

PLACE



PLATFORM OF LABORATORIES FOR ADVANCES IN CARDIAC EXPERIENCE

ROMA 2024

- 12 Giugno **MINICORSI** Precongressuali
- 13-15 Giugno **CONGRESSO**

PREVENZIONE E TRATTAMENTO DELLE INFEZIONI DEI DISPOSITIVI CARDIACI IMPIANTABILI

Pazienti non candidabili ad estrazione: cosa faccio?

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IRCCS



CIED infections: when to treat them? How?

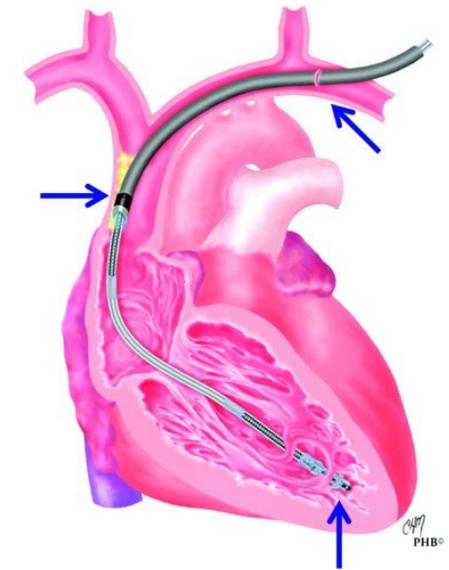
... ALWAYS!

...AND RIGHT AWAY!

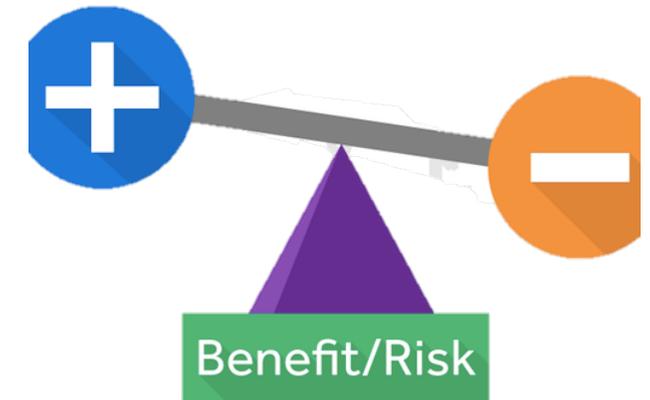
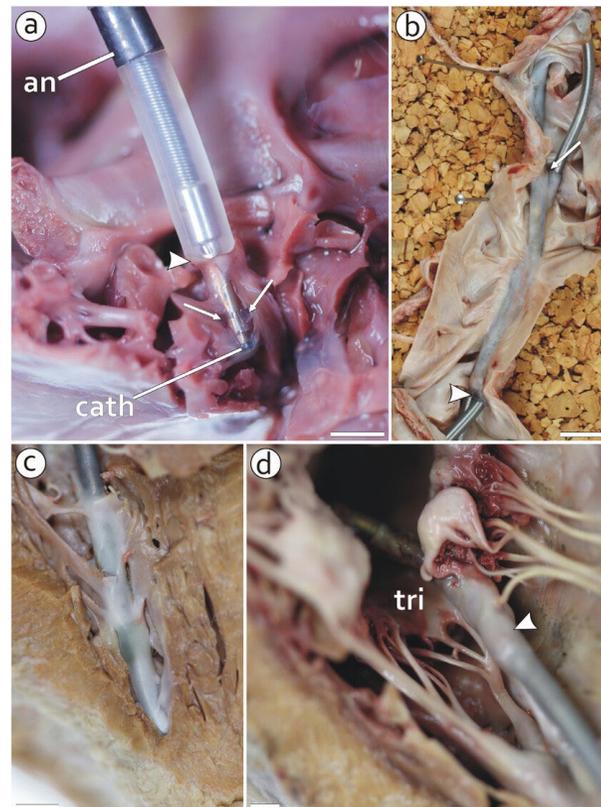
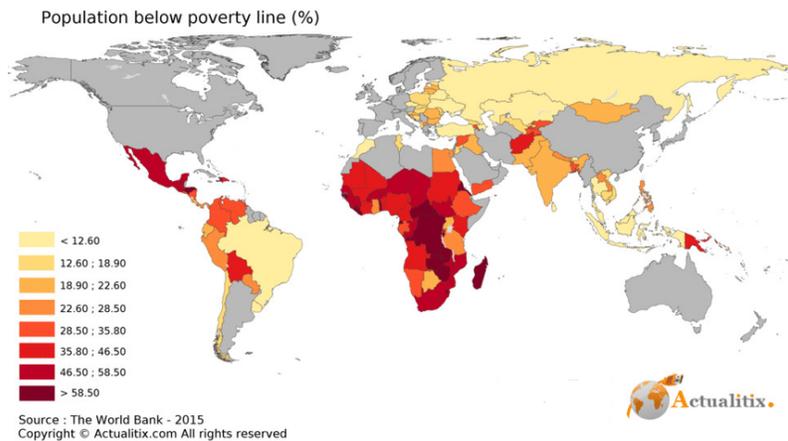
...AND WITH TLE!

