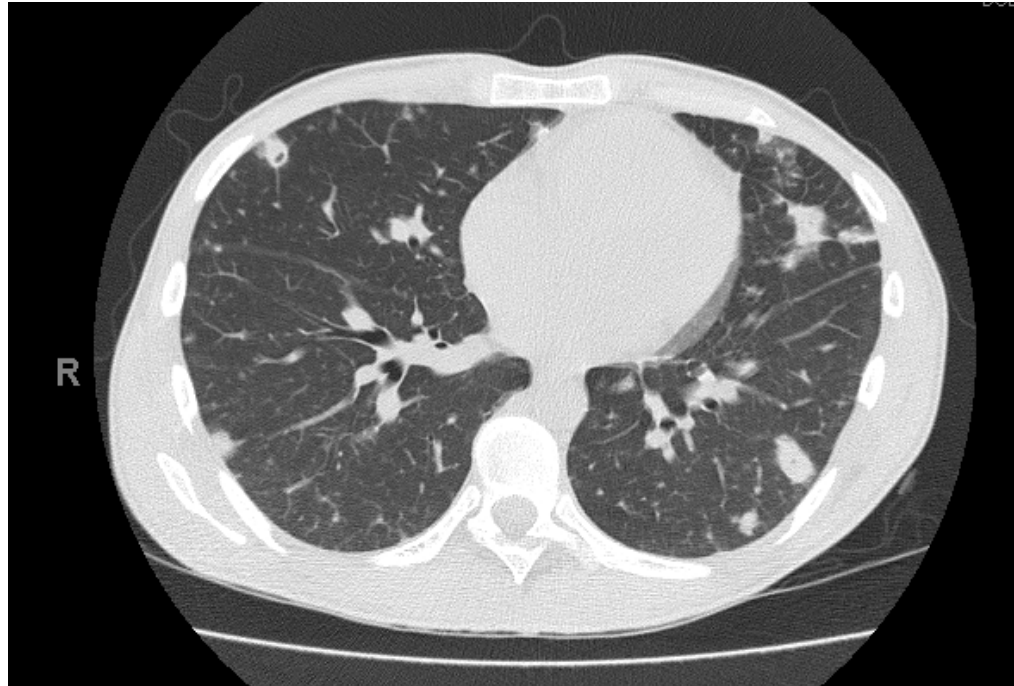
Cause of death in the ELECTRA registry

Details of non-procedure related major complications including deaths, N/Total N (%)

Heart failure	15/3510 (0.4)
Sepsis	11/3510 (0.3)
Respiratory arrest	5/3510 (0.1)
Multi organ failure	4/3510 (0.1)
Cerebrovascular accident	2/3510 (0.06)
Arrhythmias	2/3510 (0.06)
Deaths	33/3510 (0.9)
Other ^c	3/3510 (0.09)



Septic pulmonary embolization after transvenous extraction....



...as potential cause for high longterm mortality...!

ESC Guidelines

C. Mode of device removal			
1. Percutaneous extraction is recommended in most patients with CDRIE, even those with vegetations >10 mm	I	B	382, 391, 405
2. Surgical extraction should be considered if percutaneous extraction is incomplete or impossible or when there is associated severe destructive tricuspid IE	IIa	C	
3. Surgical extraction may be considered in patients with large vegetations (>20 mm)	IIb	C	

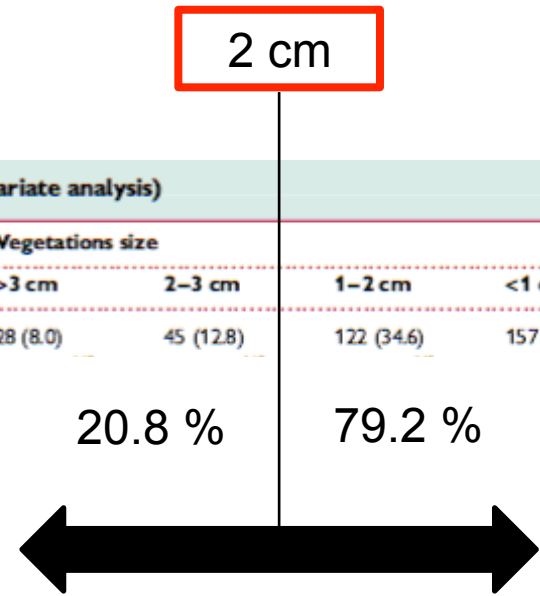
Lead-related infective endocarditis: factors influencing the formation of large vegetations

Anna Polewczyk^{1,2*}, Wojciech Jacheć³, Andrzej Tomaszewski⁴,
 Wojciech Brzozowski⁴, Marek Czajkowski⁵, Aneta Maria Polewczyk⁶,
 Marianna Janion^{1,2}, and Andrzej Kutarski⁴

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Table 1 Risk factors for developing ILVs including the giant, large, modest-sized, and small ones (univariate analysis)

Variable	Vegetations		Significant coefficient	Odds ratio [95%CI], P-value	Vegetations size			
	Absence	Presence			>3 cm	2–3 cm	1–2 cm	<1 cm
Number of patients (%)	148 (29.6)	352 (71.4)			28 (8.0)	45 (12.8)	122 (34.6)	157 (44.6)





VEGECTOMY – a NEW-OLD Concept !

Some centers define any size of vegetations, even far less than 10 mm, as an indication for cardiopulmonary bypass, because of the risk of spreading septic emboli and a possible underestimation by echocardiography [4].

