Enhancing Decision Making Capability Using Ontological Approach for Polymyalgia Rheumatica

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***Abstract*– These days, the health informatics is gaining popularity in solving some of the major issues faced in health systems. The key aspect governing this is to facilitate decision based mechanism from already existing knowledge. Ontologies can be used in this regard to conceptually define various formalisms and thereupon extracting new knowledge from it. The results fetched from ontology's can be used to find some new solutions or preventive measures. In this paper we have investigated use of ontology for Polymyalgia Rheumatica (PMR) using Protégé ontology language. The results from ontology assisted to draw some conclusions for providing some counter measures to PMR. The ontology is also flexible to extend to other related domains and comprehensive problem analysis can be performed. Undeniably, PMR is among the most common reasons for long-term steroid prescription with great heterogeneity.**

***Keywords*– Ontology, Primarily, Polymyalgia-Rheumatica, Syndrome, Properties, Domain, Modeling, Disease and Diagnosis**

I. INTRODUCTION

Indeed, ontology engineering is already considered a mature discipline in the context of the semantic web. A variety of methodologies and tools to build, manage and merge ontology emerged in the last decades. It is also generally accepted that building ontology from scratch is a challenging and time-consuming task; the development of new ontology still does not tap the full potential of the knowledge sources. *"The Polymyalgia Rheumatica is a chronic and inflammatory disease of the great arteries that frequently develops in citizens over 50 years of age. Therefore, PMR and temporal arteries are believed to represent the same disease with slightly different symptoms, but they are treated in different manner and with different medication"* [1].

Let's put in another way, the Polymyalgia Rheumatica which is often abbreviated as PMR is a kind of rheumatical disease that makes pain and stiffness in some muscle groups. Rather than most of the other rheumatical diseases, it also affects muscles instead of joints in the human body as shown in Fig. 1.

Fig. 1: PMR is primarily located around shoulders and hip side of the human body [3]

II. NARRATIVES, INDICATION AND ETHIOLOGY GROUNDS FOR PMR

PMR is an inadequately understood in terms of pain transpires mostly in citizens over the age of 50–70. It transpires at least double as frequently in women, and is comparatively regular throughout Europe and United States of America [1], [4]. Soreness and stiffness predominate in the shoulder and hips sections, along with systemic symptoms, such as (e.g., fatigue, weight loss and low grade fever etc). The syndrome of PMR was perhaps earliest reported over 100 years ago. Ever since 1950's, it has become perceptible that PMR is comparatively common disease [3].

Information which can be mentioned here is that PMR can occur mostly in white race people living in US and European countries. The real fact finding causes of PMR are still unknown in medical world [2]. The pattern of pain is usually a symmetric and perhaps provoked by the motion of joints in the body. However, pain may occur in resting position also and frequently happened when a PMR patient awakes during the night. According to real discussions with some doctors; the most important symptom of the PMR is a severe headache. Therefore, the pulse of the temporal artery is also decreased. There is a requirement of a medical biopsy in order to find out excess of CD4 cells in the temporal artery [5], [6]. Patient`s have difficulty in combing their hair or getting up out of a chair/ bed. A few patients have joint swelling, usually on knees, wrists and upper chest. Sometimes muscle softness and even joint tenderness may be

emanated in PMR [5]. In PMR a laboratory findings are typically nonspecific and occasionally, liver-function test results are abnormal in PMR. In PMR the diagnosis is generally based on two observations:

a) C-reactive Protein (CRP)

b) Erythrocyte Sedimentation Rate (ESR)

However, the only ESR test is not enough to diagnose the PMR. It deals with the level of protein which decreases or increases when the human body is ill. Additionally, when a PMR occurs; the pulse of a temporal artery decreases [2], [8]. The objective in treating PMR is to assist relieve pain and stiffness in patient body. The management includes medications to help decrease inflammation, as well as an everyday appropriate exercise and relax for some natives in order to preserve joint flexibility and muscle strength. PMR tends to be a self-limiting illness, but may involve proper therapy for months or may be a year [9]. The precise figures are very complicated to institute, but the standard duration of PMR is about two years, after which time the mainstream of patients are comparatively treated without drug therapy [1]. The Fig. 1 is also highlighting the major area of pain and stiffness in the body.

