Natural History of Non-surgical Complete Atrioventricular Block in Children and Predictors of Pacemaker Implantation
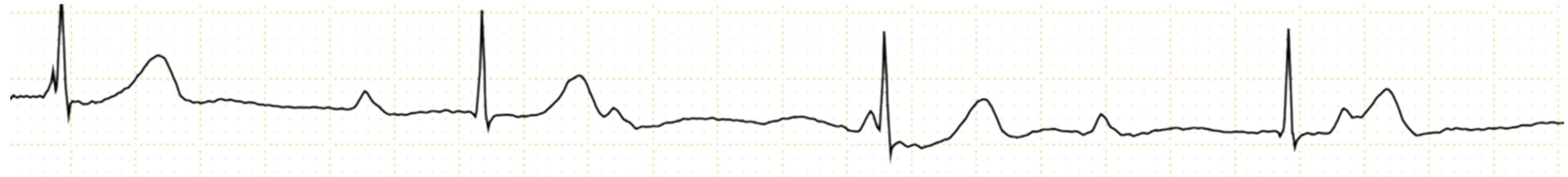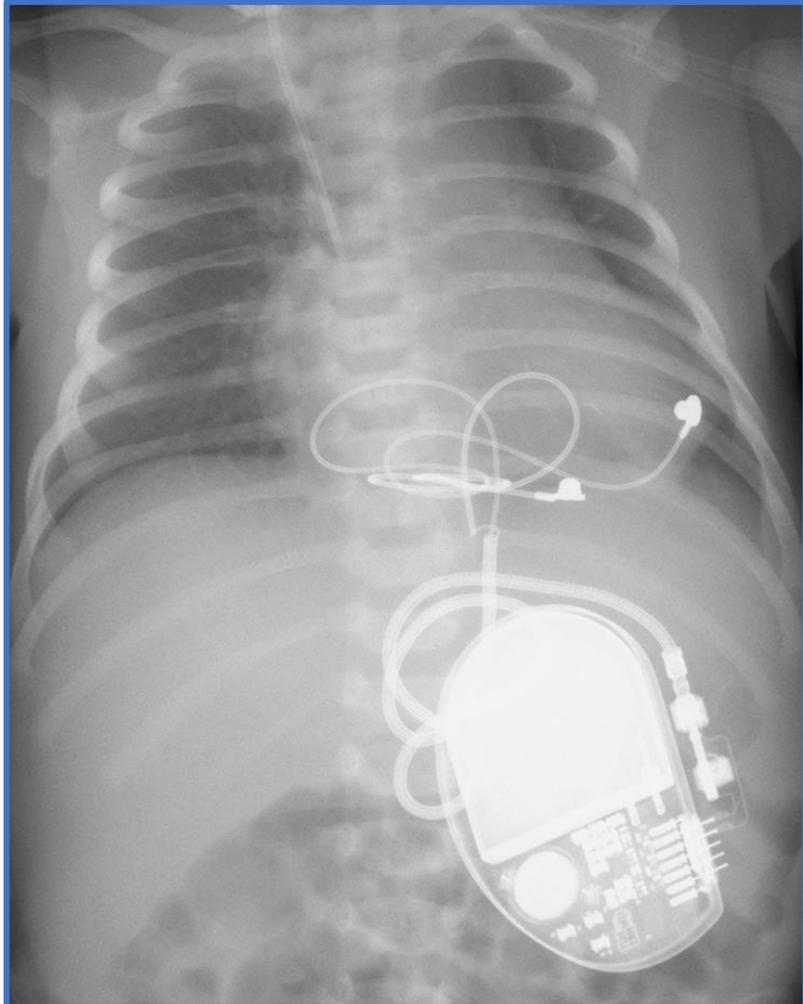
M. Jičínský, P. Kubuš, M. Pavlíková, M. Ložek, J. Janoušek

Children's Heart Centre, 2nd Faculty of Medicine, Charles University and Motol University Hospital

Indication criteria for permanent pacing

- Unconditional criteria - symptoms
- Relative/open to question criteria – reaching of rate criteria recommended by association guidelines (low levels of evidence)

2021 PACES Expert Consensus Statement on the Indications and Management of Cardiovascular Implantable Electronic Devices in Pediatric Patients ℮

Developed in collaboration with and endorsed by the Heart Rhythm Society (HRS), the American College of Cardiology (ACC), the American Heart Association (AHA), and the Association for European Paediatric and Congenital Cardiology (AEPC). Endorsed by the Asia Pacific Heart Rhythm Society (APHRS), the Indian Heart Rhythm Society (IHRS), and the Latin American Heart Rhythm Society (LAHRS).