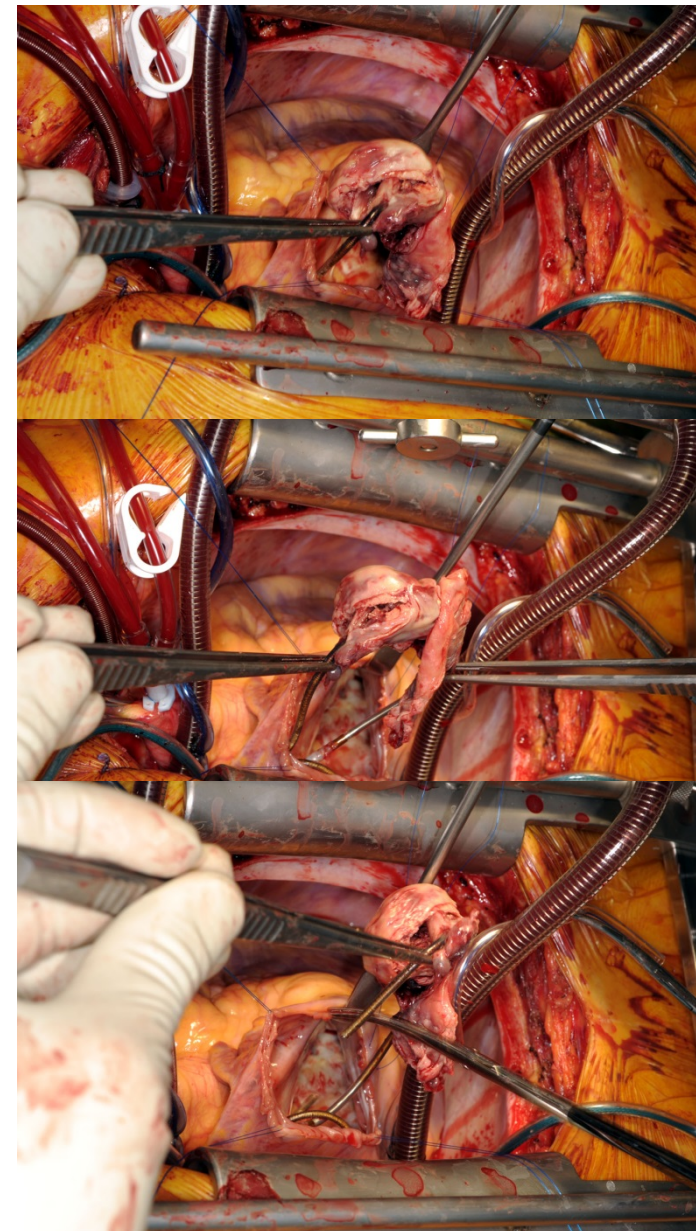
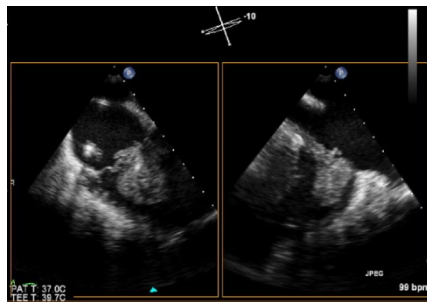
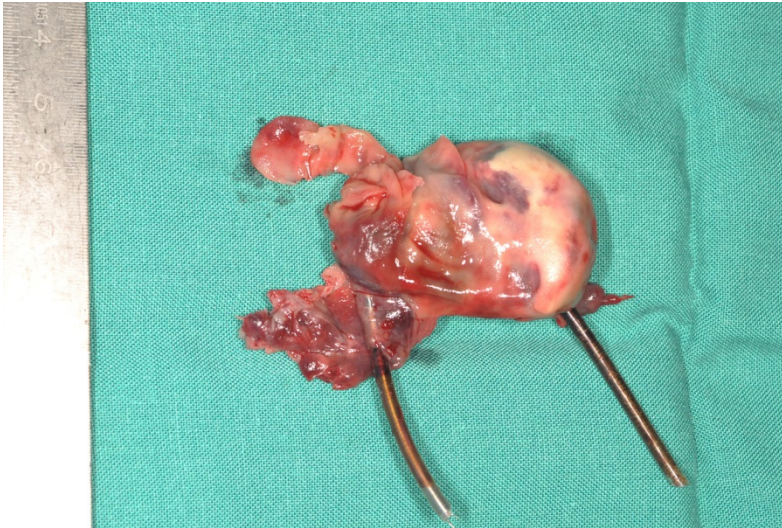
Explanation of Implantable Defibrillator Leads Using Open Heart Surgery or Percutaneous Techniques

Daniele Camboni, MD,* Christian G. Wollmann, MD,* Andreas Löher, MD, Rainer Gradaus, MD, Hans Heinrich Scheld, MD, and Christof Schmid, MD

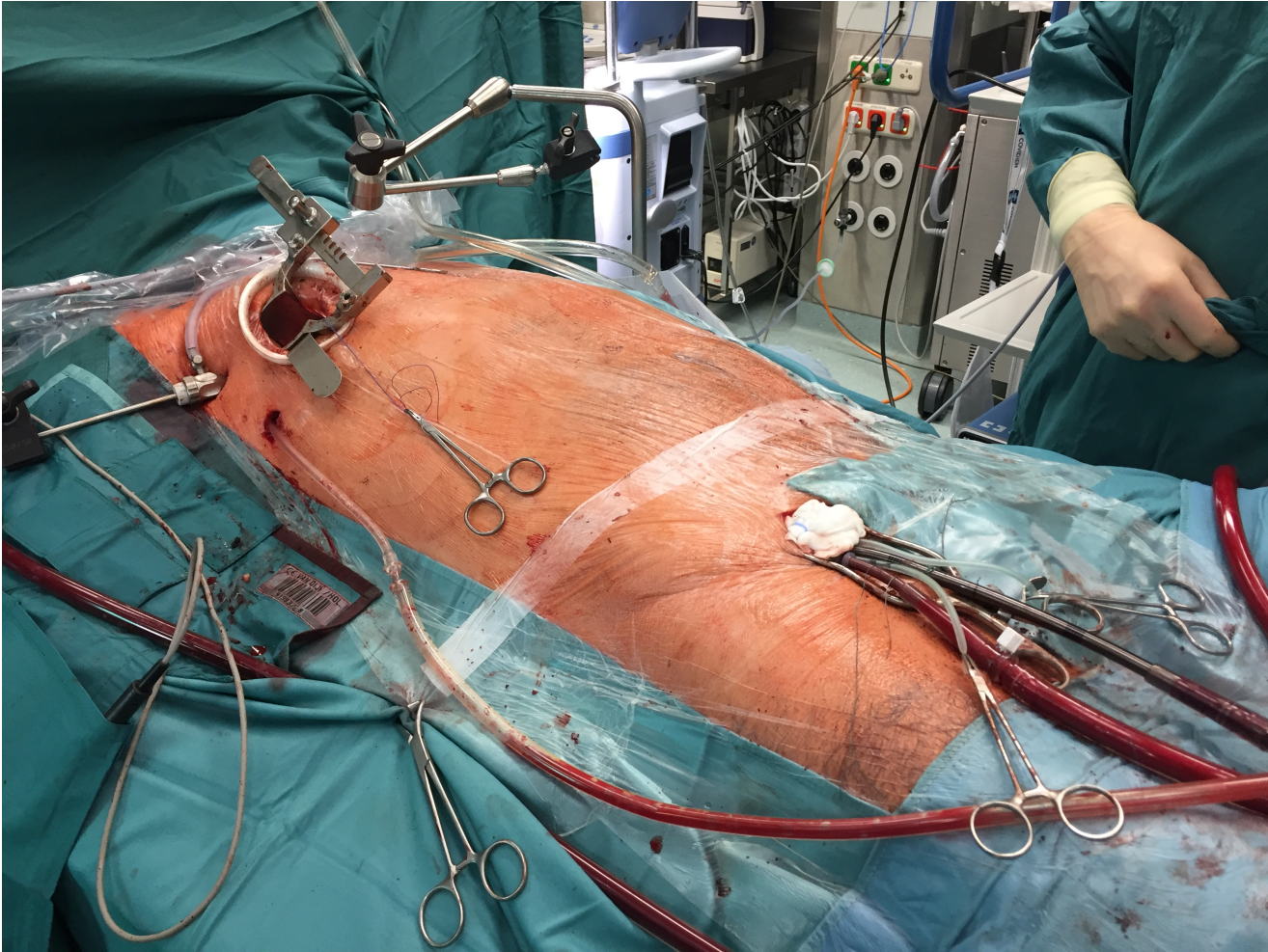
Departments of Thoracic and Cardiovascular Surgery, and Cardiology and Angiology, University Hospital, Muenster, Germany