Table 8 Recommendations for device and lead removal

Consensus statement	Statement class	Scientific evidence coding	References
In patients with definite CIED infection (systemic and local), complete device removal is recommended (including abandoned leads, epicardial leads, and lead fragments)	♥	○	81,102,104
After diagnosis of CIED infection, the device removal procedure should be performed without unnecessary delay (ideally within 3 days)	♥	○	104
The recommended technique for device system removal is percutaneous, transvenous extraction technique. Epicardial leads require surgical removal	♥	○	105



However, there are occasionally situations where lead extraction is not available, not possible, or not in the best interest of the patient



Palliation and Nonextraction Approaches

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101-year-old woman

39 Kg

Implant 1986 (32 years before)

Pacemaker dependent



Conservative approach



Factors to be considered

- Advanced age
- Frailty / comorbidities
- Life expectancy
- Long time indwelling leads making TLE challenging
- Pacemaker dependence making intra and post-operative course challenging
- Prior cardiac surgery

Multidisciplinary approach

- Cardiac electrophysiologist
- Cardiac Surgeon
- Infectious Disease Expert
- Plastic Surgeon
- Wound Care Service



Alternatives to TLE

Box 1

Management options when lead extraction cannot or should not be performed

- Chronic suppressive antibiotic therapy
- Pocket debridement with device reimplant at the same site
- Pocket relocation (deeper or adjacent to infected site) with device reimplant
- Chronic open drainage
- Closed pocket irrigation
- Vacuum-assisted wound closure
- Device removal with lead abandonment

Not mutually exclusive

Should be considered individually or in some combination to achieve the therapeutic goal.

Pocket revision

- Incision encompassing the thinned-infected area
- Extensive debridement exposing healthy tissue
 - Preserve skin blood supply
- Associate with long term ATB
- Incise drain and debride if abscess (aspiration only is useless)
- Pocket irrigation (saline; NO LOCAL ATB)
- Avoid hemostatic devices in infected tissue
- Suture with monofilament



Pocket revision

- In case of pocket abscess, atb therapy alone is insufficient because of lack of penetration within the closed chamber
- Pocket revision should be associated, or alternative strategy should be pursued



Pocket revision

Occasional case reports and small series (not randomized studies!) of non-recurrence of infection using this technique.

These success stories are not common and not reproducible.

Natural course of pocket revision → resurgence of the infection, usually weeks to months following the intervention.

Virtually every valid series has shown an unacceptably high rate of infection recurrence



Pocket revision: a failing strategy

Therapy of Cardiac Device Pocket Infections with Vacuum-Assisted Wound Closure—Long-Term Follow-Up

WOLFRAM C. POLLER, M.D., MARIUS SCHWERG, M.D., and CHRISTOPH MELZER, M.D., PH.D.

From the Department for Cardiology and Angiology Charité University Hospital, Berlin, Germany

Case series 5 pts , mean FUP 34 months. Mean hospitalization 38 days

Generator removed



Leads shortened

VAC applied



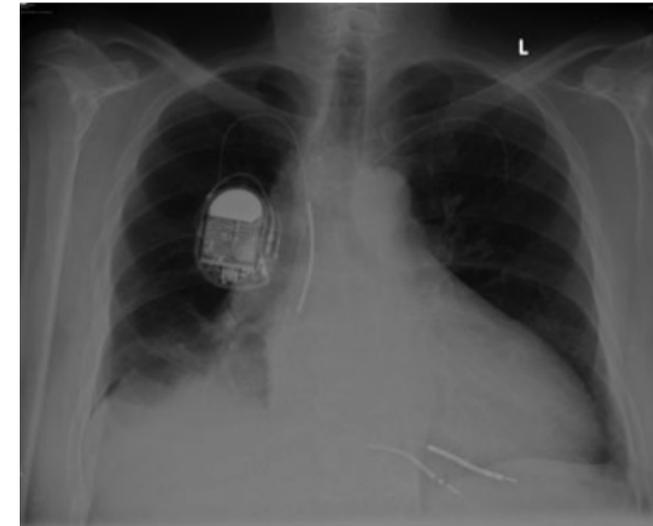
Local Device Infection patients refusing TLE

TLE not feasible

Pitfalls:

Long hospitalizations

Scant data



Only one of the 5 pts developed reinfection

Pacemaker pocket infection: Innovative conservative treatment in elderly patients with no signs of systemic infection

Antonio Bisignani MD¹ | Silvana De Bonis MD² | Luigi Mancuso MSc³  |
Gianluca Ceravolo MSc³  | Giovanni Bisignani MD² 

25 elderly pts with pocket infection (no signs of systemic infection) refusing TLE

Pocket debridement, generator removal

Washing with hydrogen peroxyde

4-days irrigation with saline and gentamycin (or targeted ATB)

New generator implanted in a new pocket
(**pocket relocation**)

