ABSTRACTS
NVVC Najaarscongres
Donderdag 5 november
09.00 – 10.30 uur

SESSIE 6: Congenital heart and aorta disease & sports

	Zaal: 15	Voorzitters: dr. Bardia Arabkhani, CTC Erasmus MC dr. Athiná Kougioumtzoglou, AIOS Antonius Ziekenhuis
1	09.00 - 09.10	**Arterial Cannulation Strategies in Acute Type A Aortic Dissection Repair: A Systematic Review and Network Meta-Analysis** *Mevrouw Theresia Feline Husen, Maastricht UMC+, Maastricht*
2	09.11 - 09.21	**Understanding Cardiac Rehabilitation in Practice: A Multi-Year Analysis of Patient Characteristics, Cardiovascular Risk, and Treatment Profiles in the Basalt Rehabilitation Center** *Mevrouw Germaine Verwoert, Basalt Rehabilitation, Leiden*
3	09.22 - 09.32	**N-of-1 Trial of Flecainide Monotherapy versus Combination Therapy in Patients with Andersen-Tawil Syndrome** *De heer Auke Bergeman, Amsterdam UMC, Amsterdam*
4	09.33 - 09.43	**Routine Clinical Traits and Thoracic Aortic Disease: A Human Genetic Perspective** *Mevrouw Julia Horjus, Amsterdam UMC, Amsterdam*
5	09.44 - 09.54	**Miniaturized Living Myocardial Slices as a Novel Research Model for Congenital Heart Disease** *De heer Yvar van Steenis, Erasmus MC, Rotterdam*
6	09.55 - 10.05	**Blood pressure control and antihypertensive treatment intensity after elective ascending aortic surgery: a longitudinal cohort study** *De heer Pim van Sambeeck, Radboud UMC, Nijmegen*
7	10.06 - 10.16	**Cardiothoracic anatomy and anterior T-wave inversion in elite athletes: a CMR study on right ventricular lateral displacement** *Mevrouw Anke Kraaijeveld, Amsterdam UMC, Amsterdam*
8	10.17 - 10.27	**Prevalence of septal asymmetry in elite athletes: results from the ELITE cohort** *De heer Bas Adema, Amsterdam UMC, Amsterdam*

Session 6: Congenital heart and aorta disease & sports
Abstract 1

Arterial Cannulation Strategies in Acute Type A Aortic Dissection Repair: A Systematic Review and Network Meta-Analysis

Presenting author: Theresia Feline Husen
Department: Cardiothoracic Surgery

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Alfian Prasetyo: Faculty of Medicine, University Atma Jaya, Jakarta, Indonesia
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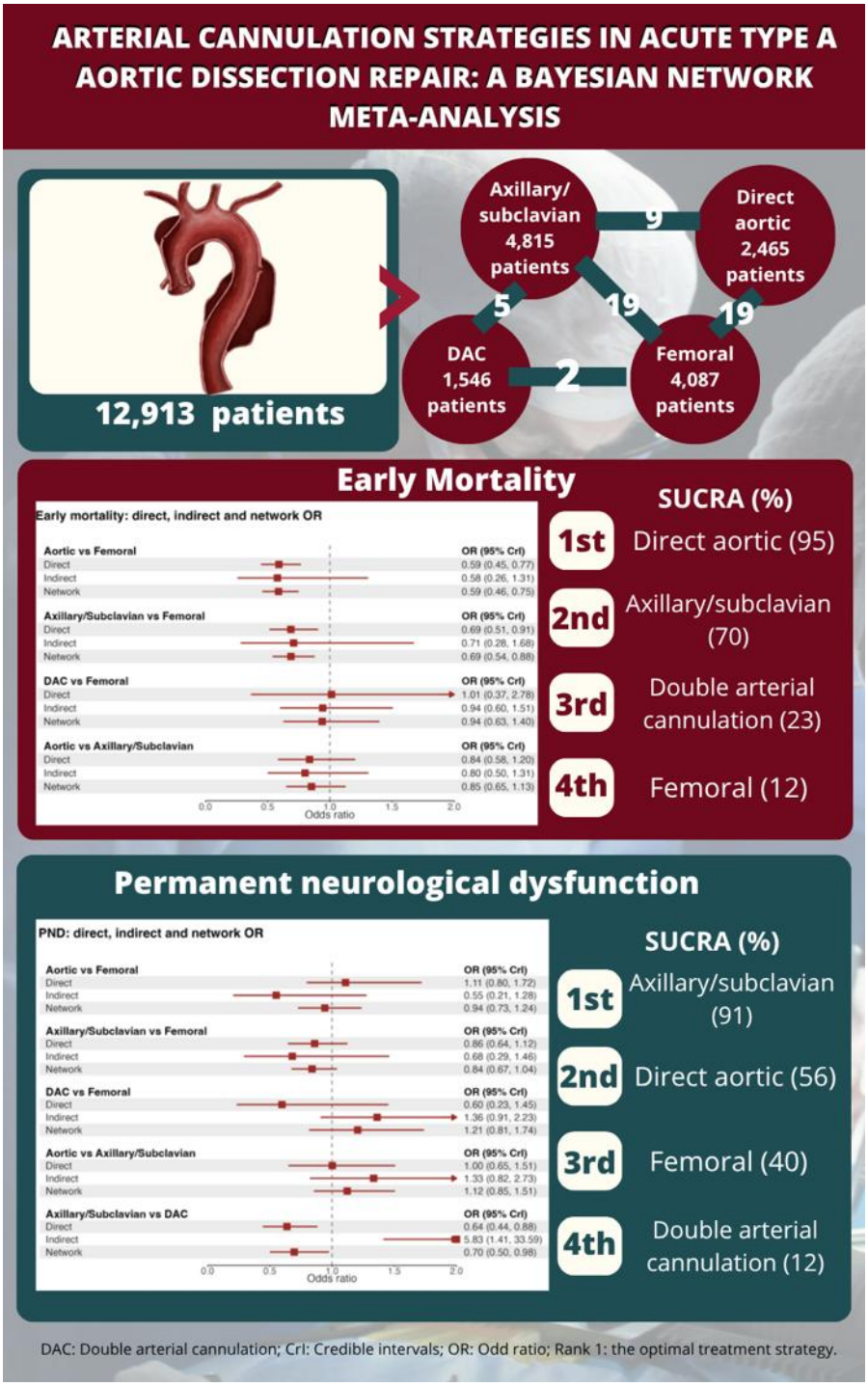
Samuel Heuts: Maastricht University Medical Center, Maastricht