2013 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy

The Task Force on cardiac pacing and resynchronization therapy of the European Society of Cardiology (ESC). Developed in collaboration with the European Heart Rhythm Association (EHRA).
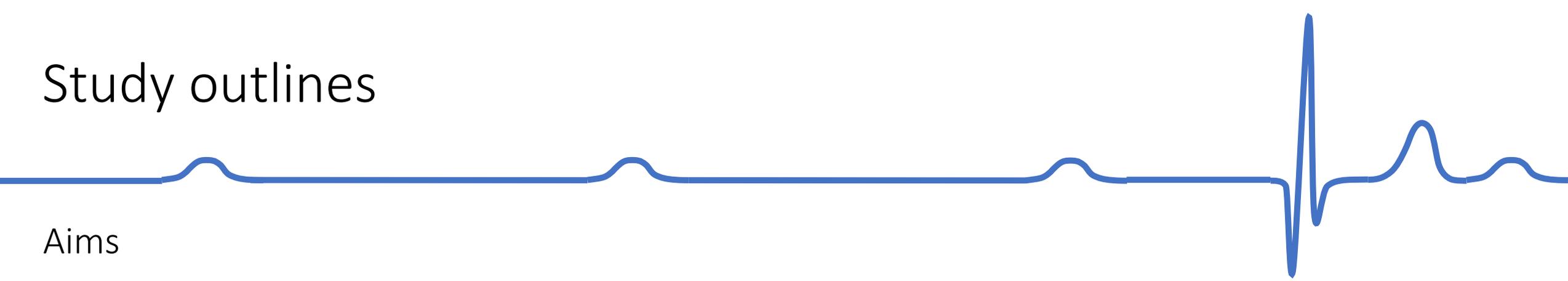
Authors/Task Force Members: Michele Brignole (Chairperson) (Italy)*, Angelo Auricchio (Switzerland), Gonzalo Baron-Esquivias (Spain), Pierre Bordachar

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association®

2012 ACCF/AHA/HRS Focused Update Incorporated Into the ACCF/AHA/HRS 2008 Guidelines for Device-Based Therapy of Cardiac Rhythm Abnormalities : A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines and the Heart Rhythm Society
Andrew E. Epstein, John P. DiMarco, Kenneth A. Ellenbogen, N.A. Mark Estes III, Roger A.

- Neonates / infants HR < 50 BPM
- Asymptomatic children > 1 year, HR < 50 BPM
- Adverse effects of bradycardia vs. adverse effects of pacing

Study outlines

Aims

- Evaluate natural history of complete non-surgical AV block
- Find possible predictors for pacemaker implantation

Methods

- Single-centre retrospective study, period 1977-2016
- N = 95 consecutive paediatric patients with non-surgical complete AV block
- Age at first presentation: median 4.05 (IQR 0.11-10.30)
- Follow-up median 0.8 (IQR 0.02-7.07) years; 347 patient-years