III. MANAGEMENT AND GENERAL CONSIDERATIONS OF PMR

The management and treatment of PMR can be challenging, as many clinical and laboratory features may also be present in other conditions, including other rheumatological diseases, infection and neoplasm. Also, the response to standardized therapy is heterogeneous, and a significant proportion of patients do not respond completely. A healthcare professional in rheumatology suggest and recommends their guidelines in the following areas:

1) Secure and further accurate diagnosis of patients presenting with polymyalgia symptoms.
2) Appropriate referral for specialist assessment and management.
3) Appropriate corticosteroid dosage regimens.
4) Bone protection to reduce the common morbidity of osteoporotic fractures and appropriate follow-up and monitoring procedures.

Although, new classification criteria based on active discussion among highly experienced physicians who are familiar with PMR have emerged [12], to date, there is no gold standards test for the diagnosis of PMR. In this regard, several conditions, including infectious, tumors or connective tissue diseases, may mimic or present polymyalgia features [11], [12]. In addition, PMR maybe an secluded syndrome [14] or perhaps presenting feature in patients who later on expand typical cranial manifestations of giant-cell arthritis (GCA), a systemic large vessel that also involves individuals aged >50 years and may lead to permanent visual loss [6]. GCA and PMR are reasonably familiar and often overlapping situations in the elderly in western countries. With respect to this, population-based studies have shown the presence of 'silent' biopsy-proven GCA in some patients presenting with PMR features [9]. Moreover, PMR manifestations are frequently observed in patients with biopsy-proven GCA [10]. We also recommend documentation in the patient's medical proof of a lowest data set, which forms the base for the diagnosis. The foundation clinical inclusion and any exclusion criteria:

a) A laboratory investigations prior to commencement of Steroid therapy
b) A complete blood count
c) Urea and the electrolytes
d) A Liver function tests and bone profiling
e) RF (anti-CCP antibodies perhaps considered)

IV. ANALYSIS OF PMR ONTOLOGICAL MODEL

Initially, we would underline some fundamental rules in an ontology aim to which we will refer many times in our article. These are as follows:

1) There is no correct method to model a domain— there are constantly viable alternatives and the ontology expansion is necessarily an iterative progression [4].
2) The concepts in ontology should be close to objects and associations in your domain of interest. These are for the most part likely (i.e. to be a nouns or verbs) in a sentences that illustrate in a domain [4].

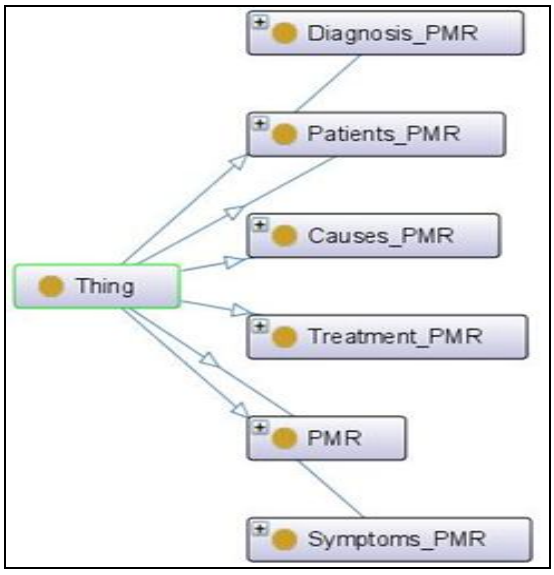

Fig. 2: The ontology of PMR in Protégé

We also need to remember that ontology is a model of veracity of world and the thoughts in ontology should reflect this veracity. Therefore, we could appraise it by means of in functions or problem- resolving techniques or by discussing it with professionals in the field.