(Ann Thorac Surg 2008;85:50–5)

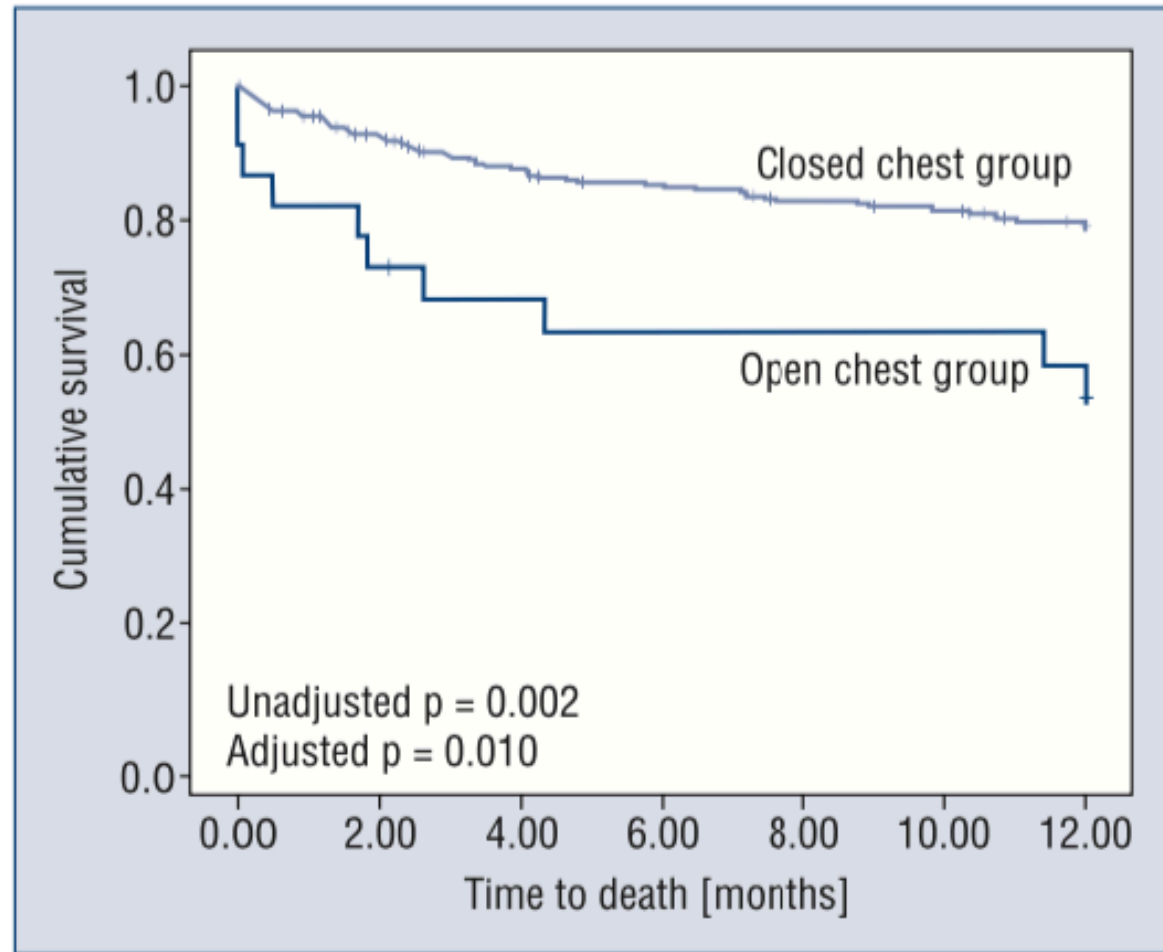
Large lead vegetations - Surgical extraction



MIC Surgical Extraction



Surgical extraction is associated with higher mortality...



Surgical extraction is associated with higher mortality...and longer hospitalisation....

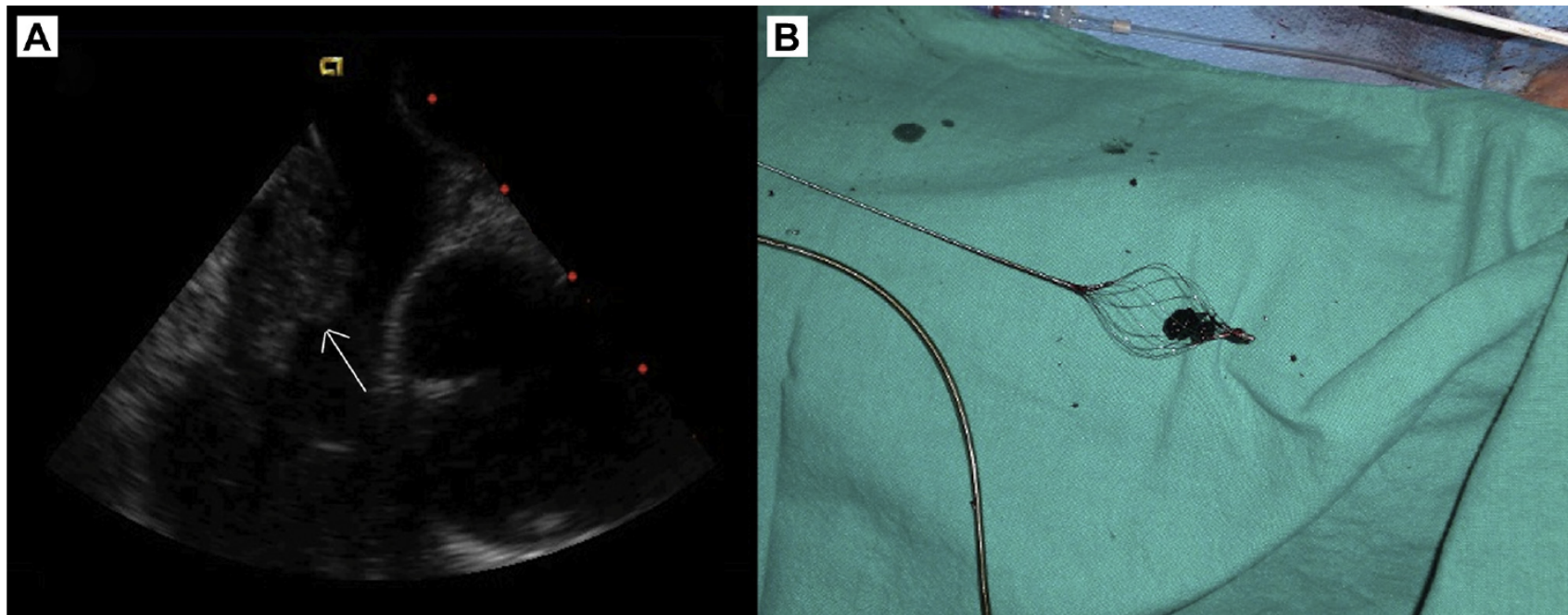
Table 2. Mortality and non-lethal complication rates for the two study groups.

