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BRIEF COMMUNICATION

Assessment of asthma control using CARAT in patients with and without Allergic Rhinitis: A pilot study in primary care

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Abstract
Background: Asthma and Allergic Rhinitis (AR) are two chronic inflammatory diseases that are often concomitant. The Control of Allergic Rhinitis and Asthma Test (CARAT) was developed to evaluate the control of these diseases from the patients' perspective. Its performance in asthma patients without AR has not been previously studied.
Aim: To test the hypothesis that CARAT can be used to assess asthma control in patients with asthma and without AR.
Methods: A cross-sectional study was conducted in 3 primary healthcare centres in Northern Portugal. Adult patients identified in the Electronic Patient Record with a diagnosis of asthma were invited to participate. CARAT was used to assess asthma control and Asthma Control Test (ACT) as a comparator. The associations between asthma patients without AR (AsAR) and with AR (AwAR) were analyzed with Spearman correlation. Additionally, Receiver Operating Characteristic (ROC) curve analysis, summarized by Area Under the Curve (AUC), was used to assess performance of CARAT for screening asthma that was not well-controlled.
Results: A total of 103 asthma patients completed the study, 64 (62%) had AwAR and in 87 (85%) asthma was not well-controlled. We observed a strong correlation between CARAT and ACT scores ($r = 0.734$) in all asthma patients and in both groups: AsAR ($r = 0.737$)

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and AwAR ($r = 0.843$). ROC curve demonstrated CARAT as having a good discriminative power for both AsAR and AwAR groups (AUC = 0.894 and 0.946, respectively).
Conclusion: These initial results suggest that CARAT has a good discriminative performance, similar to other asthma control assessment tools, for asthma patients with and without AR.

Introduction

The ''Allergic Rhinitis and its Impact on Asthma'' (ARIA) highlights a close relationship between asthma and Allergic Rhinitis (AR) and recommends a combined approach to evaluate and manage these two conditions.[1]

The Control of Allergic Rhinitis and Asthma Test (CARAT) was the first questionnaire to assess the level of control of both asthma and AR using a single tool.[2,3] CARAT was developed using a thorough formal methodological approach and the validation studies showed it has the good measurement properties observed fulfilling the ten items on the COnsensus-based Standards for the selection of health Measurement Instruments (COSMIN).[3] It is a Patient-Reported Outcome that quantifies the degree to which therapy goals are met in patients with a previous diagnosis of AR and asthma and can be used at all levels of care.[4–6]As CARAT's properties have been tested in patients with both asthma and rhinitis, the aim of this study was to test the hypothesis that CARAT can be used to assess asthma control in patients with asthma and without AR.

Methods

A cross-sectional study was conducted in Caldas das Taipas, a sub-urban area of Northern Portugal. All adult patients cared for in one of the three primary care centres (PCC), between November and December 2010, with an asthma diagnosis registered on the Electronic Patient Record (EPR), were eligible for the study. The exclusion criteria were: misdiagnosis/coding error confirmed by both the patient and the family doctor; physical or cognitive disabilities that prevented the completion of the questionnaire; patients that could not attend an appointment. A letter was sent to all eligible patients, explaining the aim of the project and inviting them to participate.

The Ethics Committee of the Regional Health Administration approved the study. Written informed consent was obtained from each participant.

Participants were classified has having AR based on the presence of two or more of five symptoms, as recommended by ARIA guidelines.[1]

CARAT has 10 questions and a rating scale from 0 to 30, with a cut-off value of 24 points to classify patients: not well-controlled ($\leq$24) and controlled asthma (>24).[4] The Asthma Control Test (ACT)[7] was used as a comparator for asthma control using a cut-off of >19, well controlled, and $\leq$19, not well-controlled. For assessing AR symptoms, the Visual Analog Scale (VAS) was used, ranging from 0 cm (good) to 10 cm (bad), with a cut-off of 5.5 cm for mild *versus* moderate/severe rhinitis.

Statistical analysis was performed using IBM SPSS v21 (Armonk, NY;IBM Corp.). The associations between CARAT with ACT scores in asthma patients without AR (AsAR) and with AR (AwAR) were analyzed by Spearman correlation. Receiver Operating Characteristic (ROC) curve analysis was used to assess the performance of CARAT score against ACT, summarized using the Area Under the Curve (AUC). A significance level of $\alpha < 0.05$ was considered. A power analysis for 2 independent proportions was conducted *post hoc*.

Results

Of the 192 patients identified 103 participated – 29 could not be contacted, 5 refused to participate, 20 missed >1 appointments, 7 were misdiagnosed and 28 (15%) were unable to complete the questionnaire. The participation rate of eligible patients was 72%.

From the 103 patients included, 64 (62%) had AwAR (Table 1). Eighty-seven participants (85%) were classified as having not well-controlled asthma based on the CARAT score and 56 (54%) by the ACT score. In the group of AwAR a higher proportion were classified as having not well-controlled asthma both by CARAT and ACT, 97% and 61%, respectively, which compares with 64% and 44% in AsAR group (Table 1).

There was a strong and significant correlation between ACT and CARAT scores in all asthma patients ($r = 0.734$) and in both AsAR and AwAR groups ($r = 0.737$ and $r = 0.843$, respectively) (Fig. 1).

The performance of CARAT for detecting not well-controlled asthma, using ACT as comparator was plotted as ROC curves and the respective AUC were 0.885 for all asthma patients, 0.894 for AsAR group and 0.946 for AwAR (Fig. 1).

Discussion

This study was the first to test CARAT for evaluating asthma control in patients without AR. Overall our results suggest that CARAT performed well in assessing the level of asthma control regardless of whether patients had rhinitis or not. The correlations between CARAT and ACT were higher than 0.73 and the AUC higher than 0.88. These were slightly lower than those between Asthma Control Questionnaire (ACQ) and ACT ($r = -0.87$ to -0.89; AUCs = 0.85–0.90) and