Endpoint

- Pacemaker implantation according to guidelines

ORIGINAL RESEARCH PAPER

Natural History of Nonsurgical Complete Atrioventricular Block in Children and Predictors of Pacemaker Implantation
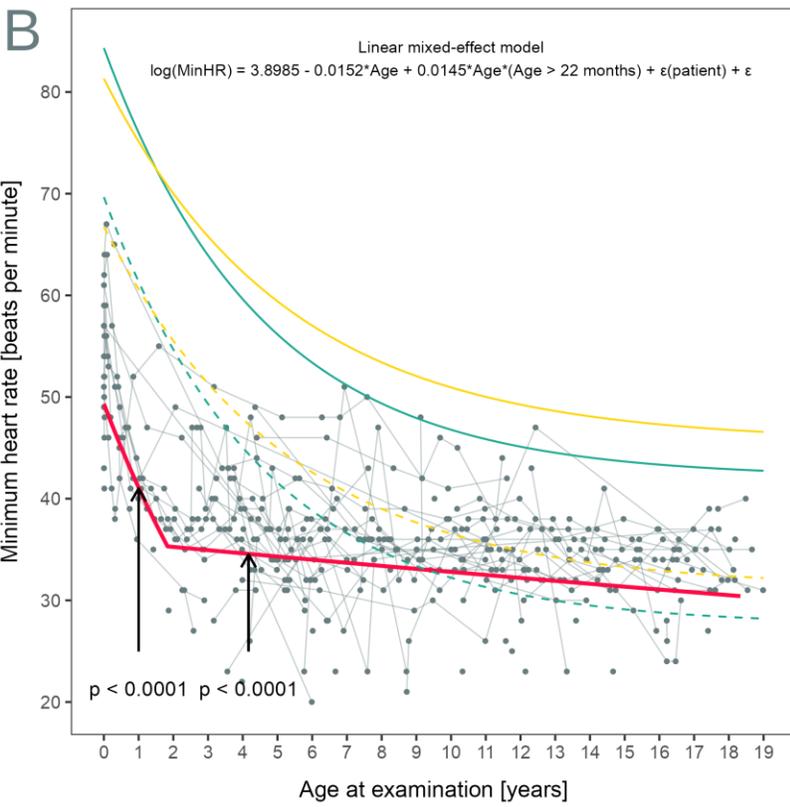
Michal Jičínský, MD,[a] Peter Kubuš, MD, PhD,[a] Markéta