Adverse events	Open thoracotomy	Percutaneous techniques	P
Deaths after 30 days	4/24 (17%)	15/329 (5%)	0.036
Deaths after 6 months	8/24 (33%)	45/329 (14%)	0.020
Deaths after 1 year	10/24 (42%)	61/329 (19%)	0.012
Non-lethal complications during procedure	0/24 (0.0%)	6/329 (2.0%)	0.99
Non-lethal complications 30 days post procedure	2/24 (8%)	22/329 (7%)	0.31
Hospital length of stay [days]	23 ± 15	12 ± 9	< 0.001

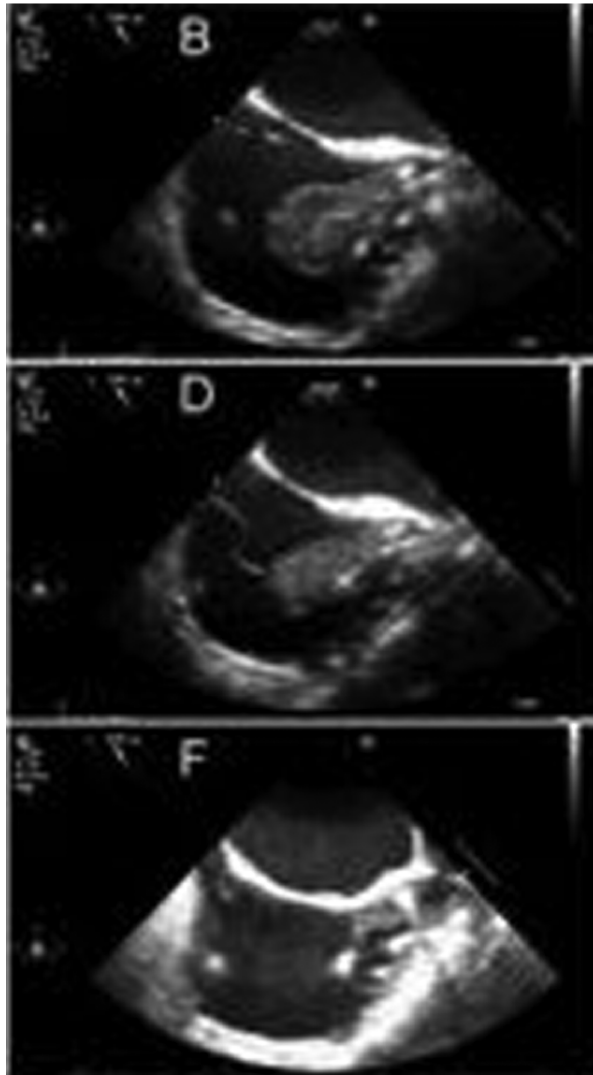
...need for alternative techniques for vegectomy



Use of intracardiac basket catheters to extract large vegetations (> 6 cm)...



Thrombolysis as a treatment option...

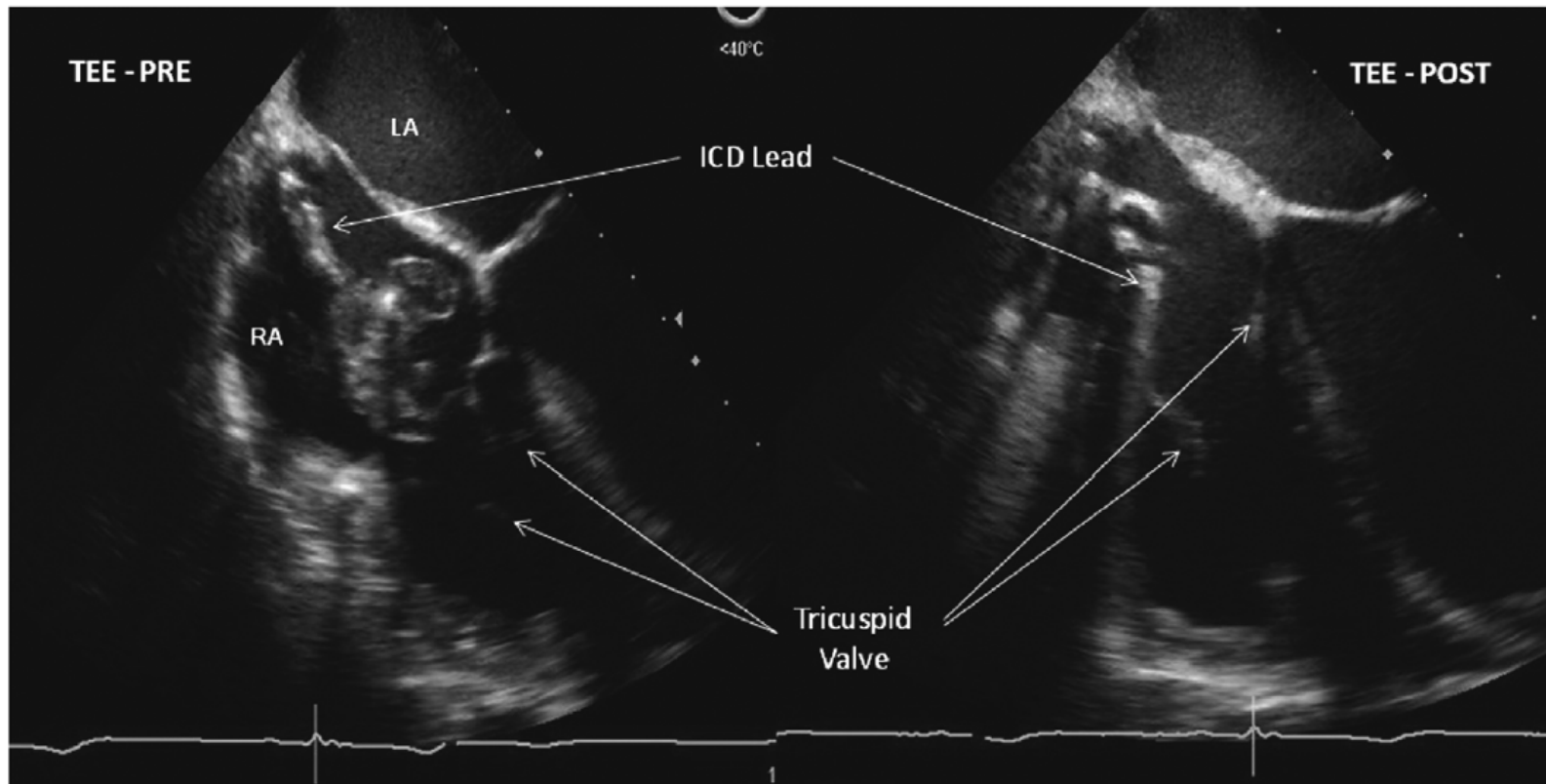


Therefore, we decided to perform an intravenous thrombolysis with recombinant tissue plasminogen activator (rtPA) using a dosing regimen of two infusions of 50 mg, each given over 2 h. The thrombolysis was performed

