

## Assessment of Disease Severity in Rheumatoid Arthritis Patients Using Das28, Cdai, Raad Score and Rapid-3 – A Review

<sup>1</sup>Athira Paulson, <sup>2</sup>Feby Ann Abraham, <sup>3</sup>Flaby Davis, <sup>4</sup>Nayana Mary Ranji,  
<sup>5</sup>K.Krishnakumar L. Panayappan\*

*1,2,3,4,5, Department of Pharmacy Practice, St. James' college of Pharmaceutical sciences and St. James' Hospital Trust Pharmaceutical Research Centre (DSIR Recognized), Chalakudy, Kerala*

**ABSTRACT:** The assessment of rheumatoid arthritis (RA) has made progressive changes in the management of the pain associated with the disease and other symptom control. Rheumatoid arthritis (RA) is characterized as an autoimmune disorder with predominant irreversible joint damage. The disease severity of RA patients can be done through various proposed diagnostic tools such as physical examination such as numbering the affected joints i.e both tender and swollen out of the 28 joint groups, estimating the blood inflammatory markers such as ESR and CRP, estimating the overall pain and disease status and so on. In addition to these measures, various disease evaluation scores or indexes were proposed and idolized as the assessment tools in evaluating the disease status of the RA patients such as the Disease Activity Score 28 (DAS28), Clinical Disease Activity Index (CDAI), Rheumatoid Arthritis Articular Damage (RAAD) score and Routine Assessment of Patient Index Data-3 measures (RAPID-3)

**KEYWORDS:** Rheumatoid Arthritis, Assessment, ESR, CRP,

### I. INTRODUCTION

Rheumatoid arthritis (RA) is a chronic systemic inflammatory autoimmune disorder that can affect more than just your joints<sup>(1)</sup>. The common clinical manifestations range from joint damages such as pain, stiffness, swelling, fatigue and loss of quality of life. The proper standard measures for RA is still under progress for the effective diagnosis, prognosis, monitoring and treatment. Recently, various disease activity scores or indexes have been implemented for the evaluating or assessing the disease status in RA patients for the effective management of symptoms and the associated morbidity rates such as Disease Activity Score 28 (DAS28), Clinical Disease Activity Score (CDAI), Rheumatoid Arthritis Articular Damage (RAAD)score and Routine Assessment of Patient Index Data-3 (RAPID-3).

**DISEASE ACTIVITY SCORE 28 (DAS28) :** The DAS28 score is popularly referred as a measure of inflammatory disease activity in RA patients. The term DAS means 'disease activity score' and the number 28 indicates the 28 joints that are examined in this assessment. It requires the measurement of acute phase reactants and a complex formula which is in need of a calculator or computer for calculation<sup>(2)</sup>. This tool is popularized due to it's effectiveness in a clinical decision making process. There are a wide range of disease activities measured in a RA patient, those includes the following:

- Examination of joints in case of swelling and tenderness.
- Global scores of pain and overall status.
- Blood inflammatory markers such as ESR and CRP.
- Questionnaires predominantly human assessment questionnaires (HAQ) to monitor the function.
- X-rays and newer imaging techniques such as ultrasound and MRI<sup>(3)</sup>.

Hence, DAS28 can be termed as a composite score derived from four of these measures. The DAS28 is also known as the 'gold standard' in the diagnosis of RA. To calculate DAS28, the physician specialized in rheumatology will perform the following:

- Swollen joints are numbered
- Tender joints are numbered
- ESR and CRP are estimated
- 'Global assessment of health' by means of a questionnaire is marked by the patient (marking a scale of 10cm)

The results obtained from the above observations are then put into the complex mathematical formula i.e ,  
 $DAS28 = 0.56*\sqrt{\text{tender}28} + 0.28*\sqrt{\text{swollen}28} + 0.70*\ln(\text{ESR}) + 0.014*GH$

$$\text{DAS28-P} = [0.56 \cdot \sqrt{\text{TJC}} + 0.014 \cdot \text{VAS-GH}] / \text{DAS ESR}^{(4)}$$

The DAS28 offers the scale ranges from 0-10. When the score obtained after the calculation, the interpretations as follows :

- If the score is greater than 5.1 – active disease
- If the score is less than 3.2 – low disease activity
- If the score is less than 2.6 – remission of the disease

The DAS28 score can also be determined in terms of C-reactive protein (CRP) in place of ESR.