Pavlíková, MSc,[b] Miroslav Ložek, MSc,[a,c] Jan Janoušek, MD, PhD[a]
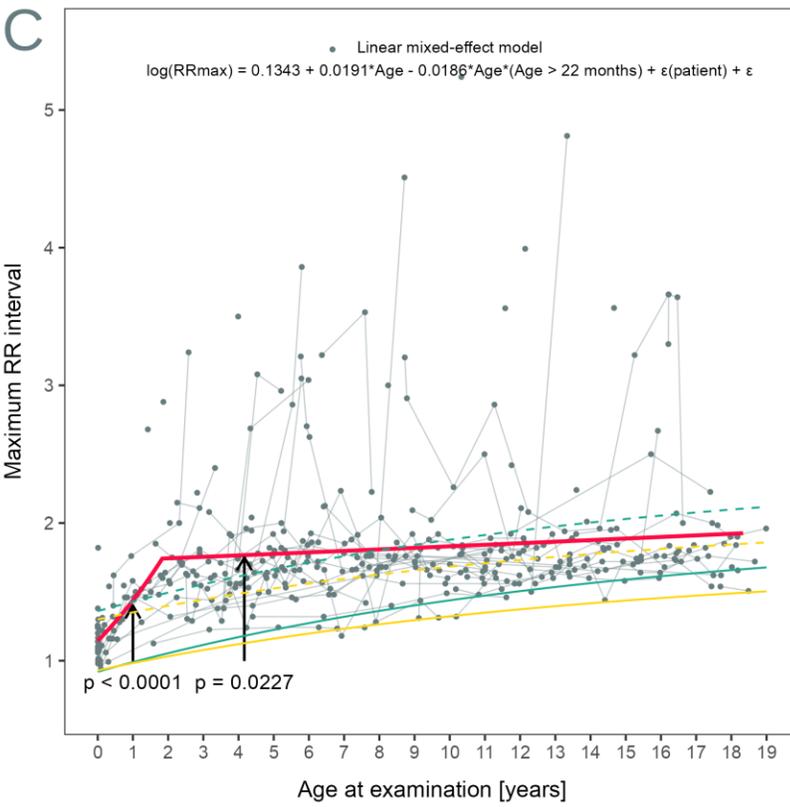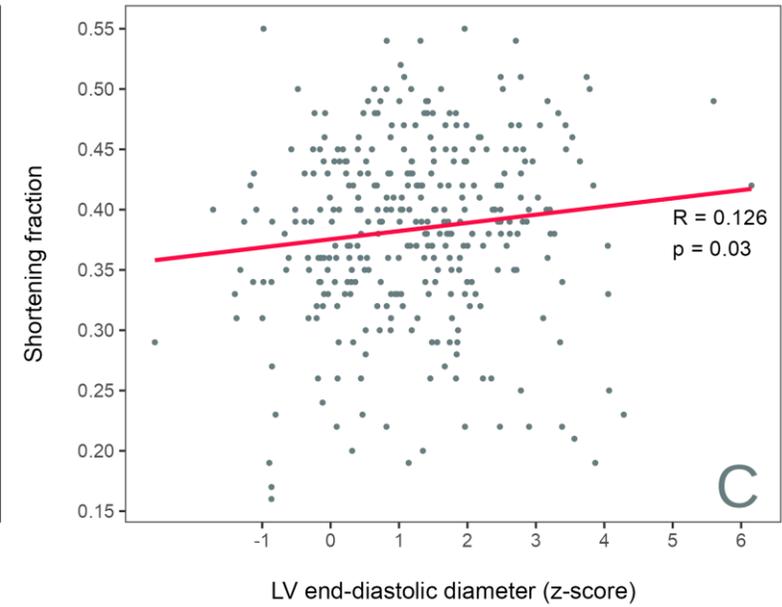
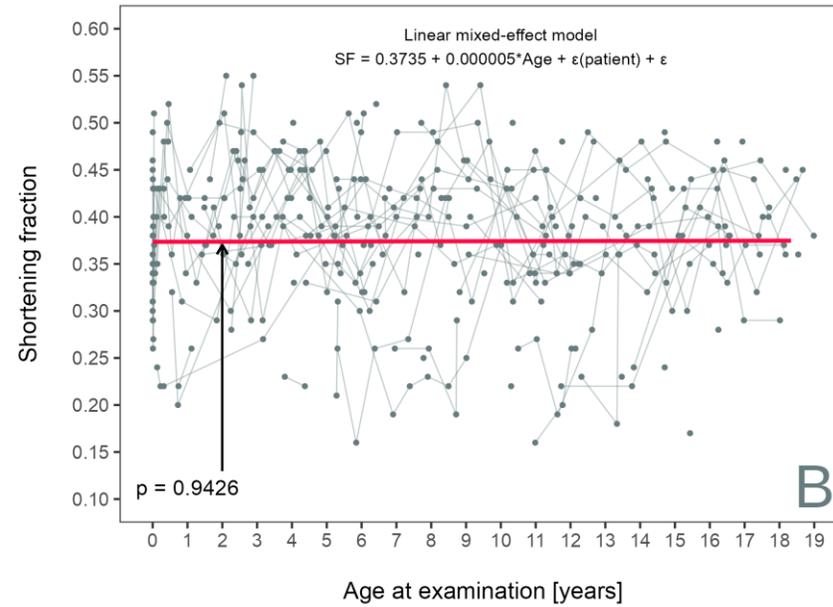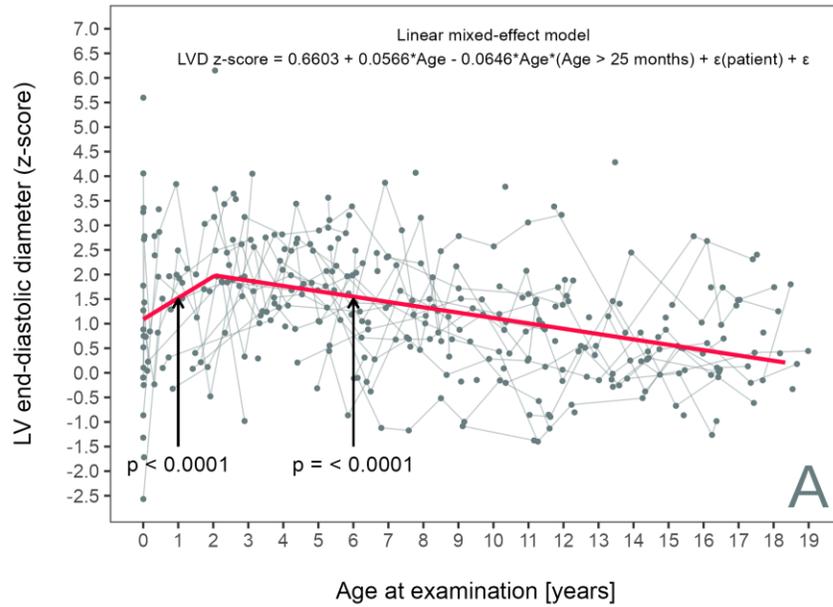# Results: Heart rate profile (24-hour Holter ECG)
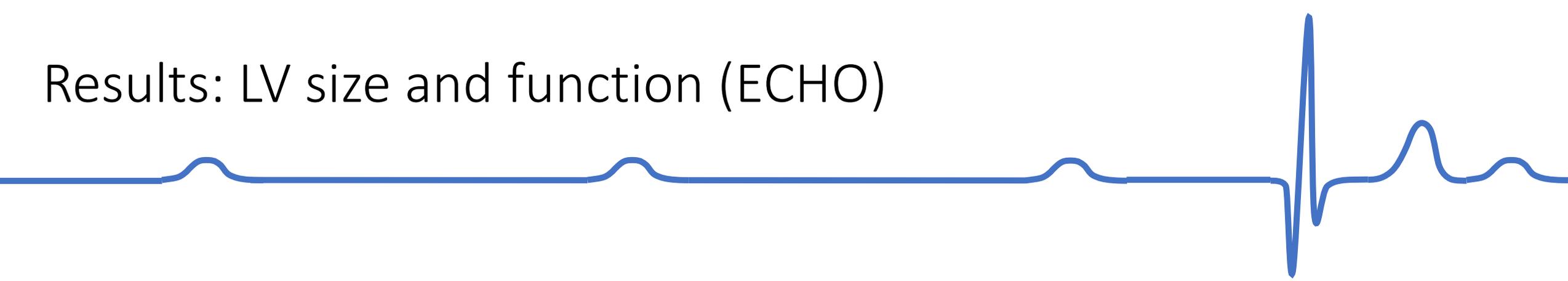