Learning points

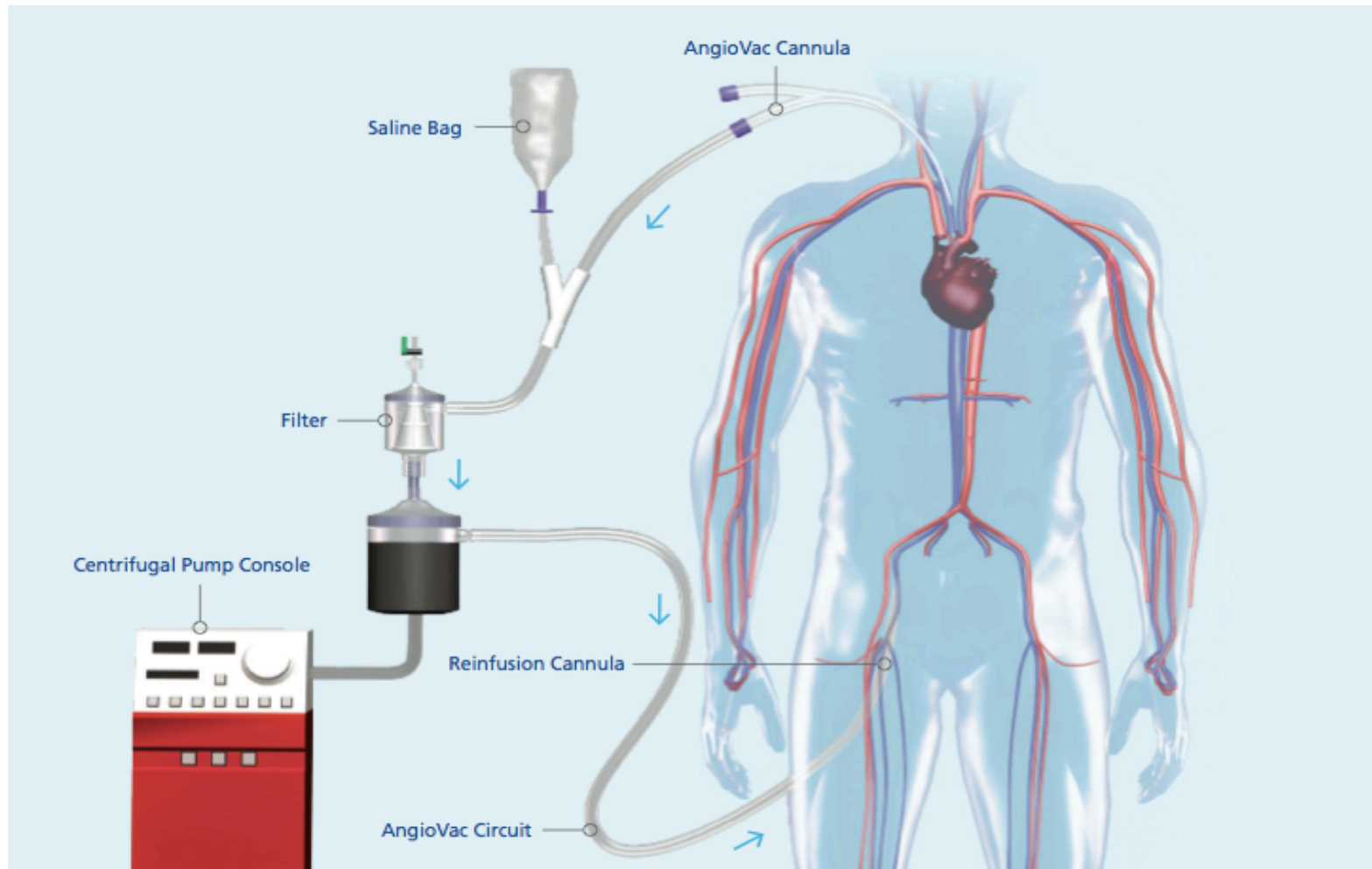
- ▶ Complete extraction of the CD should be considered as standard therapy for most patients with CD endocarditis in combination with antibiotic treatment.
- ▶ In case of large vegetations on the leads thrombolytic therapy might be an additional treatment option to avoid open heart surgery and fulminant pulmonary embolism, and should be performed before standard transvenous lead extraction.
- ▶ Thrombolysis should be administered under echocardiographic controls to monitor the size of the thrombotic material and the right ventricular function in case of acute pulmonary embolism.

Vacuum assisted extraction of large vegetations...



