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CLINICAL RESEARCH

Pretest probability of a normal echocardiography: Validation of a simple and practical algorithm for routine use

Évaluation de la probabilité pré-test de normalité d'une échocardiographie : validation d'un algorithme simple facilement utilisable en routine clinique

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Summary
Background. — Management of increased referrals for transthoracic echocardiography (TTE) examinations is a challenge. Patients with normal TTE examinations take less time to explore than those with heart abnormalities. A reliable method for assessing pretest probability of a normal TTE may optimize management of requests.
Aim. — To establish and validate, based on requests for examinations, a simple algorithm for defining pretest probability of a normal TTE.
Methods. — In a retrospective phase, factors associated with normality were investigated and an algorithm was designed. In a prospective phase, patients were classified in accordance with the algorithm as being at high or low probability of having a normal TTE.

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Results. — In the retrospective phase, 42% of 618 examinations were normal. In multivariable analysis, age and absence of cardiac history were associated to normality. Low pretest probability of normal TTE was defined by known cardiac history or, in case of doubt about cardiac history, by age > 70 years. In the prospective phase, the prevalences of normality were 72% and 25% in high ($n = 167$) and low ($n = 241$) pretest probability of normality groups, respectively. The mean duration of normal examinations was significantly shorter than abnormal examinations (13.8 ± 9.2 min vs 17.6 ± 11.1 min; $P = 0.0003$).
Conclusion. — A simple algorithm can classify patients referred for TTE as being at high or low pretest probability of having a normal examination. This algorithm might help to optimize management of requests in routine practice.

MOTS CLÉS
ETT ;
Echocardiographie trans-thoraciques ;
Algorithme ;
Pré-test ;
Probabilité

Résumé
Contexte. — La gestion de la demande croissante d'échocardiographies trans-thoraciques (ETT) est une problématique majeure des laboratoires spécialisés. Comparé à un examen complexe, le temps d'exploration d'un cœur normal est plus court.
Objectif. — À partir des demandes d'explorations, élaborer et valider un algorithme simple d'évaluation de la probabilité pré-test de normalité d'une ETT.
Méthodes. — À partir de l'analyse rétrospective des comptes rendus d'ETT un algorithme, basé sur les éléments associés à un examen normal, a été proposé. Dans un second temps, les demandes d'explorations ont été évaluées et classées prospectivement selon l'algorithme comme étant à forte ou à faible probabilité de normalité.
Résultats. — Dans la première phase ($n = 618$), le taux d'examens normaux était de 42 %, les facteurs associés en analyse multivariée à la normalité étaient : l'âge et l'absence de cardiopathie connue. La faible probabilité pré-test d'ETT normale a été définie par l'existence d'une cardiopathie connue ou en cas de doute sur une cardiopathie préexistante par un âge > 70 ans. Toutes les autres demandes étaient considérées à forte probabilité de normalité. La phase prospective a confirmé la validité de l'algorithme, il y avait 72 % d'ETT normales dans le groupe à forte probabilité ($n = 167$) et 25 % d'ETT normales dans celui à faible probabilité ($n = 241$). La durée d'un examen normal était plus courte qu'un examen anormal ($13,8 \pm 9,2$ contre $17,6 \pm 11,1$ minutes ; $p = 0,0003$).
Conclusion. — Un algorithme simple permet de classer les patients adressés pour ETT comme étant à forte ou à faible probabilité d'examen normal. Cet outil pourrait aider à l'optimisation du tri des demandes en routine clinique.

Introduction

The clinical value of transthoracic echocardiography (TTE) has been widely proven and there are currently a high number of indications for this technique [1,2]. Over the past two decades, there has been a sustained increase in the diagnostic use of TTE [3,4]. Good management of the large number of TTE requests daily is an important issue for echocardiography laboratories. The echocardiography laboratories are often overloaded, with negative consequences for the patients and their caregivers: lengthening of the period of appointment, long waiting time on the day of the examination, stress and risk of delaying an urgent review. Given this workload, and in order to optimize laboratory workflow, some teams have reported changes in their practice [5].

To the best of our knowledge, no specific work has been done to rationalize and pre-sort the examination requests. Discriminating between a long and complex examination requiring an expert operator (e.g. for the evaluation of valvular disease) and a routine, relatively more simple and potentially faster examination feasible by a less experienced operator (e.g. evaluation of left ventricular ejection fraction [LVEF]) before a cardiotoxic chemotherapeutic agent) may help to improve the efficiency of the laboratory.

The objective of this work was to develop and validate a simple and reproducible algorithm to assess the pretest probability of a normal TTE by analyzing the request data.

Methods

The study was conducted at the echocardiography laboratory of the ''Groupe Hospitalier Pitié-Salpêtrière'', which is a tertiary centre of expertise. Approximately 11,000 tests/year are performed by expert physicians. All examinations are stored on a dedicated server (Image Arena™ Version 4.6, TomTec Imaging Systems, Munich, Germany).

The study only involved TTE and was divided in two periods: a retrospective period for the design of the algorithm and a prospective period for algorithm validation. The study was approved by the institutional committee on human research.