Mean heart rate
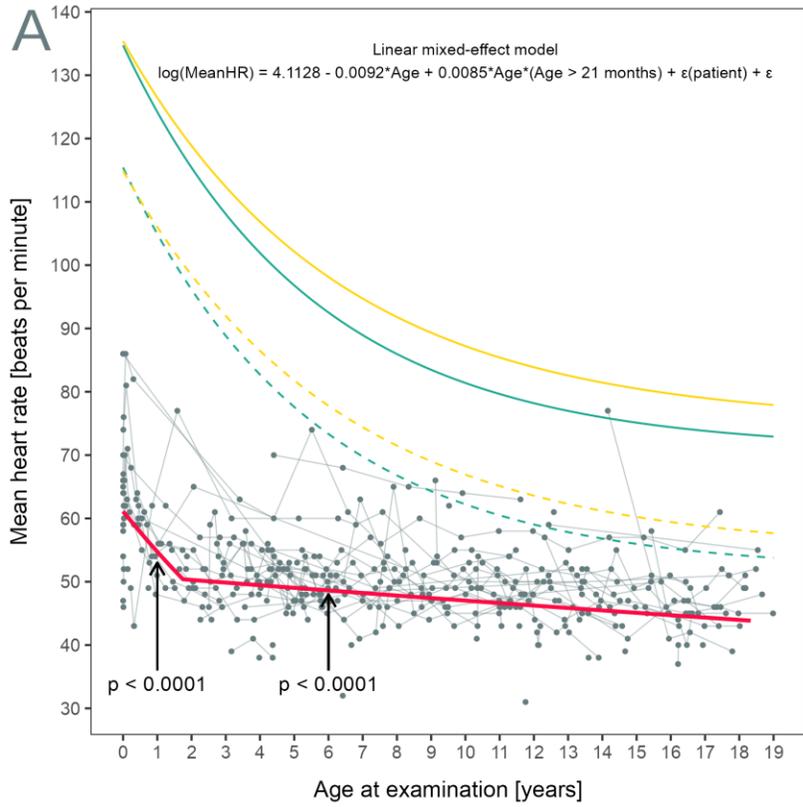
Minimum heart rate

Maximum RR interval

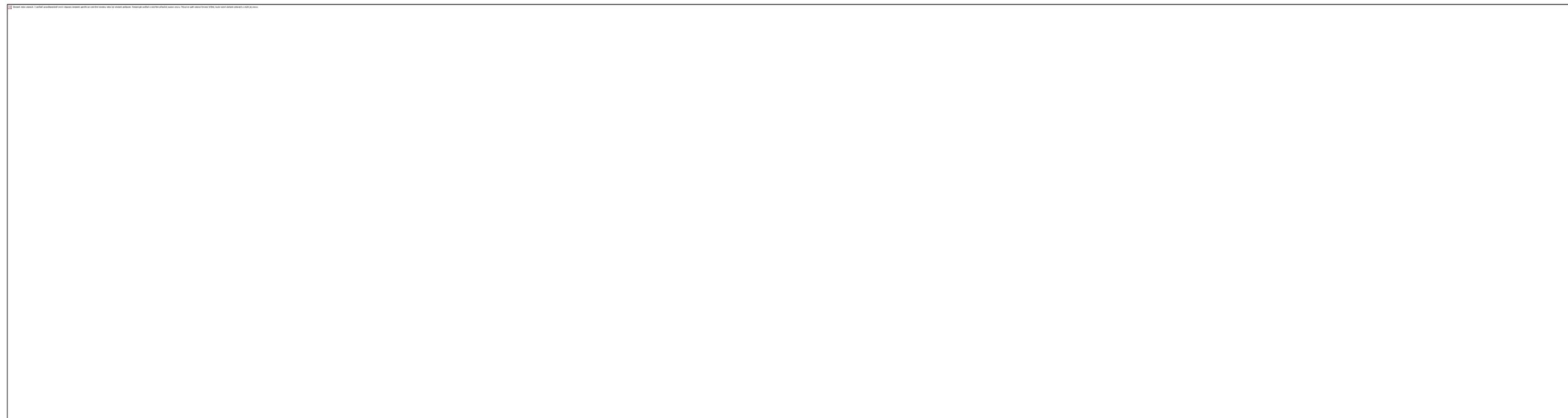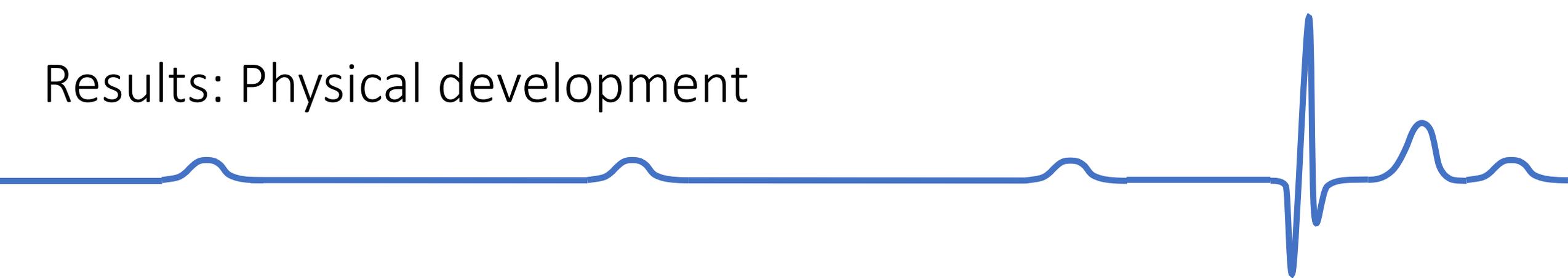# Results: LV size and function (ECHO)

Results: Relationship of LV size and mean heart rate
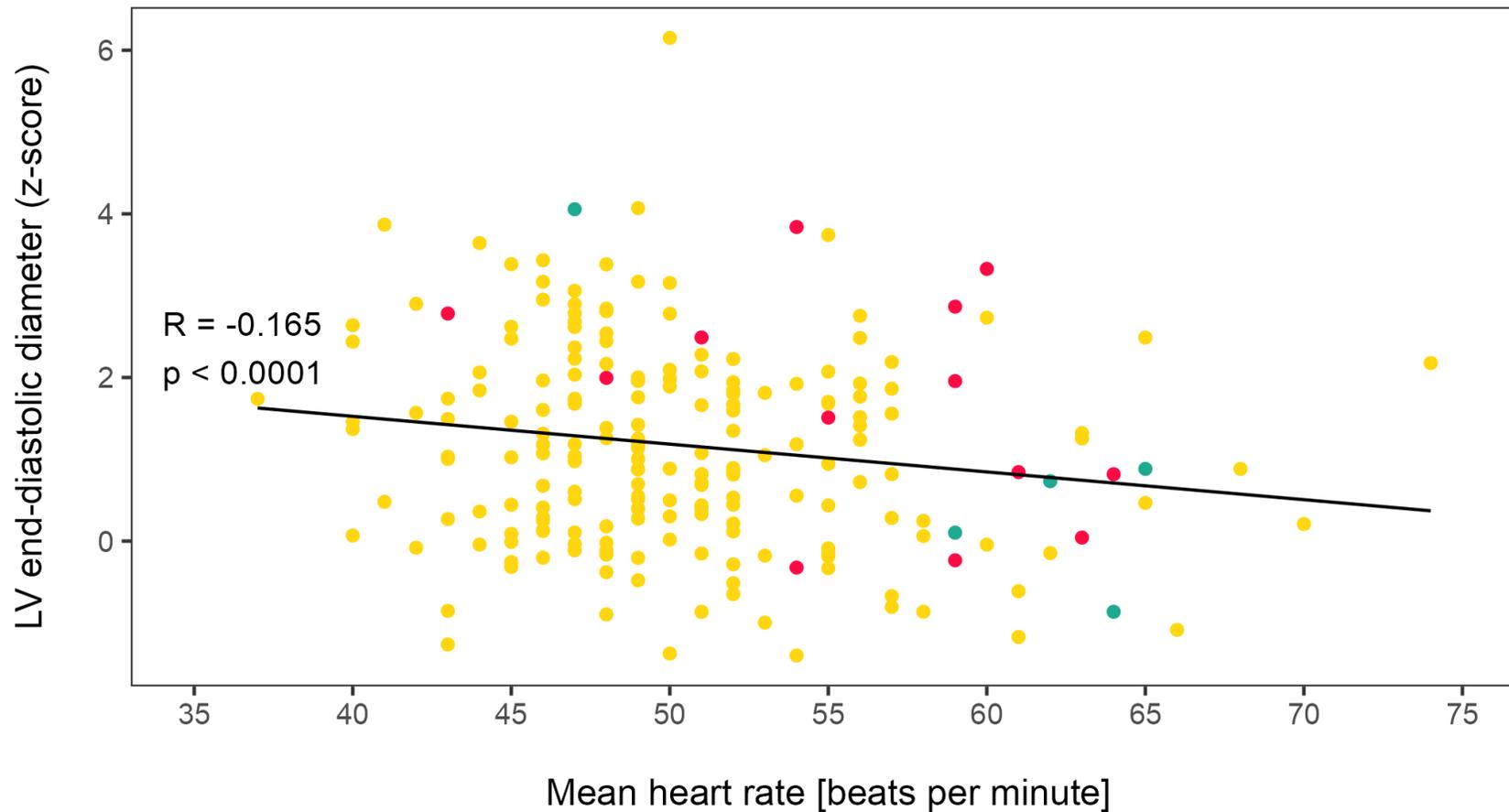
Results: Physical development