Purpose:
To compare the clinical outcomes of aortic, axillary/subclavian, femoral, and double arterial cannulation (DAC) during surgical repair of acute type A aortic dissection (ATAAD).
Methods:
This study was preregistered in PROSPERO (CRD420261411082). A systematic search was performed across multiple databases, while critical appraisal was assessed using the Newcastle-Ottawa Scale. A Bayesian network meta-analysis (NMA) with a random-effects model was applied using weakly informative priors. The primary outcomes assessed were early mortality, permanent neurological dysfunction (PND: defined as either stroke and/or spinal cord injury), and 5-year survival, while the secondary outcomes included stroke, acute renal failure, operative times, and hospitalization stays. Outcomes are expressed as odds ratios (ORs), mean differences (MDs), or hazard ratios (HRs) with their 95% credible intervals (CrIs), along with surface under the cumulative ranking curve (SUCRA) values.
Results:
Thirty-two retrospective cohort studies comprising 12,913 patients were included. For early mortality, the estimated OR of aortic versus femoral cannulation was 0.58 (95% CrI 0.46–0.74); the OR of axillary/subclavian versus femoral cannulation was 0.68 (95% CrI 0.54–0.87); and the OR of DAC versus femoral cannulation was 0.94 (95% CrI 0.62–1.42). The SUCRAs of an aortic cannulation strategy ranking as the optimal treatment regarding early mortality was 95%. For neurological outcomes, axillary/subclavian cannulation was associated with the lowest rates of PND and stroke, with SUCRAs of 91% and 92%, respectively. The results were robust across various sensitivity analyses.
Conclusion:
Direct aortic cannulation was associated with lower early mortality and the highest probability of being the optimal strategy in 5-year survival, while axillary/subclavian cannulation was associated with improved neurological outcomes. Together, antegrade perfusion strategies are associated with improved outcomes. Future randomized trials are indicated to validate these comparative findings.

Keywords:
Acute type A aortic dissection, Arterial cannulation, Perfusion strategies

Figure:
CrI: credible interval, DAC: double arterial cannulation, PND: permanent neurological dysfunction, SUCRA: surface under the cumulative ranking curve.



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Abstract 2

Understanding Cardiac Rehabilitation in Practice: A Multi-Year Analysis of Patient Characteristics, Cardiovascular Risk, and Treatment Profiles in the Basalt Rehabilitation Center

Presenting author: G. C. Verwoert
Department: Cardiac Rehabilitation

N. Sharma; N. Sharma (Basalt Rehabilitation Center); E. Verburgt (Basalt Rehabilitation Center); B. Scheenstra (Basalt Rehabilitation Center); G. C. Verwoert (Basalt Rehabilitation Center)

Purpose:
Cardiac rehabilitation (CR) is an important component of secondary prevention and long-term cardiovascular care. Understanding the characteristics of patients participating in CR is essential to identify opportunities to further enhance care through personalized and data-driven rehabilitation. In that regard, this work aims to characterize the demographic, cardiovascular risk, diagnostic, intervention, and treatment trajectories of the patients participating in a large real-world CR program.
Methods:
A retrospective analysis of routinely collected rehabilitation data from patients participating in cardiac rehabilitation was conducted. Patients were eligible for inclusion if they were aged ≥18 years and enrolled in the cardiac rehabilitation program between 2022 and 2025 at three locations (Leiden, Den Haag, and Delft) of Basalt Rehabilitation Center in the Netherlands.
Results:
The cohort comprised 5,912 patients with a mean age of 62.2 ± 12.7 years; 67.3% were male and 32.7% female. Most patients were aged ≥50 years (86.3%), and nearly half of the cohort (49.5%) had attained post-secondary education. The most frequently recorded primary diagnoses were myocardial infarction (37.1%), angina pectoris (19.4%), heart valve disease (9.9%), and heart failure (9.8%). PCI/coronary intervention was the most frequently recorded primary intervention (27.8%), followed by medication/conservative management (12.8%), CABG (10.8%), and other cardiac procedures or surgical follow-up (8.0%). Most patients completed their rehabilitation treatment (82.9%), while 9.0% completed treatment without a final consultation and 6.4% discontinued treatment prematurely.
Conclusion:
This large real-world cohort has the potential to highlight differences in patient characteristics, diagnoses, and treatment profiles, providing insights to inform more personalized and data-driven rehabilitation pathways.

Keywords:
Cardiac rehabilitation, Real-world data, Personalized rehabilitation

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Abstract 3

N-of-1 Trial of Flecainide Monotherapy versus Combination Therapy in Patients with Andersen-Tawil Syndrome