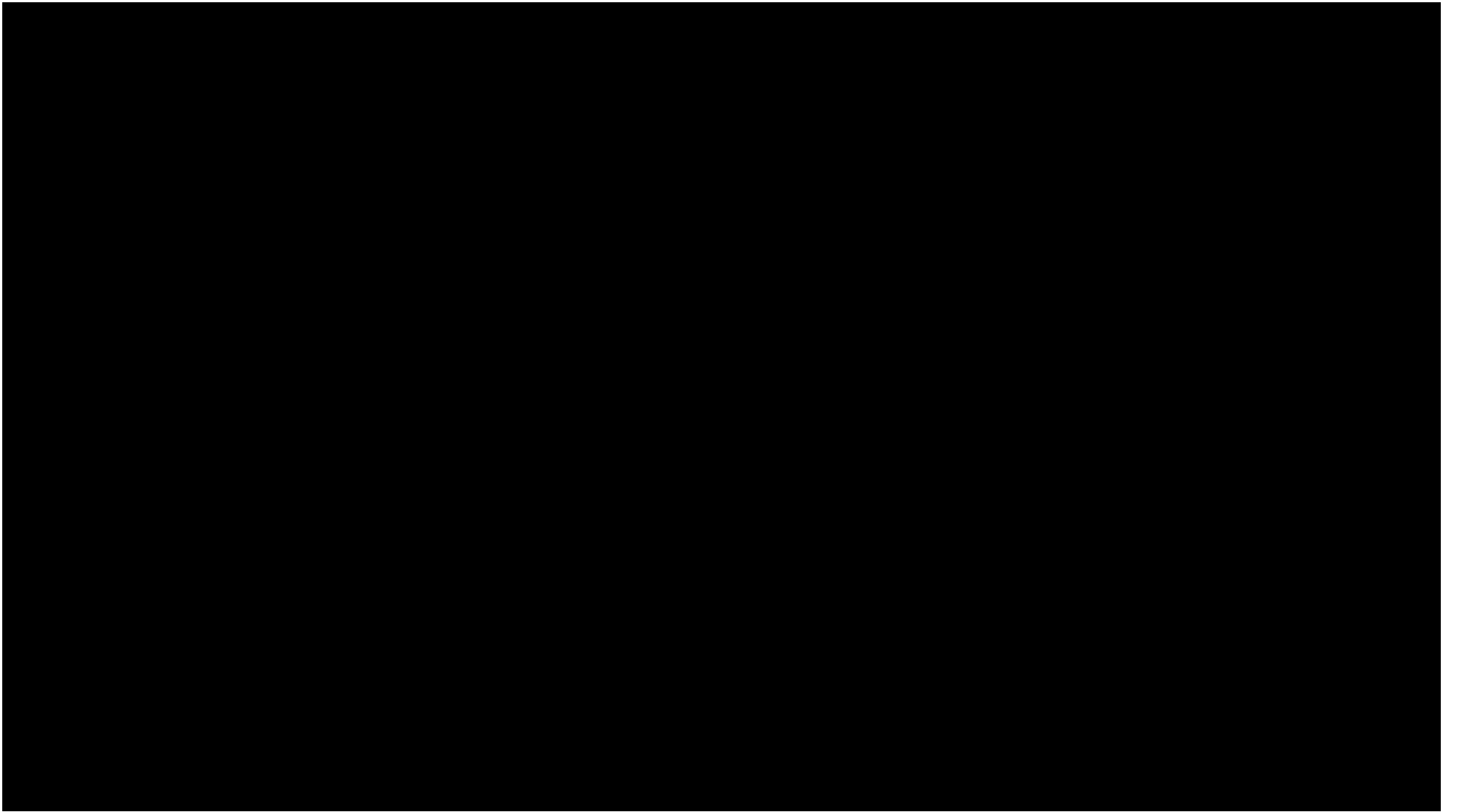
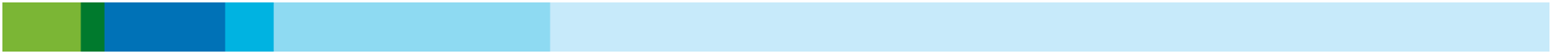
3 cases, large vegetations, two step procedure

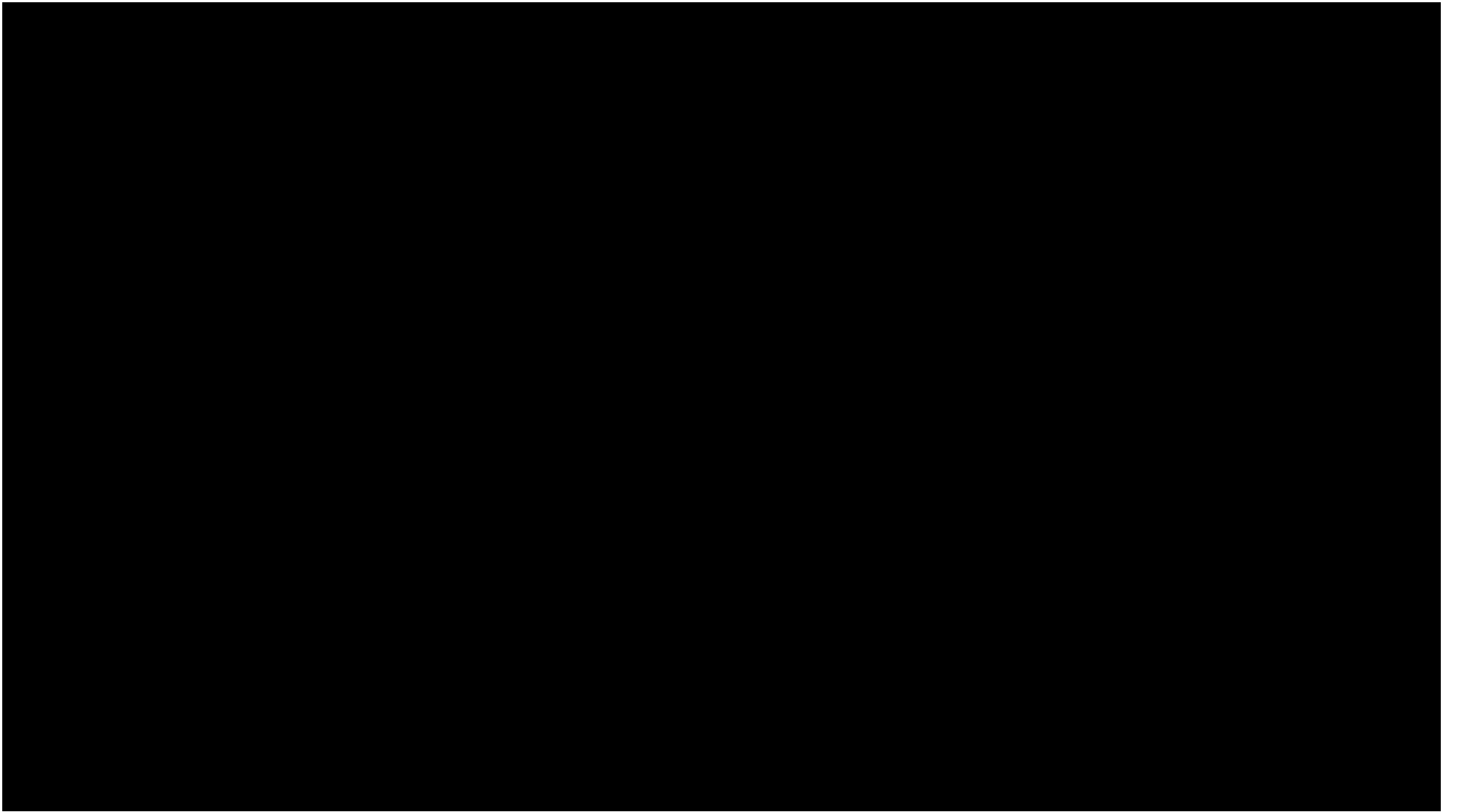
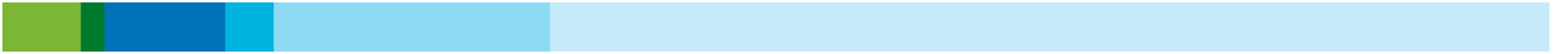
AngioVac System

