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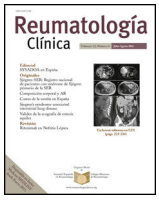

Special Article

Development of an application for mobile phones (App) based on the collaboration between the Spanish Society of Rheumatology and Spanish Society of Family Medicine for the referral of systemic autoimmune diseases from primary care to rheumatology☆

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ABSTRACT

Management of systemic autoimmune diseases is challenging for physicians in their clinical practice. Although not common, they affect thousands of patients in Spain. The family doctor faces patients with symptoms and non-specific cutaneous, mucous, joint, vascular signs or abnormal laboratory findings at the start of the disease process and has to determine when to refer patients to the specialist. To aid in disease detection and better referral, the Spanish Society of Rheumatology and the Spanish Society of

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Family Medicine has created a group of experts who selected 26 symptoms, key signs and abnormal laboratory findings which were organized by organ and apparatus. Family doctors and rheumatologists with an interest in autoimmune systemic diseases were selected and formed mixed groups of two that then elaborated algorithms for diagnostic guidelines and referral. The algorithms were then reviewed, homogenized and adapted to the algorithm format and application for cell phone (apps) download. The result is the current referral document of systemic autoimmune diseases for the family doctor in paper format and app (download). It contains easy-to-use algorithms using data from anamnesis, physical examination and laboratory results usually available to primary care, that help diagnose and refer patients to rheumatology or other specialties if needed.

Desarrollo de una aplicación para teléfonos móviles (app) basada en la colaboración Sociedad Española de Reumatología/Sociedad Española de Medicina de Familia y Comunitaria para derivación de enfermedades autoinmunes sistémicas

Palabras clave:
Anticuerpos antinucleares
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Lupus eritematoso sistémico
Proteínas de fase aguda
Signos y síntomas

R E S U M E N

El diagnóstico y tratamiento de las enfermedades autoinmunes sistémicas (EAS) constituye un reto. Aunque infrecuentes, afectan a cientos de miles de pacientes en España. El médico de familia (MF) se enfrenta a síntomas o signos inespecíficos que hacen sospechar EAS al inicio del proceso, y tiene que decidir a quiénes debería derivar. Para facilitar su reconocimiento y mejorar su derivación, expertos de la Sociedad Española de Medicina de Familia y Comunitaria y de la Sociedad Española de Reumatología seleccionaron 26 síntomas/signos-guía y alteraciones analíticas. Se escogieron parejas de MF y reumatólogo para elaborar algoritmos diagnósticos y de derivación. Posteriormente se revisaron y adaptaron al formato de aplicación para móviles (app) descargable. El resultado es el presente documento de derivación de EAS para MF en formato de papel y app. Contiene algoritmos de fácil manejo utilizando datos de la anamnesis, exploración física y pruebas analíticas accesibles en atención primaria para orientar el diagnóstico y facilitar la derivación a reumatología o a otras especialidades.

Introduction

The diagnosis and treatment of systemic autoimmune diseases (SAD) is a challenge facing any physician in their clinical practice. The combination of non-specificity of its initial signs, the overlapping of symptoms, its complex multi-systemic involvement and its low frequency all impede identification. Approach requires specific training, experience and constant updating of knowledge. If not, the patient is subjected to a barrage of different hospital and emergency services until they happen upon its diagnosis, with the subsequent delay in benefitting from treatment. These diseases are complicated for specialists in rheumatology let alone for specialists in family and community medicine where they present a massive challenge.[1]

Although each of these diseases alone is considered uncommon, when assessed together they are not exceptional and some of them, such as systemic erythematosus lupus, primary Sjögren's syndrome and rheumatic polymyalgia present incidence rates which position them as far from being classed as "rare diseases". SADs affect hundreds of thousands of patients in Spain, resulting in a general practitioner (GP) possibly facing several cases during their practice. Furthermore, they have to collaborate with other specialists in the follow-up of the affected patients assigned to them, and therefore need to recognize the signs early and improve their skills in the referral, follow-up and treatment of this group of diseases.[2,3]

In order to facilitate this recognition and referral to other specialists, a "Referral for systemic autoimmune diseases" document has been designed in collaboration with the Spanish Society of Rheumatology (SER) and the Spanish Society of Family and Community Medicine (SEMFYC), at the proposal of the work group of systemic autoimmune diseases of the SER. To facilitate its use an application (app) for smart phones has been developed based on decision algorithms, aimed at helping the GP to take decisions for referral to the rheumatologist or to other hospital specialists.