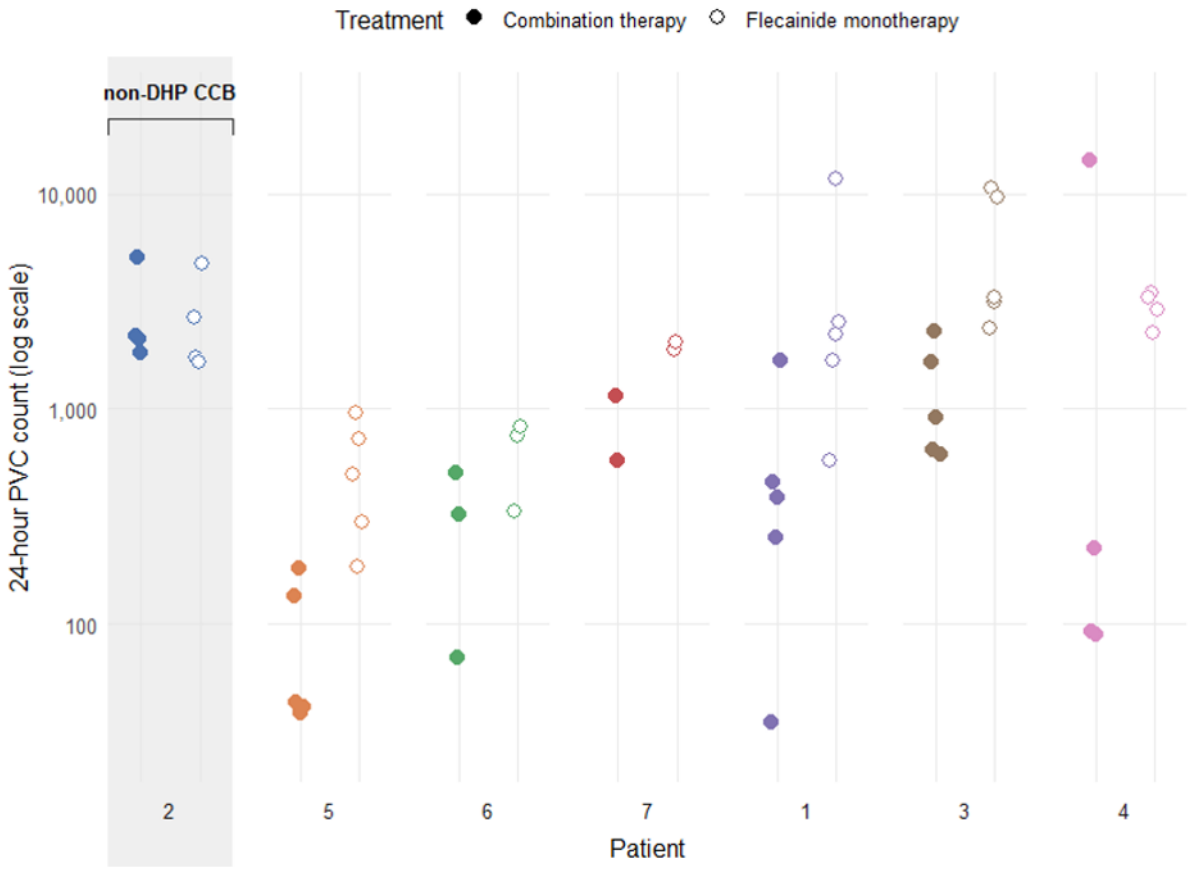
Presenting author: A.T. Bergeman
Department: Cardiology

A.T. Bergeman (Amsterdam UMC, Amsterdam); S.G. Pinto (Amsterdam UMC, Amsterdam);
A.T. Bergeman (Amsterdam UMC, Amsterdam); S.G. Pinto (Amsterdam UMC, Amsterdam); M.W.T. Tanck (Amsterdam UMC, Amsterdam); A.A.M. Wilde (Amsterdam UMC, Amsterdam); C. van der Werf (Amsterdam UMC, Amsterdam)

Purpose:
Andersen-Tawil syndrome (ATS) is an ultra-rare inherited arrhythmia syndrome, characterized by extracardiac features and a substantial burden of ventricular arrhythmias. Current pharmacological management includes beta-blockers (BB), calcium channel blockers (CCB) and/or flecainide. Evidence for these therapies is largely derived from observational studies, as randomized trials are challenging in this ultra-rare condition. We performed the first N-of-1 trial in ATS to evaluate the efficacy of flecainide monotherapy compared with combination therapy consisting of flecainide and BB or CCB.
Methods:
We conducted a series of individual randomized crossover trials in 7 adult patients with ATS. Participants underwent two to five two-week treatment periods, each comprising two one-week treatment sets in which BB or CCB therapy was either continued or randomly omitted. The primary endpoint was premature ventricular complex (PVC) count, assessed through validated continuous noninvasive ECG monitoring.
Results:
We included 7 adult patients with ATS using a median flecainide dose of 2.2 mg/kg/day (IQR 1.9-2.3). Co-medication was a BB in 6 patients and verapamil in 1. Overall, 28 treatment sets were analyzed. Overall, median 24-hour PVC counts were 2188 (IQR, 824-3161) during flecainide monotherapy versus 543 (IQR, 126-1612) during combination therapy (rate ratio, 3.96; 95% CI, 2.31-6.78; $p<0.001$) (Figure). PVC burden remained unchanged in the patient receiving verapamil.
Conclusion:
Flecainide monotherapy was associated with a significantly higher PVC burden than combination therapy, supporting the use of flecainide with BB as the more effective therapy. This study demonstrates the feasibility of N-of-1 trials to generate high-quality evidence in ultra-rare conditions.

Keywords:
Andersen-Tawil syndrome, Inherited arrhythmia syndromes, N-of-1 trial

Figure:
Individual mean 24-hour PVC counts during flecainide monotherapy and combination therapy, by patient.



