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The clinical course of polymyalgia rheumatica in Chinese
Li · Lo · Leung · Wong · Mok

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45		Received	30 April 2009
46	Schedule	Revised	12 October 2009
47		Accepted	27 October 2009
48	Abstract	<p>Polymyalgia rheumatica (PMR) is diagnosed based on clinical features that may overlap with other rheumatic conditions like rheumatoid arthritis (RA). Furthermore, a proportion of PMR patients may subsequently evolve into RA. The aim of this study was to examine the clinical characteristics of PMR patients in a Chinese cohort compared to a Caucasian series. Patients diagnosed to have PMR during 1997–2008 were reviewed for clinical features and compared to a reported Caucasian series. Rheumatoid factor (RF) and anticyclic citrullinated peptide (CCP) antibodies were determined by immunonephelometry and enzyme-linked immunosorbent assay, respectively. Forty-four patients of southern Chinese origin were diagnosed to have PMR according to specialist opinion. Seventy-five percent of patients ($n = 33$) were >65 years of age at diagnosis (mean \pm standard deviation, 75.8 \pm 9.6 years). The commonest feature at disease onset was elevated erythrocyte sedimentation rate >40 mm/h (100% vs. 95.7%; $p = 0.17$) and bilateral shoulder pain or stiffness (95.5% vs. 90.8%; $p = 0.31$), comparable in frequency to the Caucasian cohort. However, Chinese patients had significantly longer duration of symptoms before diagnosis ($p < 0.001$) but less bilateral upper arm tenderness ($p < 0.001$) and generalized stiffness ($p = 0.01$). Twelve (27.3%) patients evolved into RA after a median duration of 2 months from onset of PMR. RF and anti-CCP antibodies were positive in 66.7% and 60% of these patients compared to 9.4% and 6.2%, respectively, among those who did not evolve into RA during the period observed. Chinese patients with PMR have modestly different clinical profile compared to the Caucasian counterpart. RF and anti-CCP antibodies were more likely to be present in those who subsequently developed into RA.</p>	
49	Keywords separated by ' - '	Anticyclic citrullinated peptide antibodies - Polymyalgia rheumatica - Rheumatoid arthritis	
50	Foot note information		

The clinical course of polymyalgia rheumatica in Chinese

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Received: 30 April 2009 / Revised: 12 October 2009 / Accepted: 27 October 2009
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Abstract Polymyalgia rheumatica (PMR) is diagnosed based on clinical features that may overlap with other rheumatic conditions like rheumatoid arthritis (RA). Furthermore, a proportion of PMR patients may subsequently evolve into RA. The aim of this study was to examine the clinical characteristics of PMR patients in a Chinese cohort compared to a Caucasian series. Patients diagnosed to have PMR during 1997–2008 were reviewed for clinical features and compared to a reported Caucasian series. Rheumatoid factor (RF) and anticyclic citrullinated peptide (CCP) antibodies were determined by immunonephelometry and enzyme-linked immunosorbent assay, respectively. Forty-four patients of southern Chinese origin were diagnosed to have PMR according to specialist opinion. Seventy-five percent of patients ($n=33$) were >65 years of age at diagnosis (mean±standard deviation, 75.8±9.6 years). The commonest feature at disease onset was elevated erythrocyte sedimentation rate >40 mm/h (100% vs. 95.7%; $p=0.17$) and bilateral shoulder pain or stiffness (95.5% vs. 90.8%; $p=0.31$), comparable in frequency to the Caucasian cohort. However, Chinese patients had significantly longer duration of symptoms before diagnosis ($p<0.001$) but less bilateral upper arm tenderness ($p<0.001$) and generalized stiffness ($p=0.01$). Twelve (27.3%) patients evolved into RA after a median duration of 2 months from onset of

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Keywords Anticyclic citrullinated peptide antibodies · Polymyalgia rheumatica · Rheumatoid arthritis

Introduction

Polymyalgia rheumatica (PMR) is an inflammatory condition of unknown etiology commonly found in the elderly and is often associated with impaired quality of life of these patients [1]. The diagnosis of PMR is mainly based on clinical features such as aches and stiffness in the cervical region, shoulder, and pelvic girdles. There is yet no specific serological marker for this condition. A recent prospective study suggested that PMR is a heterogeneous condition with variable responsiveness to corticosteroid treatment [1]. There is still inconsistency with regard to the guideline on diagnosis, management, and disease response measures in this condition [2]. A number of diagnostic criteria have been proposed to classify PMR [3–5], and the criteria proposed by Bird et al. [3] have been more widely used because of their higher sensitivity [6]. The diagnosis of PMR is regarded as definite if the patient fulfills three or more of the criteria including age >65 years, time from onset of symptoms to full-blown disease of less than 2 weeks, bilateral shoulder pain or stiffness, bilateral upper arm tenderness, stiffness >1 h, depression and/or weight loss, and erythrocyte

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66 sedimentation rate (ESR) >40 mm/h at onset. Together with
 67 a positive response to corticosteroid therapy, the sensitivity
 68 of this diagnostic criteria has been reported to be as high as
 69 99.5% [6].

