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Deep learning-based differentiation of paroxysmal and persistent atrial fibrillation

J.-M. Grégoire[1,*], C. Gilon[2], F. Marelli[3], S. Ehlalouch[2], H. Bersini[2], S. Carlier[4]
[1] *Cardiologie, IRIDIA, Ixelles, Belgium*
[2] *IRIDIA, Université Libre de Bruxelles, Bruxelles, Belgium*
[3] *ISIA, UMONS, Mons, Belgium*
[4] *Département de cardiologie, UMONS – campus Plaine de Nimy, Mons, Belgium*
[*] *Corresponding author.*
E-mail address: jmgregoire3@skynet.be (J.-M. Grégoire)

Introduction Atrial fibrillation (AF) is typically classified into paroxysmal (PAF) and persistent (PeAF) forms. Accurately identifying the AF subtype is crucial for optimizing patient management. However, distinguishing between these subtypes using short ECG recordings remains a clinical challenge.
Objective This study aims to develop and evaluate deep learning (DL) models capable of differentiating PAF from PeAF using short-duration ECG segments.
Method We leveraged the IRIDIA-AF database, a curated collection of 988 Holter recordings, comprising annotated segments labeled as PAF. An equivalent number of ECG segments in AF were randomly extracted from 200 Holter recordings of patients with PeAF. Several ML architectures were trained and validated on these datasets. The models' performance was assessed using standard classification metrics.
Results The best-performing model achieved an AUROC of 0.84 on the external test set (Table 1). Attention map analysis suggested that the network captured both temporal and morphological components of the ECG waveform, potentially identifying subtle features beyond classical rhythm irregularities. In parallel, machine learning-based models indicated that most of the discriminative signal resided in RR interval dynamics, even in the absence of sinus rhythm, highlighting the informative value of ventricular response patterns in AF.
Conclusion Our findings demonstrate the feasibility of using DL models to distinguish paroxysmal from persistent AF based on short ECG recordings. Trained on the IRIDIA-AF dataset, the proposed model shows promise for enhancing clinical decision-making in AF management.

Table 1

Model	Input	Window size	AUROC	Accuracy	Sensitivity	Specificity	F1-score
ViT	Raw ECG	4096	0.79	0.69	0.74	0.66	0.7
CNN	Raw ECG	4096	0.84	0.73	0.82	0.65	0.73
XGBoost	RR	300 RR	0.72	0.71	0.73	0.7	0.72
Random forest	RR	300 RR	0.72	0.72	0.76	0.67	0.73

ViT: vision transformer; CNN: convolutional neural network; RR: RRintervals; AUROC: area under the receiver operating characteristic curve.

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The value of functional echocardiography in preterm infants

H. Mahfoudhi[1], M. Ayari[1], E. Ben Brahim[2,*], C. Chourabi[1], S. Hannachi[3], S. Chenik[1], W. Fehri[1]
[1] *Cardiologie, hôpital militaire principal d'instruction de Tunis, Tunis, Tunisia*
[2] *Cardiologie, hôpital militaire de Tunis, Tunis, Tunisia*
[3] *Neonatology, hôpital militaire principal d'instruction de Tunis, Tunis, Tunisia*
[*] *Corresponding author.*
E-mail address: emna.benbrahim@etudiant-fmt.utm.tn (E. Ben Brahim)

Introduction Neonatal echocardiography has emerged as an essential additional tool for clinical examination in neonatal intensive care units (NICU) over the last decades.
However, most studies have predominantly focused on full-term infants, often paying little attention to premature neonates whose cardiovascular systems present greater complexity and unique challenges.
Objective This study aims to identify the role of echocardiography in the management of preterm infants (PI) in a level III neonatal department.
Method This is a prospective descriptive study of 60 premature infants hospitalized in the neonatology department of the Military Hospital of Tunis over a 12-month period. Echocardiography was indicated by the neonatologist in charge and performed by the referral pediatric cardiologist. Management was then guided by echographic findings and follow-up was scheduled according to the clinical evolution.
Results Of the 60 echocardiograms, 46 showed normal cardiac structure, 30 of which also had normal function. Structural abnormalities were identified in 14 cases, 8 of which were associated with functional abnormalities: atrial septal defect in 7 cases, hypertrophic cardiomyopathy in 5 cases, and ventricular septal defect in 2 cases. Additionally, 24 functional abnormalities were noted, including 13 cases of pulmonary arterial hypertension (PAH), 6 cases of echographically collapsed inferior vena cava, 3 cases of hemodynamically significant patent ductus arteriosus (hsPDA), and 2 cases of left ventricular systolic dysfunction. Therapeutic adjustments were made in 23% of cases: rehydration in 6 cases, inhaled nitric oxide in 4 cases, acetaminophen for hsPDA in 3 cases, and furosemide in 1 case of PAH due to a left-to-right cardiac shunt. A favorable outcome was observed in 83% of cases with functional abnormalities, and 8 patients with structural abnormalities were referred to pediatric cardiology. The overall neonatal mortality rate was 20%.
Conclusion Through this study, it was demonstrated that echocardiography provides important information for the optimal management of sick newborns. Therefore, the training of neonatologists and the establishment of standardized protocols in functional echocardiography are necessary for the future of neonatal resuscitation in Tunisia.
Disclosure of interest The authors declare that they have no competing interest.

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