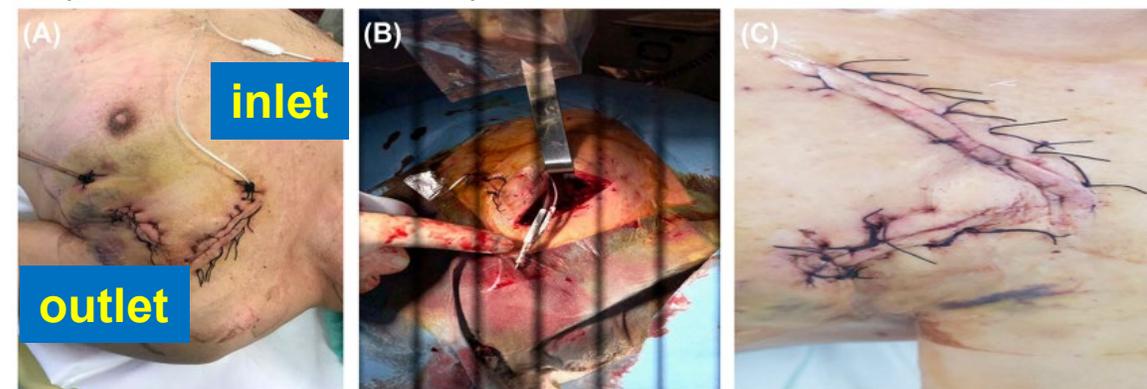
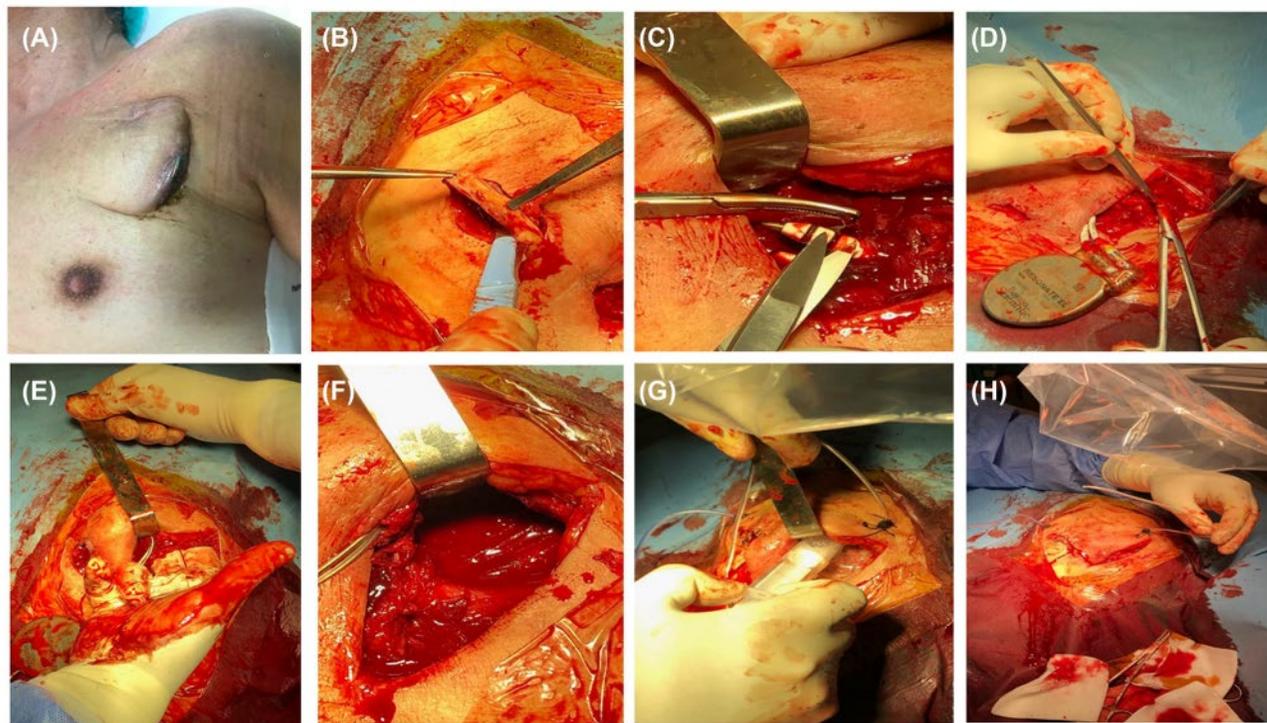