70 However, a number of rheumatic conditions including
 71 late onset rheumatoid arthritis (RA) [7], calcium pyrophos-
 72 phate deposition disease, inflammatory myositis [8], and
 73 fibromyalgia [9] may mimic PMR as they show similar
 74 clinical features but carry different prognosis. Seventy-three
 75 percent of a large cohort of 100 PMR patients have been
 76 reported to develop cranial symptoms related to ischemic
 77 events of giant cell arteries after a median of 3 weeks and
 78 among these 16.4% of patients resulted in permanent visual
 79 loss [10]. Furthermore, 6–17% of PMR patients have
 80 been found to evolve into RA subsequently [7]. Anti-
 81 cyclic citrullinated peptide (CCP) antibodies that have
 82 recently been found to be a specific marker for RA [11]
 83 have been suggested to be clinically useful in the
 84 prediction of PMR patients who subsequently develop
 85 into RA [12, 13]. Our study aimed to compare the clinical
 86 characteristics of a Chinese cohort of PMR patients to a
 87 Caucasian series and to examine the frequency of anti-
 88 CCP antibodies in patients with and without subsequent
 89 evolvement into RA.

90 Methodology

91 This study has been approved by the ethics committee of
 92 the local institutional review board. All patients diagnosed
 93 to have PMR by trained rheumatologists at a university
 94 affiliated hospital and a large regional public hospital in
 95 Hong Kong during 1997–2008 were identified through
 96 the clinical data analysis and reporting system (Interna-
 97 tional Classification of Diseases (ICD), i.e., ICD 9 Code
 98 725), and their medical records were retrieved for
 99 analysis. Demographic data, clinical features, treatment
 100 regimen and response as well as laboratory investigations
 101 including ESR, rheumatoid factor (RF) and anti-CCP
 102 antibodies at disease onset were recorded. The clinical
 103 characteristics of these patients were compared with
 104 Caucasian series reported according to the criteria of Bird et
 105 al. [3].

106 Measurement of RF and anti-CCP antibodies

107 RF was performed by latex-enhanced immunonephelometry
 108 (BN ProSpec, Dade Behring, Germany) and was considered
 109 positive at ≥ 15 IU/ml. Anti-CCP antibodies were measured by
 110 a second-generation anti-CCP enzyme-linked immunosorbent
 111 assay (Inova Diagnostic Inc., San Diego, CA, USA) according
 112 to the manufacturer's instructions. The cutoff value for
 113 positive reaction was set at 20 arbitrary units (AU) as

suggested by the manufacturer. The intra-assay variation of
 the assay was 3.5% with a high-level serum (175 AU) and 6%
 with a “low-level serum” (21 AU), and interassay variation
 was 6% for both sera. For patients who presented before
 the anti-CCP antibody assay was introduced into the
 hospital serology laboratory in early 2005, the earliest
 available serum samples after onset of presentation were
 retrieved and tested.

Statistical analysis

Statistical analysis was performed by SPSS 16.0 software
 (Chicago, IL, USA). Data were presented as mean \pm
 standard deviation (SD) unless otherwise stated. Chi-
 square test or Fisher's exact test was performed for
 categorical variables. Mann–Whitney *U* test was used for
 comparison on continuous data between groups. Kaplan–
 Meier survival curve and log-rank test were used to
 compare the frequency of RF and anti-CCP antibody
 among patients who had and had not evolved into RA
 subsequently.

Results

Presenting features of PMR

Forty-four (31 females and 13 males) patients of southern
 Chinese origin were identified from these two large
 regional hospitals during 1997–2008. The mean \pm SD age
 of these patients was 75.8 ± 9.6 years with a mean duration
 of follow-up of 4.9 ± 2.9 years. Table 1 shows a summary of
 the clinical features of these patients compared to those
 reported in a Caucasian series [6]. There was similar
 proportion of Chinese patients (75.0%) aged over 65 years

Table 1 Presenting features of PMR among the Chinese cohort
 compared with a Caucasian series diagnosed according to the criteria
 of Bird et al

Clinical Features	Chinese cohort Number (%)	Caucasian series ^a Number (%)	p value
Age >65	33/44 (75.0)	171/213 (80.2)	0.40
Onset of illness <2 weeks ^a	13/44 (29.5)	148/196 (75.5)	<0.001
Bilateral shoulder pain/stiffness	42/44 (95.5)	178/196 (90.8)	0.31
Bilateral upper arm tenderness	5/44 (11.4)	147/195 (75.5)	<0.001
Stiffness >1 h	30/44 (68.2)	147/173 (84.9)	0.01
Weight loss/depression	13/44 (29.5)	85/213 (40.0)	0.20
Initial ESR >40 mm/h	44/44 (100)	158/165 (95.7)	0.17