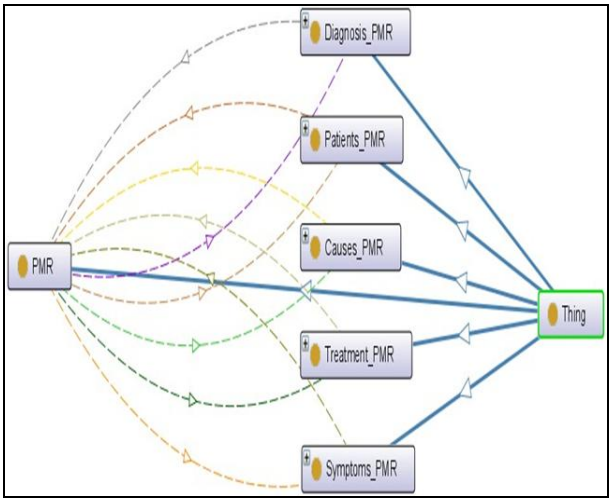

Fig. 3: The ontology of PMR in Protégé with relations (object properties which links an individual of a class to an individual of another class)

We have used the Protégé software to design our PMR ontology. In the Fig. 2, Thing is the super class of all the other classes we have suggest 6 main classes that are; Diagonsis_PMR, Patients_PMR, Causes_PMR, Treatment_PMR, PMR, Symptoms_PMR. The figure 3 is showing the object property links to one class has many relationships with many class. The Fig. 4 is determining the class hierarchy (e.g., Causes_PMR are unknown and the diagnoses of PMR in PMR).

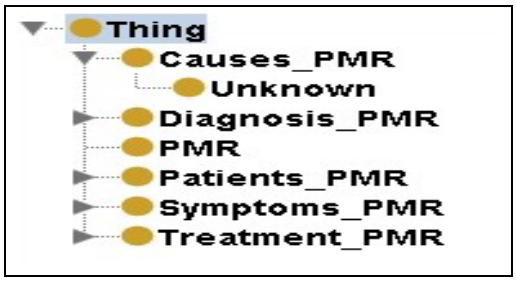

Fig. 4: All classes of the PMR ontology

Here the PMR is a disease and having unknown causes but there is a diagnosis of it. Furthermore, the Fig. 5 and Fig. 6 are classifying all the classes, sub classes and All Object properties (Properties between individuals of the classes) in PMR ontology.

This ontology would help the GP (General Practitioners) and the medical scientist to understand more in depth about the possibility of PMR and its proper way of treatment.