TABLE 1 Clinical details of 25 patients at baseline assessment

Patient No.	Age	Device	No. of leads	Years from implant	White cells count	ESR	CRP	Culture	Follow-up (months)	Status at follow up
1	74	ICD	1	4	Normal	↑	↑	Positive SE	24	No infection
2	83	ICD	2	4	Normal	↑	Normal	Negative	36	No infection
3	70	CRT-D	3	3	Normal	Normal	Normal	Negative	34	No infection
4	86	PM	2	8	Normal	Normal	Normal	Positive SA	30	No infection
5	90	PM	2	4	↑	↑	↑	Positive SA	14	No infection
6	83	CRT-D	3	3	Normal	Normal	Normal	Negative	25	No infection
7	85	CRT-D	3	7	Normal	Normal	Normal	Negative	38	No infection
8	88	PM	1	2	Normal	Normal	Normal	Positive SA	13	No infection
9	78	ICD	2	8	Normal	Normal	Normal	Negative	24	No infection
10	65	CRT-D	3	4	Normal	Normal	Normal	Negative	24	No infection
11	70	ICD	2	3	Normal	Normal	Normal	Negative	22	No infection
12	92	PM	2	3	Normal	Normal	Normal	Positive SE	25	No infection
13	80	ICD	2	4	Normal	Normal	Normal	Negative	32	No infection
14	89	PM	1	3	Normal	↑	↑	Positive SE	1	Lead extraction
15	82	PM	1	2	Normal	↑	↑	Negative	18	No infection
16	85	ICD	1	1	Normal	↑	↑	Positive SE+EC	14	No infection
17	65	ICD	2	3	Normal	Normal	Normal	Negative	12	No infection
18	72	ICD	2	7	Normal	Normal	Normal	Negative	9	No infection
19	75	PM	2	5	Normal	Normal	↑	Negative	10	No infection
20	76	PM	1	6	Normal	Normal	Normal	Positive SA	40	No infection
21	81	ICD	2	6	Normal	Normal	Normal	Negative	50	No infection
22	80	PM	2	7	Normal	Normal	Normal	Negative	30	No infection
23	81	ICD	1	3	Normal	Normal	Normal	Positive SA	80	No infection
24	83	ICD	2	4	↑	↑	Normal	Positive SA	90	No infection
25	89	PM	2	5	↑	↑	↑	Positive SA	12	No infection

24 months follow up

24/25 effective

CRP = C-reactive protein; CRT-D = Cardiac Resynchronization Therapy Defibrillator; EC = escherichia coli; ESR = Erythrocyte Sedimentation rate; ICD = Implantable Cardioverter Defibrillator; PM = Pacemaker; SA = staphylococcus aureus; SE = staphylococcus epidermidis.

Patient A

Patient B

Patient C



Suppressive Antibiotic Therapy

- Suppressive antibiotic therapy is prescribed when a patient has an infection that is presumed to be **incurable** by a defined course of therapy or source control
- Either alone or in combination with one or more of the other options
- **Oral (preferred)** or intravenous in selected cases
- Rare case are reported of successful eradication of intravascular infections → the natural course is early recurrence after atb discontinuation (**PALLIATION**)
- Lack of robust randomized trials, heterogeneous populations

Pallium



Suppressive Antibiotic Therapy

Two main categories of eligible patients

Patients in whom the
main strategy (surgery +
IV ATB course) has failed

Patients who are not
candidates for the main
treatment (surgery)



Typically elderly, frail,
comorbid

Get blood and (if possible) pocket cultures



Start broad spectrum ATB

Starting too early → culture-negative evaluations complicating therapeutic decision-making regarding antibiotic choice.

CoNS

S. Aureus
(incl. MRSA)

Gram negative

Prolonged use of more toxic or broad-spectrum ATB

Side effects

Drug resistance

Targeted therapy

Oral

Intravenous

Close biomarker and clinical surveillance for relapse

Initial close monitoring (more likely to fail in the first stages), then 6-12 months FUP after biomarkers normalize

Chronic antibiotic agents

- **Trimethoprim-sulfamethoxazole** MRSA and CoNS
 - Avoid in G6PD deficiency
 - Associated with folic acid integration (folate deficiency)
 - Active on both Gram neg and Gram pos (including some MRSA), not on anaerobia
- **Doxycycline or minocycline** (if sensitive)
- (Clindamycin) – rarely used
- (Quinolones) - not as first choice because of side effects
- Rifampin: not as single therapy

Chronic antibiotic agents

- Pts on chronic hemodialysis are often treated with intravenous **vancomycin** delivered during a dialysis session
 - Check blood levels
- **Dalbavancyn** or **Oritavancin** (long acting peptides):
 - Scant evidence on CIED infection treatment, but on their way
- ~~Linezolid not suitable for chronic therapy~~

Ultimately, the choice of antibiotic to be used should be made in consultation with an expert on the infectious disease.



Suppressive ATB Therapy - Complications

- Evolving antibiotic resistance
- Gastrointestinal complications or asymptomatic bacteriuria
- *Clostridioides infection*

Complication rate up to 41-52% in some series, but **72%** reported **complete adherence**

Either fear of relapse, or side effects not so bothersome

Suppressive antibiotic therapy duration

- Some authors suggest continuing SAT beyond one year may not further reduce the risk of treatment failure
- Cessation can be considered if:
 - Normal, stable inflammatory **markers** (WBC, ESR, CRP) for at least 1 year, without clinical signs of infection
 - No signs of infection at **re-imaging** (if baseline imaging evidence of infection)
 - **Patient preference**

Suppressive antibiotic therapy duration

- Patient factors to consider for prolonging SAT:
 - How well has the patient tolerated SAT
 - Patient's life expectancy
 - How devastating infection recurrence would be
- In frailer patients, with limited life expectancy in whom an infection recurrence may prove fatal
 - Reasonable to continue SAT indefinitely.