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Abstract 4

Routine Clinical Traits and Thoracic Aortic Disease: A Human Genetic Perspective

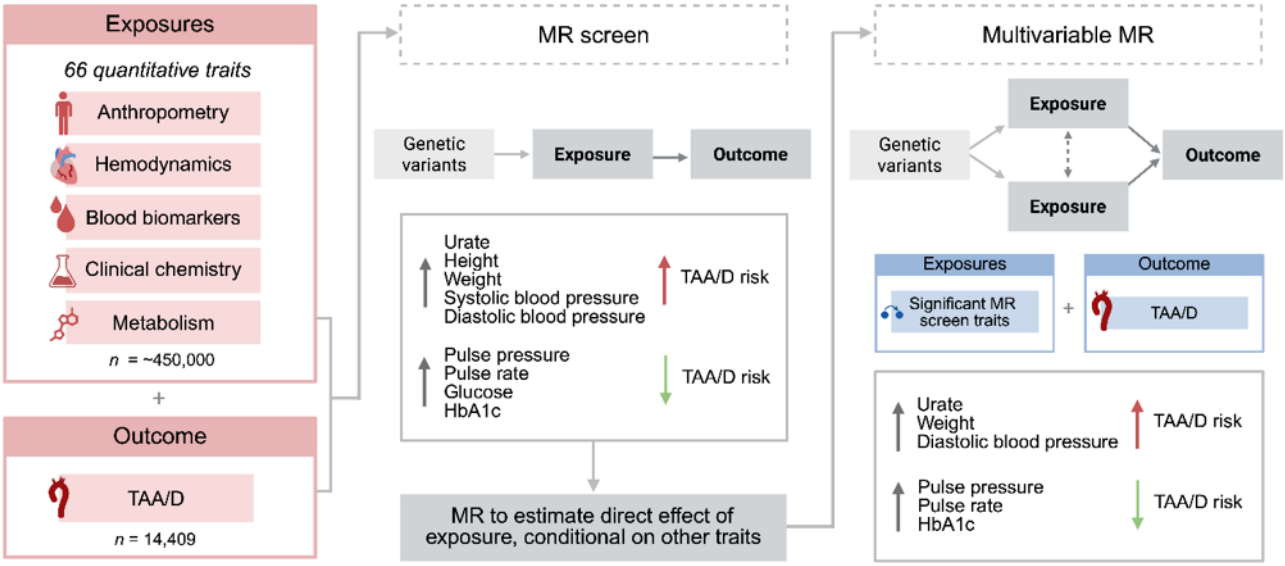
Presenting author: J. Horjus
Department: Cardiothoracic Surgery

J. Horjus (Amsterdam UMC, Amsterdam); J. Horjus (Amsterdam UMC, Amsterdam); S.J. Jurgens (Amsterdam UMC, Amsterdam); C.R. Bezzina (Amsterdam UMC, Amsterdam); N. Grewal (Amsterdam UMC, Amsterdam)

Purpose:
Thoracic aortic aneurysms and dissections (TAA/D) are influenced by multiple clinical and biological factors, yet evidence supporting causal contributions of routinely measured traits remains limited. Human genetic data can help identify factors potentially linked to disease susceptibility. We therefore evaluated 66 anthropometric, hemodynamic, hematologic, metabolic, and clinical chemistry traits for potential causal associations with TAA/D using genetic analyses, aiming to identify factors that may inform future prevention and treatment strategies.
Methods:
We performed two-sample MR using genome-wide association study (GWAS) summary statistics for 66 clinical traits and a large-scale TAA/D meta-analysis. Traits showing evidence of causal association were subsequently evaluated using multivariable MR to assess whether effects persisted after accounting for other traits, and to identify independent contributors.
Results:
Nine traits showed evidence of potential causal effects on TAA/D. Greater height, weight, diastolic blood pressure, systolic blood pressure, and urate levels were linked to higher TAA/D risk, while higher pulse pressure, pulse rate, glucose, and glycated hemoglobin (HbA1c) were linked to lower risk. Systolic blood pressure was excluded from multivariable MR due to collinearity with other blood pressure traits. Independent effects remained for diastolic blood pressure ($\beta=0.126$; $P=3.9\times10^{-111}$), pulse pressure ($\beta=-0.118$; $P=1.5\times10^{-123}$), pulse rate ($\beta=-0.715$; $P=7.5\times10^{-41}$), weight ($\beta=0.411$; $P=6.3\times10^{-11}$), urate ($\beta=0.147$; $P=0.007$), and HbA1c ($\beta=-0.135$; $P=0.002$).
Conclusion:
Human genetic analyses identified several routinely measured clinical traits with potential causal relevance to TAA/D. Weight, hemodynamic traits, pulse rate, urate, and HbA1c showed independent effects, highlighting clinically accessible factors that may contribute to disease risk and inform future mechanistic studies and preventive strategies.

Keywords:
Thoracic aortic disease, Genetics, Clinical risk factors

Figure:
Workflow to identify potential causal effects from 66 commonly measured clinical traits on thoracic aortic disease risk.



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Abstract 5

Miniaturized Living Myocardial Slices as a Novel Research Model for Congenital Heart Disease