**CLINICAL DISEASE ACTIVITY INDEX SCORE (CDAI) :** CDAI can be defined as a clinical composite score used for assessing the disease activity of RA. It is a newer tool which does not need any requirements like that of the DAS28 such as the calculators or computer for calculation or the measurements of acute phase reactants. The idea of CDAI was developed as a sum of swollen /tender joints (out of the 28) which also includes the patient and physician global assessment on visual analogue scale (VAS ) i.e the scale ranges from 1-10 helpful in predicting the disease status. The advantages of CDAI are as follows :

- It's ability to function independently of calculators or normograms.
- Deals with the ease in implementing this measure anywhere and at anytime.

The CDAI cut off values are found to be much more precise than DAS28 as it exhibits much lower residual disease function. It is said that DAS28 < 2.4 accepts upto 8 tender/swollen joints while the CDAI only accepts upto 2 tender/swollen joints<sup>(5)</sup>. The remission of the disease according to the cut-off values is found to be favourable for the RA patients in terms of symptom control and disease morbidity. Various studies have been carried out to examine correlation between the CDAI score and DAS28. The CDAI can be calculated by the following equation :

$$\text{CDAI} = \text{SJC}(28) + \text{TJC}(28) + \text{PGA} + \text{EGA}, \text{ where}$$

SJC(28) is the swollen 28 joint count (shoulders, elbows, wrists, MCPs, PIPs including thumb IP, knees)

TJC(28) is the tender 28 joint count (shoulders, elbows, wrists, MCPs, PIPs including thumb IP, knees)

PGA is the patient global activity (patient's self-assessment of overall RA disease activity on a scale 1-10 where 10 is maximal activity)

EGA is the evaluator's global disease activity (evaluator's assessment of overall RA disease activity on a scale 1-10 where 10 is maximal activity)<sup>(6)</sup>.

### **RHEUMATOID ARTHRITIS ARTICULAR DAMAGE (RAAD) SCORE**

The RAAD score was setup by using the information obtained from physical examination of the affected patient. It is quick and easy to obtain. An essentiality for monitoring the severity of the disease and therefore, a three point scale is used for such purpose. The three point scale indicates the following the description of the severity of RA:

- If the score is 0, it means no irreversible damage
- If the score is 1, it means the affected joint or joint groups are partly damaged.
- If the score is 2, it points out severe damage of the affected joint or joint groups, ankylosis or prosthesis.

The descriptions assigned for each score for measuring the joint damage is done in order to make sure that the RAAD score is accessible to all types of assessors especially the inexperienced ones. The RAAD score can be implemented with ease for determining the disease status. It was well explained by the Tugwell and Bombardier in terms of feasibility, reliability, validity and responsiveness<sup>(7)</sup>. The RAAD score is used for the detailed study of long term damage in large patient population with the affected joints or joint groups. The five aspects of validity of outcome measures in RA can be distinguished by the following :

- Face validity
- Content validity
- Construct validity
- Criterion validity, and
- Discriminant validity<sup>(8)</sup>

The face validity points out credibility i.e a sensible way of describing articular damage. The content validity means it deals with the question of whether a measure covers all aspects of the subject. Before the application of RAAD score in research or follow up of patients with RA, it's inter-observer and intra-observer variability must be known.

### **ROUTINE ASSESSMENT OF PATIENT INDEX DATA-3 MEASURES (RAPID-3)**

RAPID-3 is a composite index with the information exclusively from the patient, collected through a self reported questionnaire which includes the three measurements

- Functionality (MDHAQ)
- Pain (VAS), and
- PtGA i.e patient global assessment<sup>(9)</sup>.