Regional Antibiotic Delivery for Implanted Cardiovascular Electronic Device Infections



Moris Topaz, MD, PhD,^{a,b,*} Ehud Chorin, MD, PhD,^{a,c,*} Arie Lorin Schwartz, MD,^{a,c} Aviram Hochstadt, MD,^{a,c} Avraham Shotan, MD,^{d,e,f} Itamar Ashkenazi, MD,^g Mark Kazatsker, MD,^d Narin-Nard Carmel, MD,^c Guy Topaz, MD,^{c,h} Yoram Oron, PhD,^c Gilad Margolis, MD,^{a,c} Eyal Nof, MD,^{c,i} Roy Beinart, MD,^{c,i} Michael Glikson, MD,^{c,i,j} Anna Mazo, MD,^{a,c} Anat Milman, MD, PhD,^{c,i} Michal Dekel, MD,^{c,k} Shmuel Banai, MD,^{a,c} Raphael Rosso, MD,^{a,c} Sami Viskin, MD^{a,c}

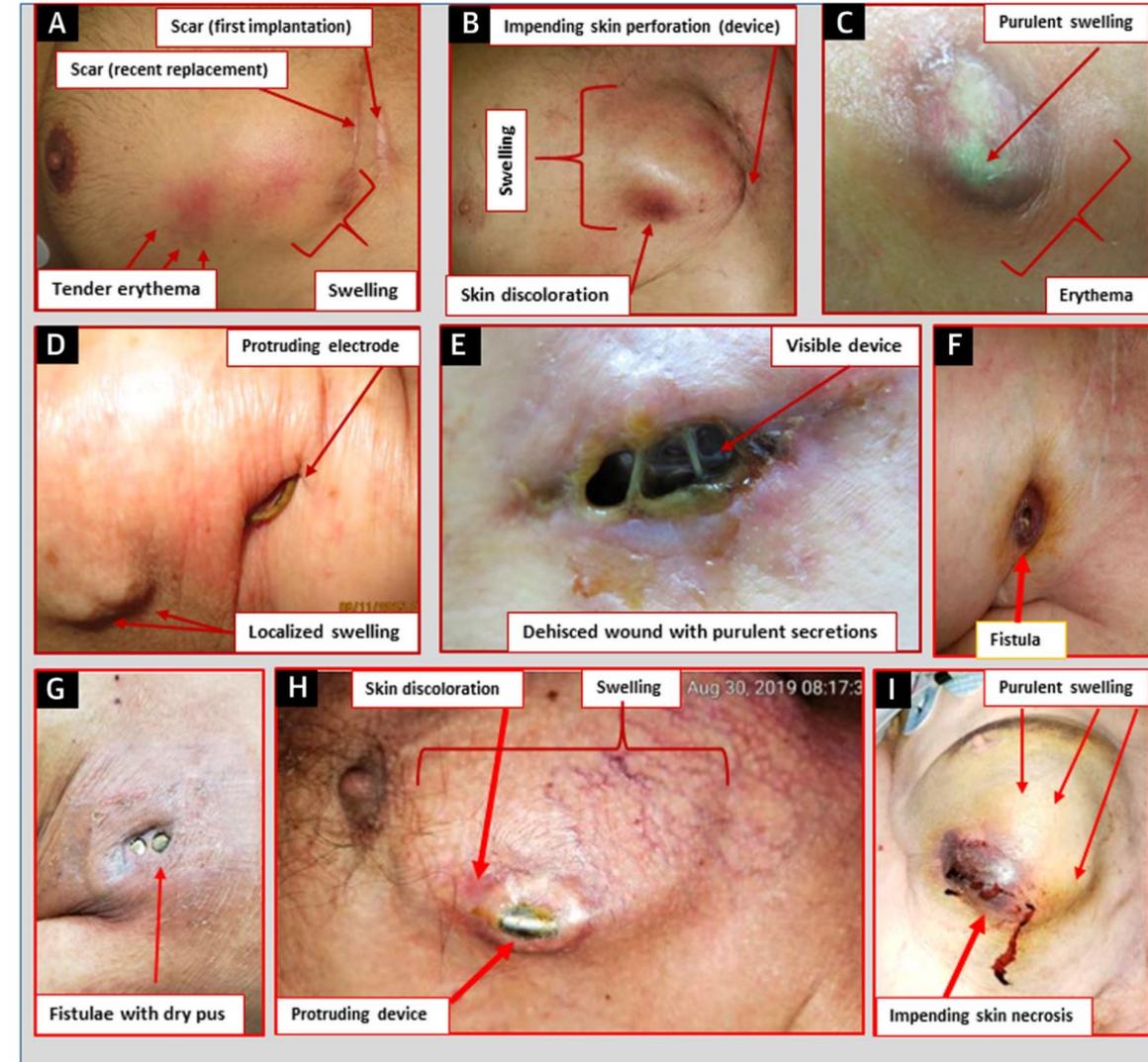
Local infection only – systemic infection must be excluded