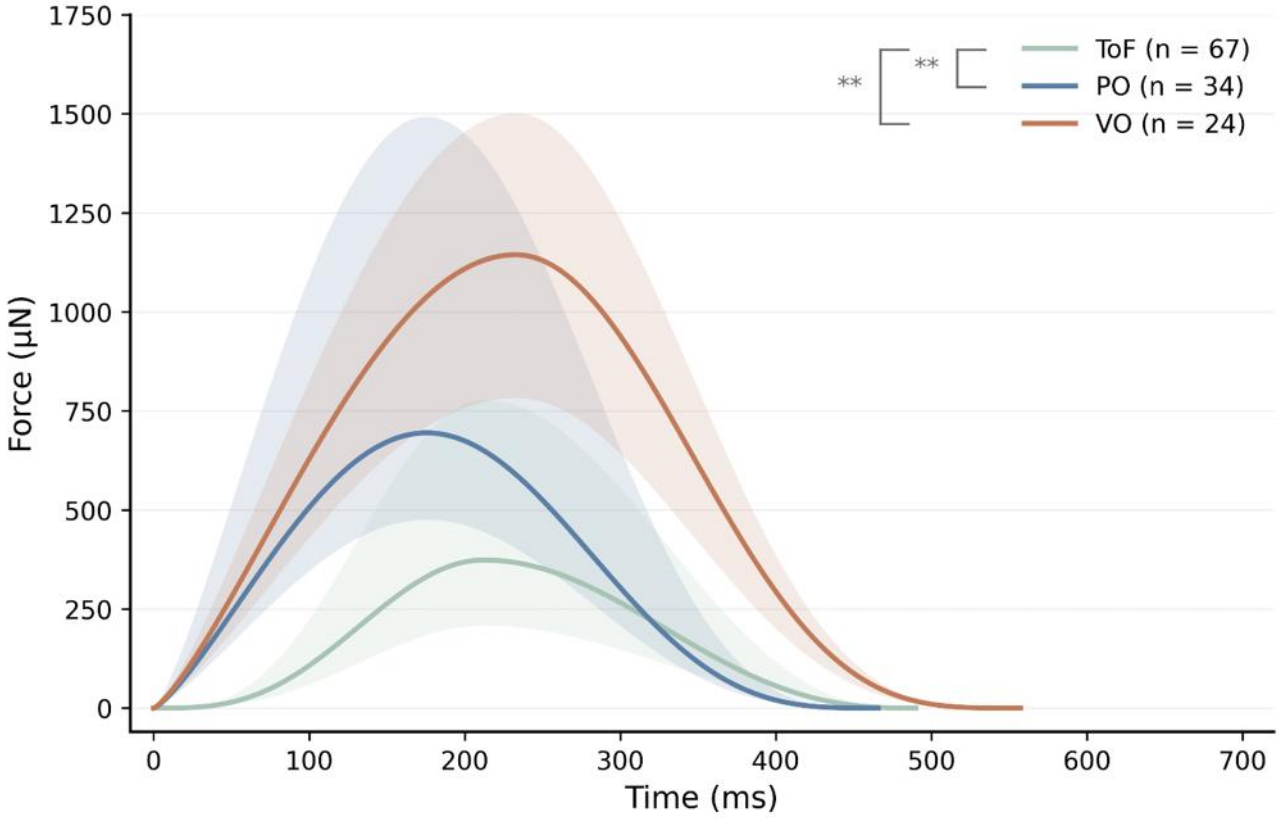
Presenting author: Y.P. van Steenis
Department: Translationele Cardiothoracale Chirurgie

Z. Zhou (Erasmus MC, Rotterdam) & Y.P. van Steenis (Erasmus MC, Rotterdam); Z. Zhou (Erasmus MC, Rotterdam), Y.P. van Steenis (Erasmus MC, Rotterdam), Y.J.H.J. Taverne (Erasmus MC, Rotterdam)

Purpose:
Differences in right ventricular contractility among congenital heart diseases (CHD) are not completely understood. Living myocardial slices (LMS) are an established platform for studying myocardial mechanics ex vivo, but require large tissue specimens rarely available in pediatric CHD surgery. We explored the feasibility of generating miniaturized LMS (mini-LMS) from small CHD surgical specimens and characterized their biomechanical profiles across CHD phenotypes.
Methods:
Right ventricular outflow tract tissue was obtained from 21 CHD patients (Tetralogy of Fallot, ToF, n = 13; volume overload, VO, n = 3; non-Fallot pressure overload, PO, n = 5). Mini-LMS were cultured and assessed for contractile function across culture days 0–3.
Results:
125 functional mini-LMS were generated, and all were contractile from day 0. Maximum twitch force was highest in VO (1144 µN, IQR 783–1502), lowest in ToF (374 µN, IQR 208–777), and intermediate in PO (695 µN, IQR 476–1493) mini-LMS, and twitch force generation was irrespective of age. Contraction duration and time to peak did not differ significantly between groups, but time to relax differed significantly ($p = 0.0463$). During culture, VO mini-LMS showed a progressive Fmax increase exceeding 200% by day 2, while other groups declined.
Conclusion:
Functional mini-LMS can be generated from small CHD surgical specimens and display disease-specific biomechanical profiles. These findings support mini-LMS as a platform for studying congenital myocardial function and provide a foundation for future mechanistic and translational investigations in pediatric CHD.

Keywords:
Congenital heart disease, Living myocardial slices, Myocardial mechanics

Figure:
Contraction curves stratified by CHD subgroup at day 0 (ToF n = 67; PO n = 34; VO n = 24). Curves were modeled using median values of Fmax, TTP, and TTR. Shaded areas indicate the interquartile range (Q1–Q3) of Fmax. Vertical brackets indicate significant pairwise differences in Fmax (Dunn's post-hoc test): ** $p < 0.01$ (ToF vs PO, $p = 0.0067$; ToF vs VO, $p = 0.0017$).


1750
1500
1250
1000
750
500
250
0
Force (µN)
0
100
200
300
400
500
600
700
Time (ms)
**
**
ToF (n = 67)
PO (n = 34)
VO (n = 24)

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Abstract 6

Blood pressure control and antihypertensive treatment intensity after elective ascending aortic surgery: a longitudinal cohort study

Presenting author: P.S. van Sambeeck
Department: Cardiothoracic surgery

P.S. van Sambeeck (RadboudUMC, Nijmegen); A. Ibrahim (RadboudUMC, Nijmegen); S.R. van Dinter (RadboudUMC, Nijmegen); N.A. Hasami (RadboudUMC, Nijmegen); J. Jaspers Focks (Slingeland hospital, Doetinchem); A.H. Sadeghi (RadboudUMC, Nijmegen); N. Saouti (RadboudUMC, Nijmegen); M.W.A. Verkroost (RadboudUMC, Nijmegen); M.A. Brouwer (RadboudUMC, Nijmegen); F.J.H. Nauta (RadboudUMC, Nijmegen); R.H. Heijmen (RadboudUMC, Nijmegen)