The main aim of the project was to develop a referral document to help GPs to take decisions in the face of clinical suspicion of a SAD, aiding recognition and referral to a rheumatologist or other specialist if applicable.

Material and methods

The SER systemic autoimmune disease workgroup created a promoter group for the document, uniting experts in SAD proposed by both scientific societies, the SER and the SEMFYC. Several joint criteria were established for creating algorithms and an index of symptoms-and-signs-guide and analytical changes were created which belonged to the SAD, based on their clinical prevalence and relevance. This was put forward to the GPs and rheumatologists linked to both societies who had an interest in these diseases and mixed couples were formed for each algorithm. A model algorithm and basic common reference were made available to them.[2,3]

From each symptom, sign or change in laboratory findings each pair developed an algorithm for taking decisions which led to one or several possible diagnoses and referral proposals. Each algorithm included specific clarifying notes and updated references.

The algorithms were then assessed by the coordinators and editors of the project, homogenized and adapted for an app, the task of which was given to an external IT company.

The complete process took 2 years. No conflict of interests or any ethical conflicts were identified, since this was not a study with patients. There was no external financing or payment to the authors. The financing of the company which made the adaptation of the algorithms to the app format was provided by the SER's own resources.

Table 1
Algorithms: symptoms and signs guide and analytical changes.

Cutaneous	Exanthema
	Photosensitivity
	Purpura
	Erythema nodosum
	Livedo reticularis
Mucous	Oral and genital sores
	Chronic sinusitis
	Xerostomia
	Parotidomegaly
Vascular	Raynaud phenomenon
	Recurrent venous thrombosis
	Arterial ischaemia
Ocular	Uveitis
	Dry eye
	Episcleritis
Neurological	Headache/temporal arteritis
Obstetric	Recurrent miscarriages
Musculo skeletal	Acute arthritis
	Chronic arthritis
	Arthromyalgias and chronic pain
General symptoms	Weight loss
	Fever
Analytical changes	Acute phase reactants (ESR, RCR)
	Rheumatoid factor
	Antinuclear antibodies
	Creatine phosphokinase

Results

Twenty six algorithms were made, homogenized with symptoms and syndromes ordered by organs and apparatus: cutaneous, mucous, vascular, ocular, neurological, gynae-obstetric, musculoskeletral, general symptoms and laboratory test changes (Table 1). Each one was a decision tree or algorithms of normally dichotomous (yes/no) successive questions. The final recommendations referred to the probable diagnosis and the need or non need for referral, to which specialty and whether the need was for urgent referral or not, without entering into therapeutic recommendations.

A minimum set of analytical determinations was proposed for "SAD profile" diagnosis, usually available in primary care: haemogram, basic biochemistry, creatine kinase, ESR rate, reactive C protein, antinuclear antibodies and urinalysis.

The app user, after downloading and installing it on their device, selects a symptom or sign guide from a closed list and will respond to questions, mainly in a dichotomous manner, depending on each clinical case. The system allows the user to "go backwards" when some of the responses need to be modified (maybe a symptom was unclear) and links are available for consultation like, for example, lists of drugs associated with symptoms or a list of recommended complementary tests. When the algorithms reach a supposed diagnosis the suspected criteria may be reviewed. Finally, this leads to a proposal for the diagnosis and referral of their case.

The final format for the algorithms was in a text (appendix 1) and in a mobile application (Fig. 1). The *app* occupies 36 MB, is free, is available in its free format, only in Spanish and is compatible with Android and iOS (Apple) systems on the platforms:

Android: https://tinyurl.com/y825lkxr
IOS: https://itunes.apple.com/us/app/id1374778956

The platforms detect the application within the 5 first rankings from searches with "Semfyc", "Rheumatology", "Referral", "Autoimmune", "Algorithm disease" or "family medicine". The app is regularly updated (currently in its 7th version) correcting errors communicated by its users (especially at the beginning) and incorporating minor changes from proposals for improvements by its authors.

Fig. 1. Cover of the app.