Results: Freedom from pacemaker implantation
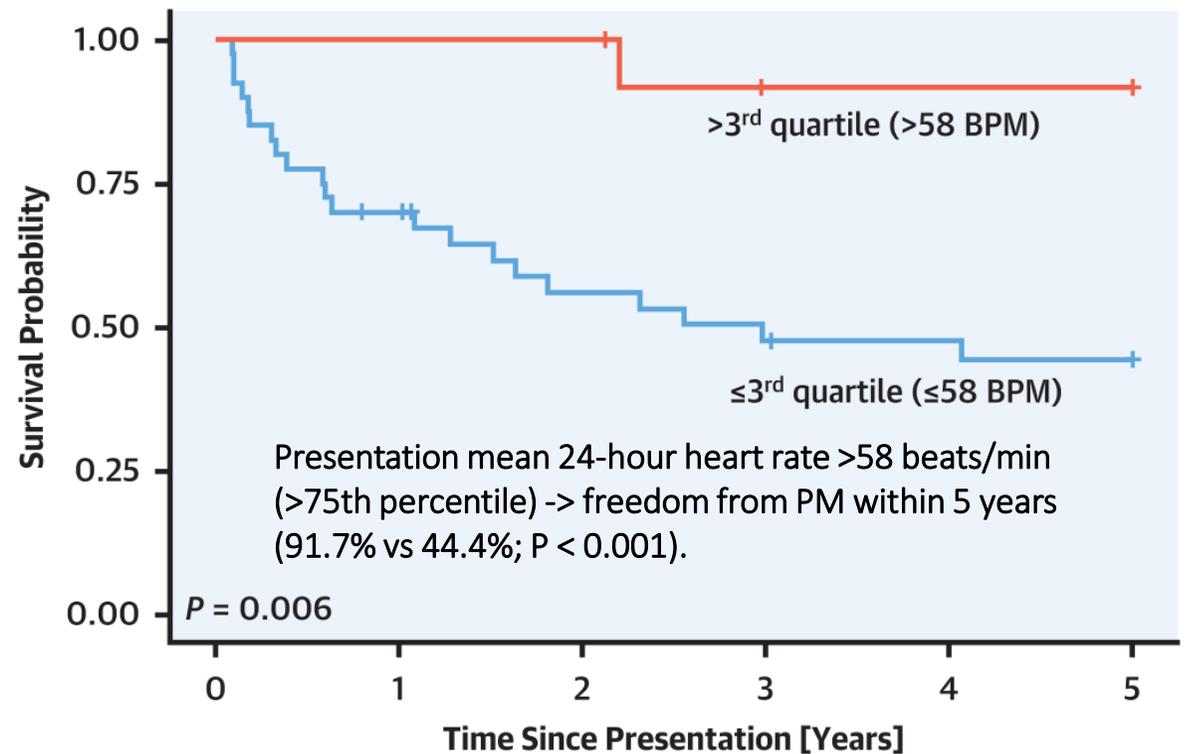
Freedom From Pacemaker Implantation