Purpose:
To assess blood pressure (BP) after elective ascending aortic surgical repair (AASR) in relation to anti-hypertensive treatment intensity and endorsed aortic guideline goals.
Methods:
Follow-up study of consecutive patients undergoing elective AASR (excluding valvular disease) at the Radboudumc, Nijmegen, The Netherlands (2014-2025). Baseline BP was assessed the day before surgery. The primary outcome parameter was BP obtained at outpatient follow-up, 12-24 months after discharge. Hypertension was defined as ≥130/80mmHg and the defined daily dose (DDD) was calculated according to the WHO-criteria (i.e. 10mg amlodipine = 1 DDD).
Results:
We followed 115 patients (mean age 64 years , 62.6% men) with BP assessed at 491 days (IQR 395-753). In total, at baseline 84/115 (73%) were hypertensive. At follow-up, 89/115 (77%) scored >130/80 mmHg, despite an increase in DDD (2.0±1.8 to 2.7±1.9; p<0.001). Of the preoperatively 31 normotensive patients, 23 scored higher than 130/80 mmHg (74%), while DDD did not change. In 66 of the preoperatively 84 hypertensive patients (79%) a BP >130/80 mmHg was noted, despite an increase in DDD (2.0±1.7 to 3.0±1.9; p=<0.001). Only 18 (21%) of the preoperatively 84 hypertensive patients had a guideline endorsed blood pressure at follow-up (DDD 0.9 (0.2–1.6) to 1.6 (0.9–2.7); p=0.192).
Conclusion:
This study after elective AASR shows that over 70% of pre-operative normotensive patients have hypertension at 1-year follow-up, and that about 80% of pre-operative hypertensive patients remain hypertensive despite a significant increase in DDD. These findings call for improved anti-hypertensive treatment and more mechanistic studies as to underlying pathophysiology.

Keywords:
Hypertension, Ascending aortic surgery,

Figure:
Blood pressure category and antihypertensive treatment intensity before and after elective ascending aortic surgical repair. Depending on the distribution of the data, values are presented as means or as medians (marked with an asterisk); p-values are corrected for multiple testing. HT = hypertensive, NT = normotensive.

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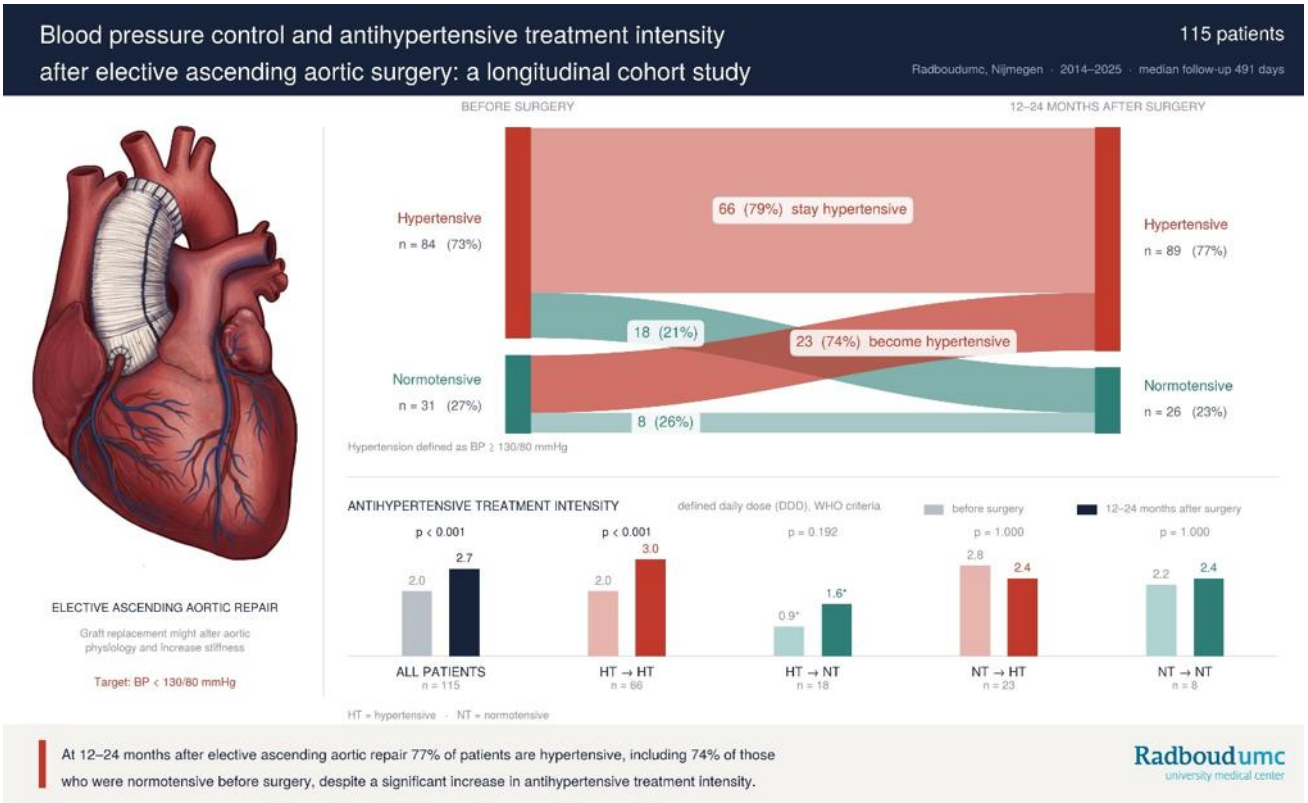

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Abstract 7

Cardiothoracic anatomy and anterior T-wave inversion in elite athletes: a CMR study on right ventricular lateral displacement

Presenting author: A.J. Kraaijeveld
Department: Sportscardiologie

A.J. Kraaijeveld; A.J. Kraaijeveld (AUMC, Amsterdam), M.A. van Diepen (AUMC, Amsterdam), B.J. Adema (AUMC, Amsterdam), H. el Hri (AUMC, Amsterdam), H.T. Jorstad (AUMC, Amsterdam)