News of the app came about through conferences, workshops and web sites of the SER and SEMFYC, and a leaflet with the QR codes was created which enabled direct access to the download (Fig. 2).

To date (May 2019) there have been 2419 downloads, 1310 (54%) in Android and 1109 (46%) in iOS. The mean score of users was 3.7 out of 5 (iOS).

Discussion

The SAD is a complex and uncommon group of rheumatic illnesses which are a challenge for primary care physicians, both in their early detection, preliminary study, referral, diagnosis and treatment shared with the rheumatologists. The creation of algorithms of referral by SAD from the GP to the rheumatologists is pertinent and pioneer not so much for its content, but for the format used, making it unnecessary for the professional to read the complete text and being able to follow the line of the decision tree to adapt it to their individual patient, so that they can benefit directly from the selected option in a short space of time. These decision algorithms use accessible entry criteria for the GP, obtained from patient anamnesis, physical examination or from laboratory tests which are generally accessible in primary care. Other authors[2–5] have sought to combine, simplify and approach these diseases to physicians who are less familiarized with them. However, the complexity of these diseases also impedes the management of these documents, which must necessarily be extensive. This app could be a more useful and user-friendly tool than the documented available

Fig. 2. QR download codes.

to date. It may meet the needs arising in daily practice, resolving doubts the GP may have on a day-to-day basis.

We would like the use of this app to contribute in some way to making the GP more aware of the existence of these less common diseases, reducing waiting time and coordinating the 2 care levels. Moreover, a decision taking algorithm platform has been developed which could be used for future projects.

Coordinating pairs made up of a rheumatologist and a GP to design the app and then homogenizing it afterwards in the editorial committee has led to extensive consensus for enabling decisions to be made for referral to the rheumatologist.

The adaptation of an algorithm to a mobile app format means that with a few clicks the solution and final recommendation may be reached. The rheumatologists use apps at work, but according to one study, only 10% are specific to the speciality.[6] In the download platforms apps are offered for criteria of disease activity for patients,[7] but it is difficult to find any which help in the diagnosis of rheumatic diseases. In other specialties, such as ophthalmology,[8] there are apps for taking diagnostic and therapeutic decisions.

This study has limitations: decisions with algorithms demand choosing between dichotomous alternatives, without the possibility of nuances or intermediate positions. However, to compensate for this grey scale, the algorithms and the app allow one to "step backwards" and follow a different route of the decision tree to see what the final result would be. The usability has not been measured, and neither have the algorithms been previously passed to a group of users for assessment. The algorithms are also unable to evaluate all options. On the other hand, the app is not supposed to be exhaustive, and other signs and symptoms may exist.

Validity of the app has not been tested in real situations to compare diagnostic decisions with that of an expert clinician, who would act as the gold standard against the decision guided by the app for different case scenarios. This remains pending as a project.

Another limitation is that the app is not available for a personal computer or a tablet, due to the expense this development would entail.

The excessive information the medical world has to cope with makes this 21st app important. The app defined as an application is a type of computer programme designed as a tool, to allow the user to carry out different types of work, in our case the algorithms of systemic diseases.

Medicine is a field in continuous flux. The app allows its users, who have downloaded it onto their mobile, to periodically receive free updates, to incorporate improvements. More ambitiously in the future it may even be able to offer other applications not just aimed at patient referral with SAD, but with algorithms of diagnosis and shared treatment for primary care and rheumatology, depending on their disease or the treatment received.

Our current task as editors is to publicize the algorithms and the app among GPs, and encourage rheumatologists to recommend it to primary care physicians in their area of care, all of which may be achieved through publications like this one and with promotion from scientific societies. We are also committed to keeping the app updated and expanding its objectives.

To conclude, we developed an app to help with diagnosis and referral which will offer assistance to the GP in taking decisions when faced with a suspected SAD. The app will help them to identify the SAD and refer the patient to a rheumatologist or other specialist when applicable. All GPs and rheumatologists now have to work together in this passionate and difficult area of early diagnosis of SAD.

Financing

The coordinators, editors and authors did not receive any funding or grants for any of this project. The external IT company which undertook the adaptation of the algorithms to the mobile application (app) was financed by the Spanish Society of Rheumatology through its own funds.

Conflict of interests

The authors declare that they have no conflicts of interest in this article.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.reumae.2019.09.001.

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