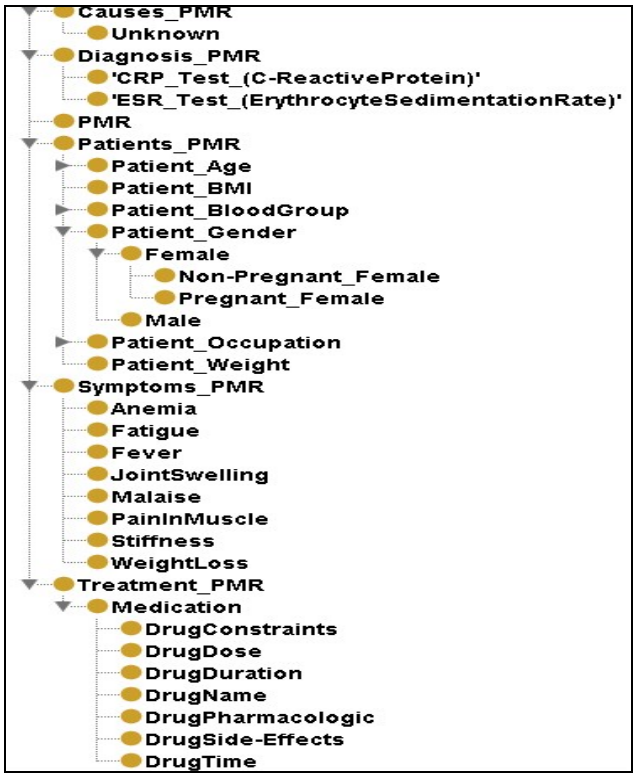

Fig. 5: All Classes and Subclasses of the PMR

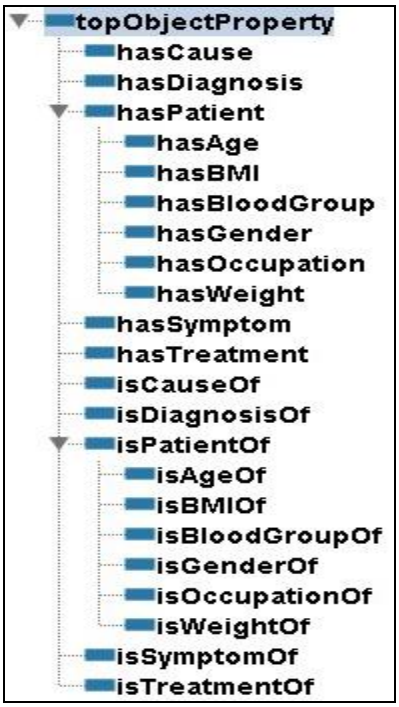

Fig. 6: All object properties (properties between individuals of the classes) in PMR ontology

V. ALTERNATIVE AND POSSIBILITIES TO CONTROL PMR GROWTH RATE

"Corticosteroid is the drug in tablet form that can be prescribed to treat PMR and it is an anti-inflammatory drug. In medical dictionary a corticosteroid drugs are burly medications that assist to reduce inflammation and pain inside the human body. Corticosteroids can cause harmful side effects like weight gain and high blood pressure in body" [3], [5]. Taking daily doses of calcium and vitamin D supplements would helps to prevent PMR. Indeed, the main causes of PMR and other harmful diseases are lacking of vitamins and calcium in the body. So it is suggested by the doctors to take these supplements in the following quantity daily [4]:

a) 1,000 to 1,200 milligrams of calcium supplements.
b) 400 to 1,000 milligrams of vitamin D supplements.

VI. CONCLUSION AND FURTHER RESEARCH TO CONTROL GROWTH RATE

Following are some research questions that can be taken in to account in order to control the growth rate of PMR in a society by answering these question there is a possibility that in future medical scientist would try to better understand and control its growth rate.

1) What are the side effects of Prednisolon as a drug using to control the PMR?
2) Is there any other diagnosis required to trace the PMR?
3) It is feasible to use Corticosteroid as a medication instead of Prednisolon in PMR?

Ontology is a recognized explicit explanation of ideas in a realm of concepts, properties of each concept describing a variety of characteristics and attributes of the concept. In this assignment we have developed application ontology for a clinical process for the benefit of medical informatics [7, 12]. The problem is about treatment of the disease Polymyalgia rheumatic with the drug Prednisolon. This ontology contains necessary information on the disease PMR such as (e.g., symptoms, diagnosis, prescription, treatment, etc). The plan of this implementation is to prop up how medical entities are exercise in the process of diagnose and treating the diseases. Furthermore, in order to control the growth of Polymyalgia rheumatic in the society we have identified some important research questions that must be identified in future are:

a) What are the side effects of Prednisolon as a drug using to control the PMR?
b) Is there any other diagnosis required to trace the PMR?
c) It is feasible to use Corticosteroid as a medication instead of Prednisolon in PMR?
d) What are the different kinds of entities that will need to be recognized in the ontology?

In this article, we have used Protégé software as a modeling tool for conceptualizing the modeling of ontology. We listed the steps in the ontology process and defined class hierarchies and properties of classes. Ontology integration means not only the translation of the representation to a common understandable format, but also the matching of the resulting schemes. We are also currently working on further methods to optimize the costs and the quality of the reuse process related to PMR. In the same time the cost estimation methods shall also be presented in future which will be a subject of additional detailed empirical refinements. The ontology enables the cross-walk between disease concepts, symptoms contributing to disease and associated treatment. As an outcome, a general practitioners consultation can use this ontology to diagnose and treat the disease.

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