S. aureus pts excluded (unless in intraoperative culture from already initiated procedure)

80 pts between 2007 and March 2021

Initial experience: patients declined for lead extraction due to operative risk

Favourable results → extended to TLE candidates who preferred less invasive strategy



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Sami Viskin, MD^{a,c}

- 1) Extensive pocket revision, debridement, cleansing with H2O2 + Pov-Iodine
- 2) 6 Fr indwelling catheter through healthy skin to pocket
- 3) TopClosure if wound under tension
- 4) RNPT system (vacuum on closed wound)
- 3) Continuous infusion of high dose ATB for 10-14 days
- 4) Serum levels monitoring

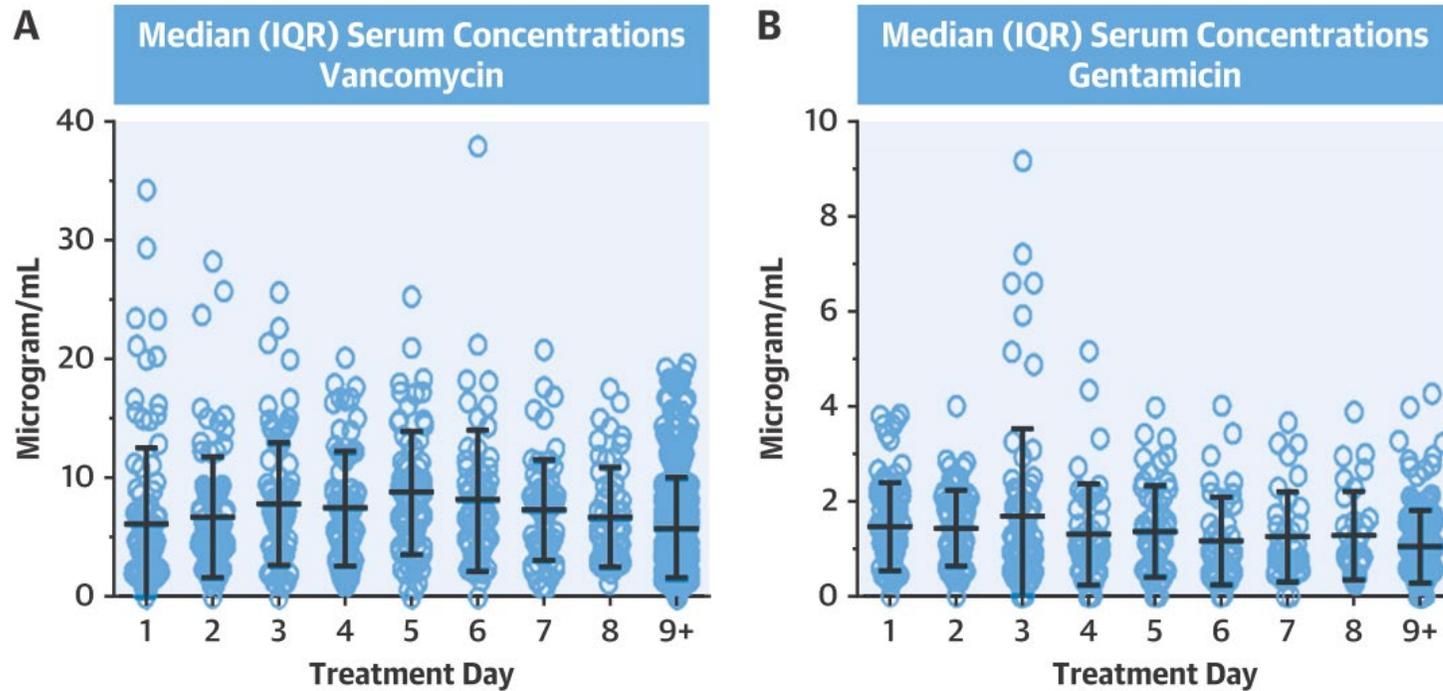


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FIGURE 5 Serum Antibiotic Levels Achieved With CITA Into the Subcutaneous Pocket-Infection



Vancomycin 1-2 g
Gentamicin 80-240 g
Amikacin 250-500 mg

In 25-50 ml saline, 1-2 ml/h

Then, concentrations adjusted based on daily serum levels, with the same infusion rate