As RAPID-3 was compared with ESR-DAS28, CDAI and SDAI in patients with RA and hence, high correlation was setup between these measures. It is said to be a patient driven tool to measure the disease activity of a patient with RA. It is found to be valid and most reliable tool<sup>(10)</sup>. The monitoring of the disease status using RAPID-3 is said to be completed within a short span of time. For using this measure as a tool, it does not require staff training. As the importance of the physical examination was taken into consideration, while monitoring of patients cannot be ignored. It requires less time and resources and no reliable availability of laboratory results are present.

## II. CONCLUSION

The new measures which have implemented for the clinical research or study in assessing the disease status has been helpful and precise. These scores are adequately efficient in detecting the severity of the disease and hence, paved a way for systematic and favourable monitoring of rheumatoid arthritis. Despite of the need of a calculating device, DAS28 has been considered as the gold standard. Both DAS28 and CDAI possess a fairly significant correlation as these are used in the evaluation of patients with early RA. Thus, all the indexes and questionnaires pose as an important and reliable source in keeping track with the RA patients.

## REFERENCES

1. Mayo Clinic. Rheumatoid arthritis. Available from: <https://www.mayoclinic.org/diseases-conditions/rheumatoid-arthritis/symptoms-causes/syc-20353648>[Accessed on 27 April 2020].
2. B. Siddharta Kumar, P. Suneetha, Alladi Mohan et al. Comparison of Disease Activity Score in 28 joints with ESR (DAS28), Clinical Disease Activity Index (CDAI), Health Assessment Questionnaire Disability index (HAQ-DI) & Routine Assessment of Patient Index Data with 3 measures (RAPID-3) for assessing disease activity in patients with rheumatoid arthritis in initial presentation. Indian J Med Res[Internet]. 2017[cited on 2015 May 6];146(suppl 2):S57-S62.
3. National Rheumatoid Arthritis Society. The DAS28 score. Available from://www.nras.org.uk/the-28[Accessed on 27 April 2020].
4. Daniel F. McWilliams, Patrick D. Kiely et al. Interpretation of DAS28 and its components in the assessment of inflammatory and non-inflammatory aspects of rheumatoid arthritis. BMC Rheumatol [Internet] 2018 [cited 2018 Mar 23];2(8):1-12. Available <https://bmcrheumatol.biomedcentral.com/> doi:10.1186/s41927-018-0016-9.
5. H. Singh, H. Kumar, R. Handa et al. Use of clinical disease activity index score for assessment of disease activity in rheumatoid arthritis patient: an Indian experience. Arthritis[Internet]. 2011[cited on 2011 Dec 29];2011:146398. Available <https://ncbi.nlm.nih.gov/doi/10.1155/2011/146398>.
6. Dr. Raj Carmona. Clinical disease activity index. Available from:<https://www.rheumtutor.com/assessment-tools/clinical-disease-activity-index/>[Accessed on 29 April 2020]
7. Tugwell P, Bombardier C. Methodological framework for developing and selecting end points in clinical trials. J Rheumatol 1982; 9:758-762.
8. T.R.Zijlstra, H.J. Bernelot Moens, M.A.S. Bukhari. The RAAD: first steps in developing a clinical index of long term damage in RA. Ann Rheum dis 2002; 61: 20-23.
9. Pincus T, Bergman MJ, Yazici Y. RAPID3- an index of physical function, pain and global status as “vital signs” to improve care for people with chronic rheumatic diseases. Bull NYU Hosp Jt Dis. 2009;67(2):211-225.
10. Jesus Giovanni Ballestron Munoz, Rodrigo B. Giraldo et al. Correlation between RAPID-3, DAS28, CDAI and SDAI as a measure of disease activity in a cohort of Colombian patients with rheumatoid arthritis. Clin Rheumatol[Internet]. 2017;36(5):1143-1148. Available <https://ncbi.nlm.nih.gov/doi/10.1007/s10067-016-3531-5>.