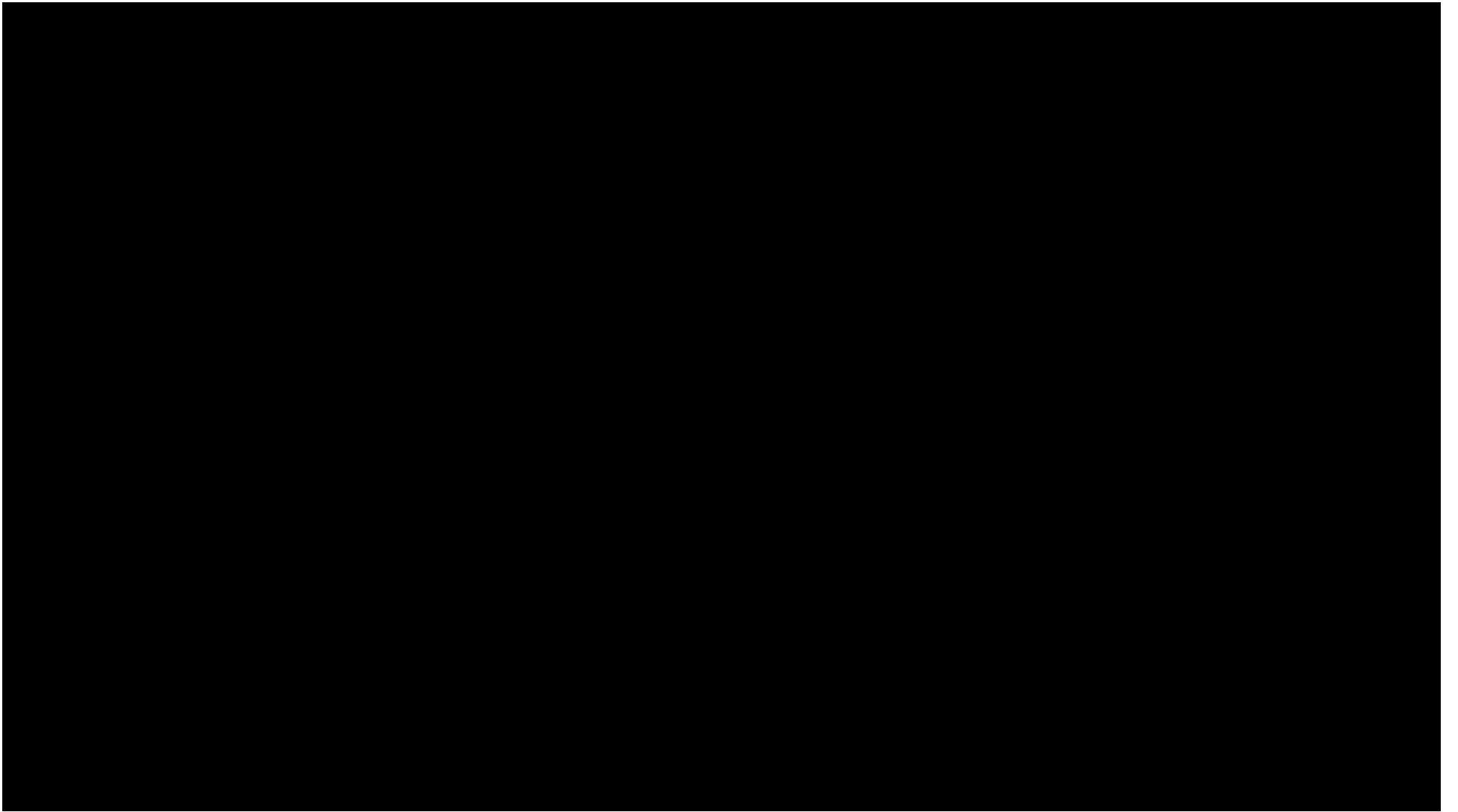
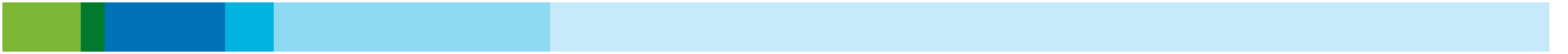


AngioVac[®]
Cannula and Circuit









AngioVac – Berlin experience

	06/2015 – 12/2018
Number of patients	78 (49 male, 29 female)
Patient age	63.5 (18-86) years
Indications:	
Right atrial thrombi	9 (11.5%)
Central vein thrombi	6 (7.7%)
Lead vegetations (>1cm)	57 (73.1%)
Pulmonary embolism	3 (3.8%)
Isolated Tricuspid valve endocarditis ("Debulking")	1 (1.3%)
Vegetations Central venous catheter	2 (2.6%)

AngioVac – Berlin experience

	06/2015 – 12/2018
Primary ECC configuration:	
RFV – LFV	68 (87.2%)
RIJV – RFV	9 (11.5%)
RFV – RIJV	1 (1.3%)
Configuration change (Drainage RFV to RIJV)	2 (2.6%)
Steering Support with Amplatz Gooseneck Snare	9 (11.5%)

AngioVac – Berlin experience

	06/2015 – 12/2018
Procedural success (Aspiration):	
Complete	66 (84.6%)
Partial	9 (11.5%)
Failure	3 (3.9%)
Major complication rate	1 (1.3%) (tricuspid regurgitation)
30-day mortality	2 (2.6%)

AngioVac – Berlin experience

Procedural success (Lead Vegetations):	
Complete	91.2 %
Partial	7.0 %
Failure	1.8 %
Procedural success (Right Atrial Thrombi):	
Complete	77.8 %
Partial	22.2 %
Failure	0 %
Procedural success (Central Venous Thrombi):	
Complete	33.3 %
Partial	33.3 %
Failure	33.3 %

ORIGINAL RESEARCH



Managing large lead vegetations in transvenous lead extractions using a percutaneous aspiration technique

Christoph T. Starck^{a,b,c}, Jürgen Eulert-Grehn^{a,b}, Marian Kukucka^d, Dirk Eggert-Doktor^d, Thomas Dreizler^e, Benjamin Haupt^e and Volkmar Falk^{a,b,f}

Table 1. Basic characteristics of patients.

Number of patients	35
Mean age	67.7 years (31–86)
Male/female	26/9
Infection:	
Systemic CIED infection	35 (100%)
Additional local pocket infection	3 (8.6%)
Clinical symptoms of infection:	
Fever (>38.5°C)	35 (100%)
Local symptoms related to device pocket	3 (9%)
Septic shock	6 (17%)
Mean time from diagnosis to procedure	10.9 ± 9.3 days
Diabetes mellitus	12 (34.3%)
Chronic kidney disease	20 (57.1%)
Mean left ventricular function (EF)	38.7 ± 14.3 %
Number of targeted leads	83
Mean lead implant duration	56.1 months (1–200)
Lead characteristics	
Pacemaker leads	53
ICD leads (single versus dual coil)	30 (15/15)
Preoperative mean vegetation size (assessed by TEE)	22.6 mm (12–40)
Postoperative mean vegetation size (assessed by direct measurement)	33.6 mm (10–60)

Table 2. Procedural data and outcomes.