Age at First Presentation
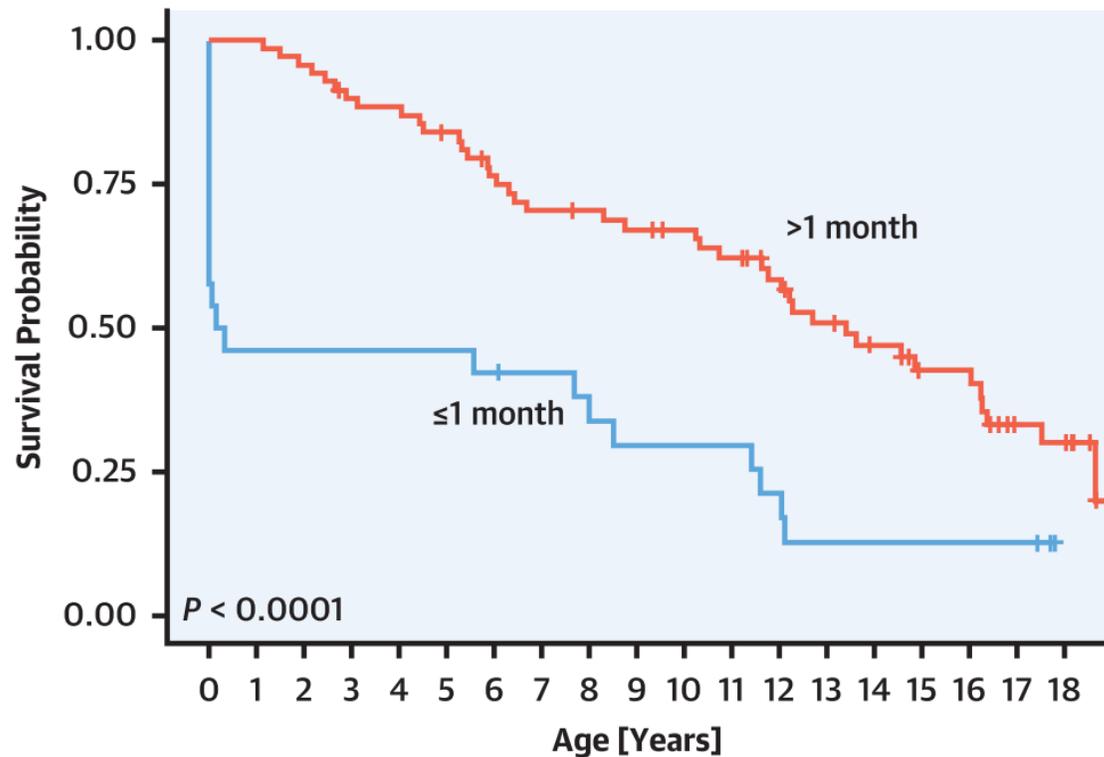
Predictors of Pacemaker Implantation

Mean Heart Rate at Presentation
(HR = 0.938, *P* = 0.003 Per Unit Increase)

>3rd quartile (>58 BPM)

≤3rd quartile (≤58 BPM)

Presentation mean 24-hour heart rate >58 beats/min (>75th percentile) -> freedom from PM within 5 years (91.7% vs 44.4%; P < 0.001).

Results: Predictors of pacemaker implantation

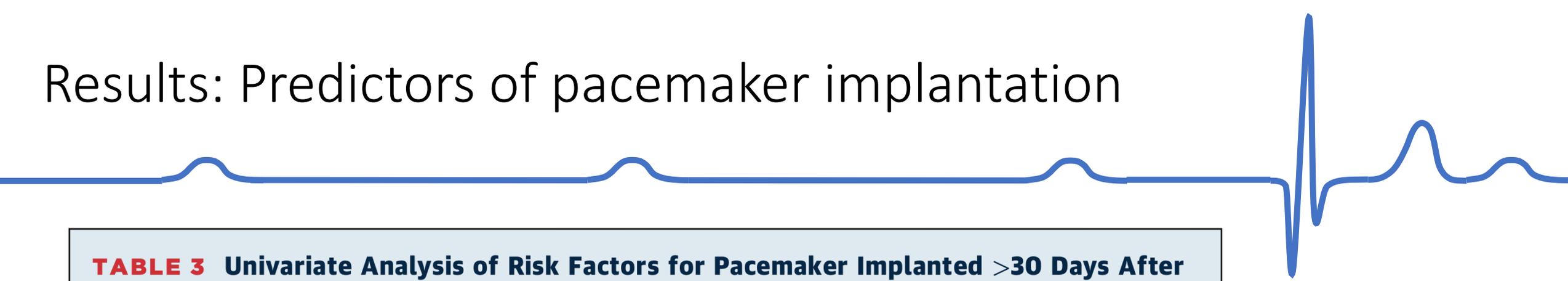**TABLE 3** Univariate Analysis of Risk Factors for Pacemaker Implanted >30 Days After First Presentation

	HR	95% CI	*P* Value
Gender (male vs female)	1.328	0.677-2.606	0.412
Age at presentation, y	1.003	0.997-1.009	0.382
Minimum heart rate at presentation, beats/min	0.968	0.934-1.002	0.060
Mean 24-hour heart rate at presentation, beats/min	0.938	0.894-0.983	0.003
Maximum RR interval at presentation	1.406	0.905-2.184	0.149
RR ratio at presentation	2.384	0.947-6.000	0.091
LV end-diastolic diameter *z*-score at presentation	1.056	0.874-1.277	0.578
LV shortening fraction at presentation	0.674	0.013-35.092	0.845

LV = left ventricular; RR ratio = maximum RR interval divided by mean RR interval.

