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CLINICAL RESEARCH

Echocardiographic assessment of right ventricular systolic function in a population of unselected patients before cardiac surgery: A multiparametric approach is necessary

Évaluation échographique de la fonction systolique ventriculaire droite dans une population de patients non sélectionnés avant chirurgie cardiaque : une approche multiparamétrique est nécessaire

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KEYWORDS
Right ventricular function;

Summary
Background. — According to recent USA guidelines, right ventricular (RV) dysfunction can be diagnosed on the basis of a single parameter, such as tricuspid lateral annular systolic velocity (S') < 10 cm/s or RV fractional area change (RVFAC) < 35%.

Abbreviations: ASE, American Society of Echocardiography; AT, Acceleration time; AUC, Area under the curve; IVA, Isovolumic acceleration; IVC, Inferior vena cava; IVRT, Isovolumic relaxation time; IVV, Peak isovolumic velocity; MRI, Magnetic resonance imaging; PVR, Pulmonary vascular resistance; RA, Right atrial; RMPI, Right myocardial performance index; RV, Right ventricle/ventricular; RVEF, Right ventricular ejection fraction; RVFAC, Right ventricular fractional area change; RVOT, Right ventricular outflow tract; S', Doppler-derived tricuspid lateral annular systolic velocity; SPAP, Systolic pulmonary artery pressure; TAPSE, Tricuspid annular plane systolic excursion; TDI, Tissue Doppler imaging; TR, Tricuspid regurgitation; TVI, Time velocity integral.

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Right ventricle fractional area change;
2D strain;
Isovolumic acceleration;
Right myocardial performance index

Aims. — To assess these recommendations in a large unselected cohort of patients awaiting cardiac surgery and evaluate less validated RV function criteria.
Methods. — Among the consecutive patients, 413 were prospectively enrolled and underwent comprehensive echocardiography, including S', RVFAC and other RV parameters (right myocardial performance index; acceleration time, isovolumic velocity and isovolumic acceleration [IVA]; RV dP/dt; isovolumic relaxation time; two-dimensional [2D] strain). We defined subgroups of highly probable RV dysfunction (S' < 10 cm/s and RVFAC < 35%) and highly probable normal RV function (S' ≥ 10 cm/s and RVFAC ≥ 35%) as reference groups. Indices of preload and afterload were also recorded.
Results. — Of 413 patients, 320 (77.5%) had normal RV function. In 93 patients, S' and/or RVFAC were abnormal; both were abnormal in 39 (42%) patients. Using our reference groups, IVA ≤ 1.8 m/s^2 and basal 2D strain ≥ −17% were of most value in diagnosing RV dysfunction. IVA was least load dependent while basal 2D strain appeared to be afterload and preload dependent.
Conclusion. — In this large population, S' and RVFAC were sometimes discrepant, supporting the need for a multiparametric approach when evaluating RV function. Among seven less validated criteria, IVA and 2D strain had the best diagnostic value. Unlike 2D strain, IVA was not influenced by loading conditions.

MOTS CLÉS
Fonction ventriculaire droite ;
Fraction de raccourcissement de surface du ventricule droit ;
2D strain ;
Accélération de la contraction isovolumique ;
Indice de Tei

Résumé
Contexte. — Les récentes recommandations américaines proposent de diagnostiquer la dysfonction ventriculaire droite (VD) sur au moins un critère validé tel que le pic de vitesse systolique annulaire tricuspide (S') < 10 cm/s ou la fraction de raccourcissement de surface VD (FRSVD) < 35 %.
Objectifs. — Le but de notre étude a été d'évaluer ces recommandations sur une large population de patients non sélectionnés en attente de chirurgie cardiaque, et d'évaluer d'autres indices de fonction VD moins validés.
Méthodes. — Parmi les patients, 413 ont bénéficié d'un examen échocardiographique complet incluant S', FRSVD et d'autres paramètres VD non routiniers : indice de Tei, dP/dt ; temps de relaxation isovolumique ; temps d'accélération, vitesse de la contraction isovolumique et accélération de la contraction isovolumique (IVA) ; 2D strain. Nous avons défini un sous-groupe de patients ayant une forte probabilité de fonction VD normale (S' ≥ 10 cm/s et FRSVD ≥ 35 %) et un sous-groupe ayant une forte probabilité de dysfonction VD (S' < 10 cm/s et FRSVD < 35 %) comme nos groupes de référence. Les indices de pré- et post-charge ont également été recueillis.
Résultats. — Parmi les 413 patients, 320 (77,5 %) patients ont une fonction VD très probablement normale (S' et FRSVD normaux). Chez 93 patients, S' et/ou FRSVD sont anormaux mais seuls 39 (42 %) patients ont les 2 critères simultanément pathologiques. En utilisant nos groupes de référence, l'IVA ≤ 1,8 m/s^2 et le 2D strain basal ≥ −17 % ont la meilleure valeur diagnostique pour détecter une dysfonction VD. De plus, l'IVA est indépendante des conditions de charge alors que le 2D strain est pré- et post-charge dépendant.
Conclusion. — Dans cette large population, S' et FRSVD sont parfois discordants soulignant la nécessité d'une approche multiparamétrique pour évaluer la fonction VD. Parmi 7 nouveaux paramètres, l'IVA et le 2D strain basal ont la meilleure valeur diagnostique. Contrairement au 2D strain, l'IVA reste indépendante des conditions de charge.

Background

Right ventricular (RV) systolic dysfunction has long been recognized as being of prognostic value in various pathological conditions. However, the definition of RV dysfunction using echocardiography has evolved significantly in recent years. In the past, RV function was assessed visually, until studies focusing on tricuspid annular displacement demonstrated convincing results [1,2]. Since then, numerous echocardiography-Doppler criteria have been proposed and clinical guidelines were published recently by the American Society of Echocardiography (ASE) [3]. The guidelines recommend performing and reporting at least one of the following: RV fractional area change (RVFAC); Doppler-derived tricuspid lateral annular systolic velocity (S'); tricuspid annular plane systolic excursion (TAPSE); and right myocardial performance index (RMPI). Among these criteria, abnormal RV function should be suspected when S' is < 10 cm/s, TAPSE is < 16 mm, RVFAC is < 35% or RMPI (tissue Doppler) is > 0.55. As proposed by the ASE guidelines,