Outcome percutaneous aspiration procedure	
Complete procedural success	31 (88.6%)
Partial success	3 (8.6%)
Major complications (aspiration procedure related)	0 (0%)
Lead extraction devices	
Locking stylet	53 (63.8%)
Polypropylene extraction sheath	1 (1.2%)
Powered rotational extraction sheath	46 (55.4%)
Outcome TLE procedure	
Complete procedural success (per patients)	34 (97.1%)
Clinical success (per patients)	34 (97.1%)
Major complications TLE related (per patients)	1 (TLE related high grade TR)
Mortality	
Operative mortality (not procedure related)	1 (2.9%) (due to refractory septic shock)
Survival	
30-day survival	34 (97.1%)

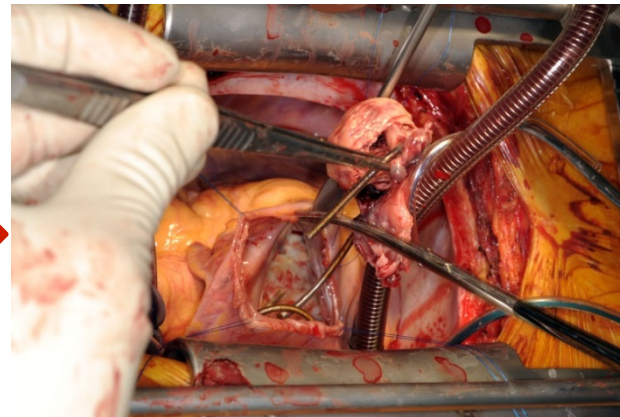
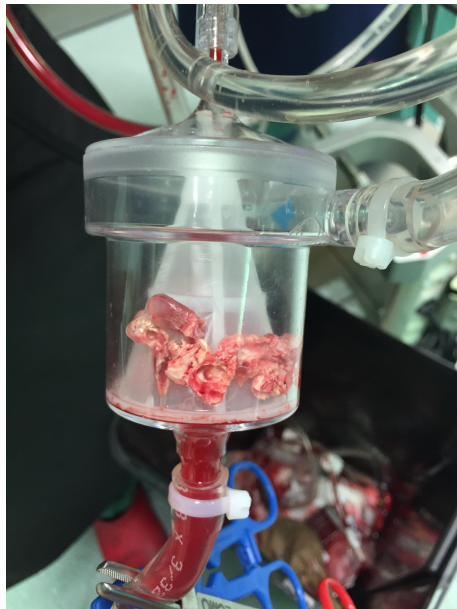
Number of patients	100
Mean Age	67.7 years (30-92)
Male / female	70 / 30
Infection:	
Systemic CIED infection	100 (100%)
Bacteria:	
MSSA	21 (21%)
MRSA	9 (9%)
Staph. epi.	25 (25%)
Other	45 (45%)
Diabetes mellitus	29 (29%)
Chronic kidney disease	41 (41%)
Number of targeted leads	243
Mean lead implant duration	78.9 months (1-231)
Lead characteristics	
Pacemaker leads	167
ICD leads (single vs. dual coil)	76 (27/49)
Preoperative mean vegetation size (assessed by TEE)	30.8 p 13.5 mm

Table 1:
Basic characteristics of patients

Outcome percutaneous aspiration procedure	
Complete procedural success	94 (94.0%)
Partial success	5 (5.0%)
Major complications	3 (3.0%)
Lead extraction devices	
Locking stylet	158 (65.0%)
Polypropelene extraction sheath	3 (1.2%)
Bidirectional rotational extraction sheath	139 (57.2%)
Laser extraction sheath	14 (5.8%)
Outcome TLE procedure	
Complete procedural success (per leads)	241 (99.2%)
Mortality	
30-day mortality	3 (3.0%)

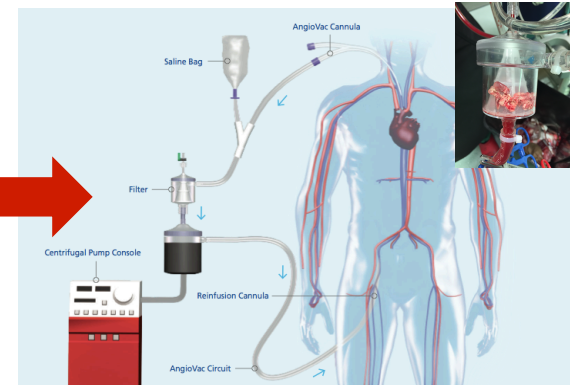
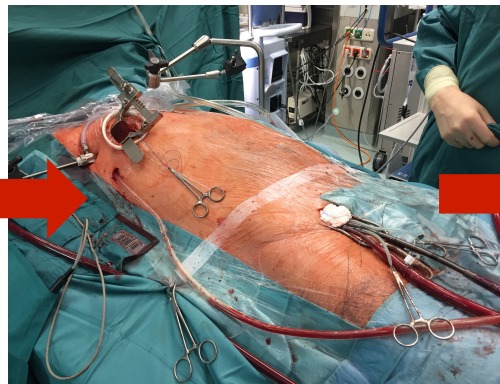
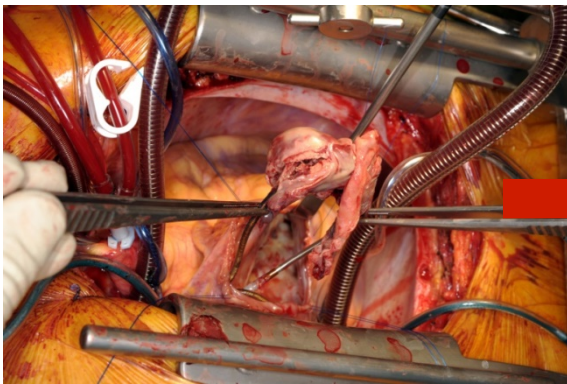
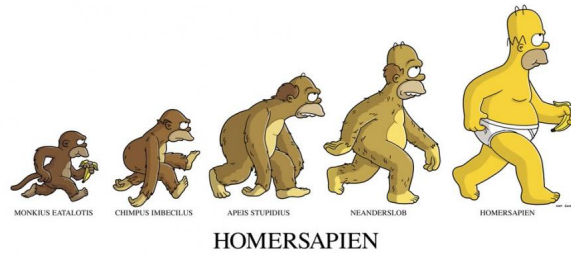
Table 2:
Procedural data and outcomes

Percutaneous aspiration of lead vegetations...



... facilitates safe transvenous lead extraction !

Evolution of therapy in CIED infections with LLV...





Take home messages

- CIED infections with large lead vegetations = challenge
- Guidelines:
 - Cut-off 20 mm → May consider surgical extraction
 - Individualized therapy
- Percutaneous aspiration + TLE = promising concept
- Percutaneous aspiration in all infections with vegetations to improve long-term outcomes...?! (NEEDS scientific proof!)
„General rule“: Vegetations > 10 mm = Vegectomy with Angiovac

**Thank you very much for your
attention !**