Could be re-offered if persistent signs of infection

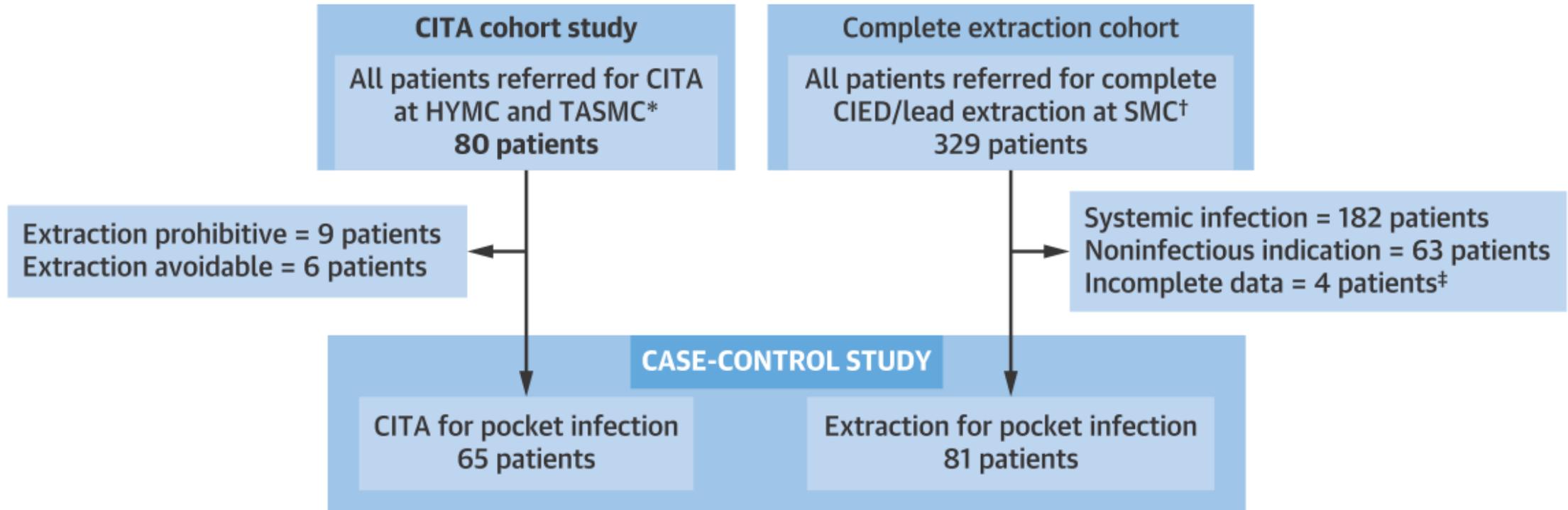


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FIGURE 1 CITA Cohort and Case Control Study (CITA vs Device/Lead Extraction for Pocket Infection)