Conclusions
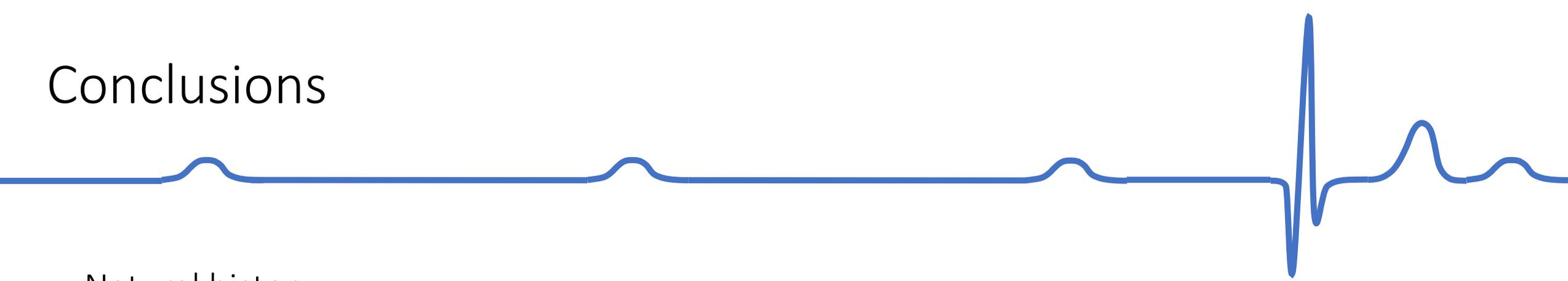
Natural history

- Age dependent decrease in heart rate
  - Fastest in the first two years of live

- Increased left ventricular size related to bradycardia and normal systolic function

- Normal physical development

Predictors of pacemaker implantation

- Mean 24-hour heart rate at first examination regardless of age at the time
  - Identification of low/high risk groups of patients
  - Rational adjustment of follow-up frequency

Study Limitations
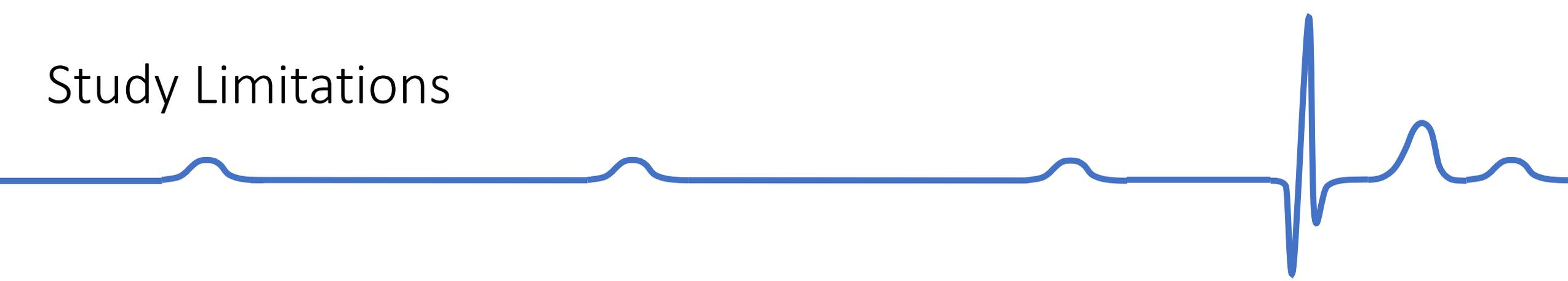
- Patients who underwent PM implantation immediately after presentation did not allow for the evaluation of the natural course of CAVB.

- A sufficient number of patients were followed for a substantial amount of time (349 patient-years)

- Impact of PM technology development not assessed

- Maternal antibody status not known in majority of patients

- Genetic background was not evaluated as a risk factor

Study results in context
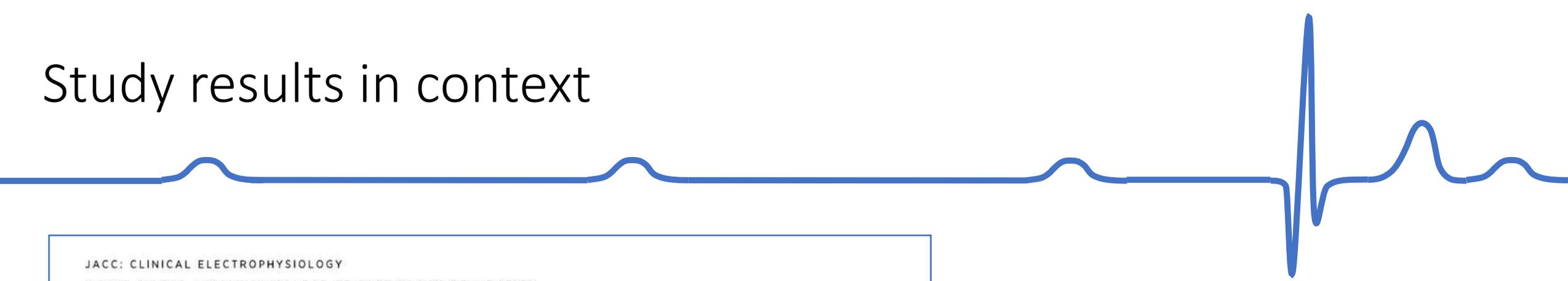
EDITORIAL COMMENT

A Not-So-Natural History of Nonsurgical Complete Atrioventricular Block in Children in the Current Era*

Scott Weinreb, MD, Maully J. Shah, MBBS

From The Children's Hospital of Philadelphia, Department of Pediatrics, Perelman School of Medicine, The University of Pennsylvania, Philadelphia, Pennsylvania, USA.

- Current elective pacemaker implantation criteria for children with non-surgical complete AV block are safe.

- Caretakers/parents should be reassured by normal LV function and physical development despite bradycardia.

- This study cannot answer the question whether current implantation criteria are too strict.

- Prospective studies to answer such question are not possible nowadays.