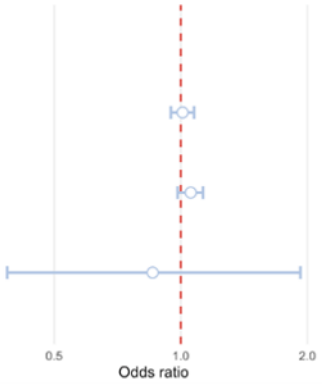
Purpose:
Anterior T-wave inversion (TWI) on the 12-lead ECG is one of the most challenging findings in cardiovascular screening of elite athletes, given the overlap between physiological exercise-induced cardiac remodelling (EICR) and repolarization abnormalities associated with cardiomyopathies such as arrhythmogenic right ventricular cardiomyopathy (ARVC). Lateral displacement of the heart toward the left axilla, resulting from EICR, may contribute to TWI independently of right ventricular (RV) size or pathology. However, it remains unknown whether this cardiothoracic anatomical adjustment is also reflected in continuous measures of repolarization, such as T-wave area.
Methods:
In this cross-sectional analysis within the ELITE cohort study 296 elite athletes, including paralympic athletes, without known cardiac disease (58% male, median age 24 years, mean 25 years), were included with a resting 12-lead ECG and cardiac magnetic resonance imaging (CMR) performed within ≤3 months. RV lateral displacement was quantified using the septal angle on four-chamber CMR images. Anterior TWI beyond V1 was defined as a binary outcome; T-wave area in V2 and V3 as a continuous measure of repolarization. Multivariable (penalized) logistic and linear regression analyses were performed, adjusted for age, sex, and RV end-diastolic volume.
Results:
Anterior TWI beyond V1 was present in 33 athletes (11.1%), with no difference between male and female athletes (8.4% vs 9.8% p = 0.6823). Athletes with TWI had a greater septal angle than athletes without TWI (39.4° vs. 37.7°), although this difference did not reach statistical significance (p = 0.244). In multivariable penalized logistic regression, a greater septal angle was not associated with higher odds of TWI (OR 1.01 [95% CI 0.947–1.076], p = 0.761) and age and sex were not significant predictors. Septal angle showed no discriminative ability for TWI (AUC 0.5399) and was not associated with T-wave area in both V2 (β = -0.104, p = 0.068) and V3 (β = 0.018, p = 0.739), where male sex was the only significant predictor in both leads and age only in V2.
Conclusion:
In our cohort of elite athletes, RV lateral displacement, quantified by the septal angle, was not associated with the presence of anterior T-wave inversion or with the magnitude of repolarization abnormalities. These findings suggest that prior hypotheses regarding the relevance of cardiothoracic positioning for interpreting TWI in sports cardiology screening warrant caution. Larger cohorts with a higher prevalence of TWI are needed to clarify the role of RV lateral displacement and to help differentiate physiological from pathological T-wave inversion associated with cardiomyopathies.

Keywords:
T-wave inversion, Septal angle,

Figure:
Figure 1. Penalized logistic regression (Firth) TWI beyond V1 and multivariable linear regression T-wave area V2 & V3
OR = odds ratio; CI = confidence interval. Filled circles and bold P values indicate statistical significance (P<0.05). Open circles indicate a non-significant predictor. TWI beyond V1 (n=33): > -0.05mV. Penalized logistic regression (Firth's method); RVEDV = Right Ventricle End Diastolic Volume indexed for BSA

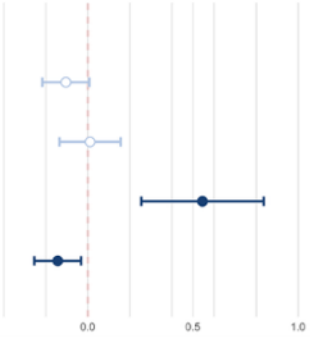
T-wave inversion beyond V1
Firth penalized logistic regression | n = 289 | events = 26

Predictor	OR	95% CI	p
Septal Angle	1.010	0.947 to 1.076	p=0.761
Age	1.056	0.983 to 1.129	p=0.132
Male Sex	0.857	0.387 to 1.924	p=0.703



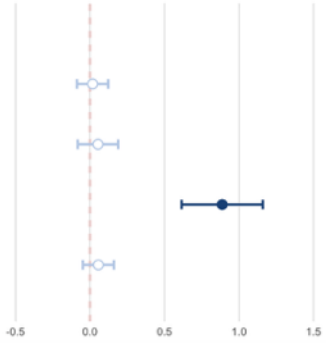
T-wave Area V2
Multivariable linear regression | n = 288 | Adj R^2 = 0.100

Predictor	β (std)	95% CI	p
Septal Angle	-0.104	-0.217 to 0.008	p=0.068
RVEDV	0.011	-0.135 to 0.156	p=0.887
Male Sex	0.545	0.254 to 0.836	**p<0.001**
Age	-0.143	-0.254 to -0.032	**p=0.012**



T-wave Area V3
Multivariable linear regression | n = 288 | Adj R^2 = 0.215

Predictor	β (std)	95% CI	p
Septal Angle	0.018	-0.087 to 0.123	p=0.739
RVEDV	0.053	-0.082 to 0.189	p=0.440
Male Sex	0.887	0.615 to 1.159	**p<0.001**
Age	0.056	-0.048 to 0.160	p=0.290



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Abstract 8

Prevalence of septal asymmetry in elite athletes: results from the ELITE cohort

Presenting author: B.J. Adema
Department: Sports Cardiology

B.J. Adema (Amsterdam UMC, Amsterdam); B.J. Adema (Amsterdam UMC, Amsterdam)
M.A. van Diepen (Amsterdam UMC, Amsterdam)
H. el Hri (Amsterdam UMC, Amsterdam)
A.J. Kraaijeveld (Amsterdam UMC, Amsterdam)
N.R. Bijsterveld (Amsterdam UMC, Amsterdam)
H.T. Jorstad (Amsterdam UMC, Amsterdam)