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Rates of cure P=0.027

Extraction 96.2%

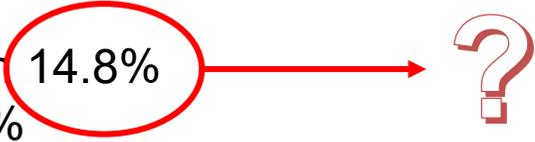
CITA 84.6%

Serious complications

P=0.005

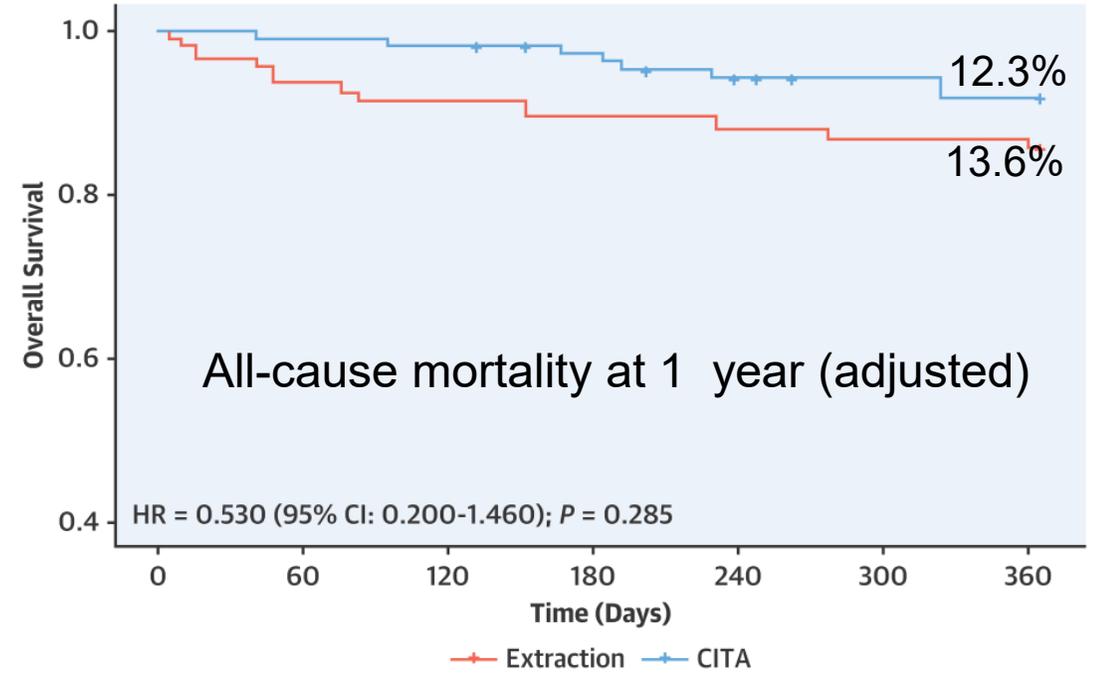
Extraction 14.8%

CITA 1.5%



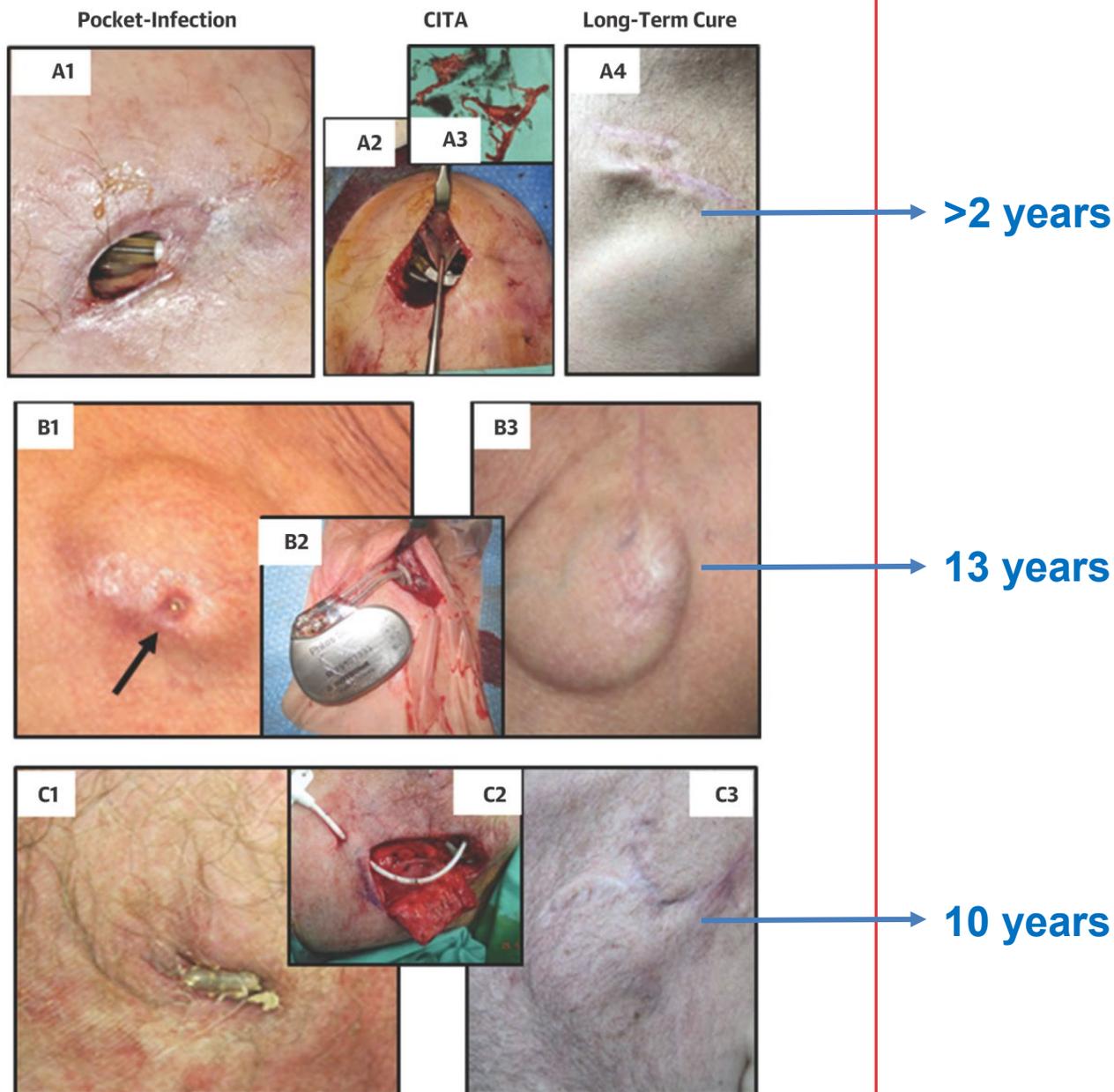
Median follow up 3 years

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Topaz M, et al. J Am Coll Cardiol. 2023;81(2):119-133.

combined with appropriate antibiotic therapy.¹¹ Our study indicates that treatment of CIED pocket infections with CITA provides a reasonable alternative to immediate extraction, achieving cure in most patients, while reducing the risk of complications. Survival rates, at 30 days and 1 year, were similar in



STUDY LIMITATIONS

Case-control design

Underpowered to reach definitive conclusions regarding the noninferiority of CITA vs TLE

S. Aureus under-represented

Non high-volume extraction centers: under-referral and high complication rate

Take home message

- In patients **unsuitable for TLE**, alternative approaches to CIED infection management may be pursued
 - Often more strategies need to be combined
 - None of the non-extraction methods is guaranteed
 - Consider them as a **palliation**, with rare exceptions
- The goal of CIED infection treatment should always be early complete system removal, if achievable



Thank you