Purpose:
Differentiating exercise-induced cardiac remodelling (EICR) from hypertrophic cardiomyopathy is challenging when left ventricular wall thickness (LVWT) approaches the upper physiological limit. Septal asymmetry may help distinguish physiology from pathology, but this has not been investigated in extreme phenotypes of young, elite athletes. We therefore investigated the prevalence and determinants of septal asymmetry in elite athletes
Methods:
Cross-sectional cardiac magnetic resonance imaging study in healthy ELITE cohort athletes (≥16 years, ≥10 training hours, national/international/Olympic level). LVWT was defined as maximal wall thickness and quantified at end-diastole using a validated AI pipeline. Septal-to-lateral wall thickness ratio (SLR) was calculated by dividing septal- by lateral basal/midventricular segments. Asymmetry was defined as SLR of ≥1.3; borderline and definite hypertrophy were defined as LVWT 13-15 mm and ≥15 mm, respectively. Associations with SLR were investigated using multivariable linear regression.
Results:
In 481 athletes (24 [20-28] years old; 41.5% women; 43.5% mixed-sport), mean maximum septal and lateral LVWT were 9.78 ± 1.53 mm and 8.93 ± 1.29mm, respectively. Asymmetry occurred in 32 (6.7%) athletes: 24 without hypertrophy, 7 with borderline hypertrophy, and 1 with hypertrophy. Endurance athletes had slightly higher SLR than non-endurance athletes (1.11 ± 0.13 vs 1.07 ± 0.13, p=0.036); mixed athletes did not differ from either group. Older age (p<.001) and larger BSA (p=0.044) were associated with a higher SLR; sex and weekly training hours (p>0.05) were not
Conclusion:
Asymmetrical septal hypertrophy was rare, suggesting not a typical feature of EICR. Septal-to-lateral ratio was associated with age and BSA, with only modest sport-specific variation.

Keywords:
Athlete's heart, Asymmetrical septal hypertrophy,
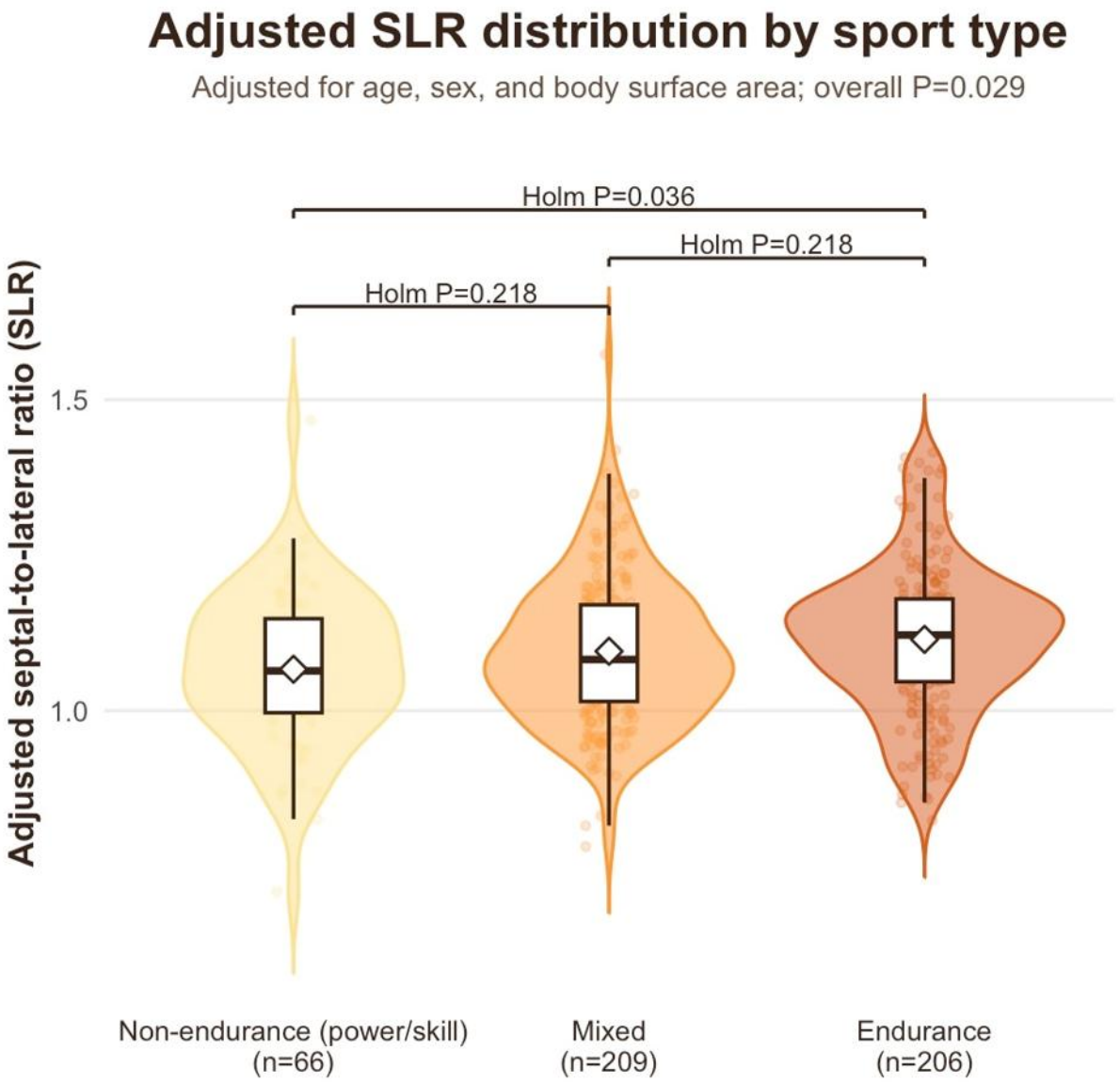
Figure:
Adjusted Septal-to-lateral wall thcikness ratio distribution by sport type. Individual values and group distributions are adjusted for age, sex, and body surface area. Boxes show medians and interquartile ranges; diamonds indicate adjusted means.