^a Refers to time taken for symptoms to reach their full-blown picture

143 as the Caucasian counterpart (80.2%; $p=0.40$). Bilateral
144 shoulder pain/stiffness was the commonest symptom for
145 both cohorts (95.5% in Chinese and 90.8% in Caucasian,
146 $p=0.31$). However, Chinese patients had significantly
147 longer period before diagnosis ($p<0.001$), lesser bilateral
148 upper arm tenderness ($p<0.001$), and generalized stiffness
149 ($p=0.01$) compared to the Caucasian counterpart. All our
150 patients had ESR >40 mm/h at disease onset compared to
151 95.7% of the Western cohort ($p=0.17$), 25 (56.8%) among
152 whom had ESR level above 100 mm/h.

153 Response to treatment

154 Two patients (4.4%) responded to nonsteroidal anti-
155 inflammatory drugs (NSAIDs) alone. Most patients (39 of
156 44, 88.6%) were treated with prednisolone (mean daily
157 dose of 17.2 ± 10.2 mg). There was a rapid response with
158 drop of ESR level by 50% or over from baseline within 2 to
159 3 months after treatment.

160 Evolvment into RA

161 Twelve (27.3%) PMR patients in our cohort subsequently
162 fulfilled the 1987 American College of Rheumatology
163 (ACR) criteria for RA [14] after a median duration of
164 2 months (range 1–24 months) from diagnosis of PMR. The
165 commonest ACR features fulfilled by these patients
166 included arthritis of three or more joint areas (100%) and
167 symmetrical arthritis (100%), followed by stiffness
168 (83.3%). Arthritis of hand joints and RF was present in
169 75% and 66.7% at the time of diagnosis of RA.

170 Predictive role of RF and anti-CCP antibodies in PMR
171 patients who evolved into RA

172 RF was checked in all patients and anti-CCP antibodies
173 in 21 patients. Among the 12 patients who had evolved
174 into RA, 66.7% were RF positive and 60% were anti-
175 CCP positive. RF and anti-CCP antibodies were present
176 in only 9.4% and 6.2% for those who had not evolved
177 into RA ($n=32$) for the period observed (Table 2). The
178 positive and negative predictive values for RF in the
179 development of RA were 72.7% and 87.9%, respectively,

while those for anti-CCP antibodies were 75.0% and 88.2%,
respectively.

Figure 1 shows the Kaplan–Meier survival curve with
evolvment into RA among PMR patients who were
seropositive for RF (Fig. 1a) or anti-CCP antibodies
(Fig. 1b) compared to those who were not. Patients who
had positive serum RF ($p<0.01$) and anti-CCP antibodies
($p=0.02$) were more likely to develop RA during the period
of observation.

Discussion

Our study showed that Chinese patients with PMR
presented with similar features as the Caucasian counterpart
including age at onset, bilateral shoulder pain or stiffness,
constitutional symptoms, and ESR >40 mm/h. However,
our patients were found to complain less of bilateral upper
arm tenderness and generalized stiffness. Our patients also
had longer duration of symptoms before seeking medical
help. This may be due to the lack of awareness of an
underlying rheumatic disease as nonspecific musculoskeletal
rheumatism are frequent complaints in the elderly or that
Chinese patients may demonstrate a different health care
seeking behavior. Indeed, cultural and social influences have
been demonstrated to affect the experience and adjustment to
pain among subjects of different racial or ethnic groups [15].

Our study showed that 27.3% of Chinese patients with
initial diagnosis of PMR subsequently evolved into RA
after a median of 2 months (range 1–24 months) since
disease onset. This frequency was higher than the Western
cohort where 6–17% of patients have been reported to
develop into RA after a period of 3 to 5 years [12]. This
may be related to the small sample size of our study and
may also be explained by the more subjective items in the
criteria of Bird et al. that lead to variations in different
populations. Furthermore, PMR patients who had milder
symptoms and those who readily respond to NSAIDs alone
may have been managed at the primary care instead of
being referred to our tertiary care units. It is also possible
that we have included more patients with late onset RA into
our cohort as PMR and elderly onset RA can be difficult to
discriminate. A proportion of patients with late onset RA have

t2.1 **Table 2** The frequency of RF
and anti-CCP antibodies
among PMR patients who
had evolved into RA and
those who had not

^a Test performed by
second-generation
anti-CCP antibody assay

	RF		Anti-CCP antibodies ^a		t2.2	
	<i>N</i> (%)		<i>N</i> (%)			t2.3
	Positive	Negative	Positive	Negative		
PMR with evolvement into RA	8/12 (66.7)	4/12 (33.3)	3/5 (60.0)	2/5 (40.0)	t2.5	
PMR without evolvement into RA	3/32 (9.4)	29/32 (90.6)	1/16 (6.2)	15/16 (93.8)	t2.6	

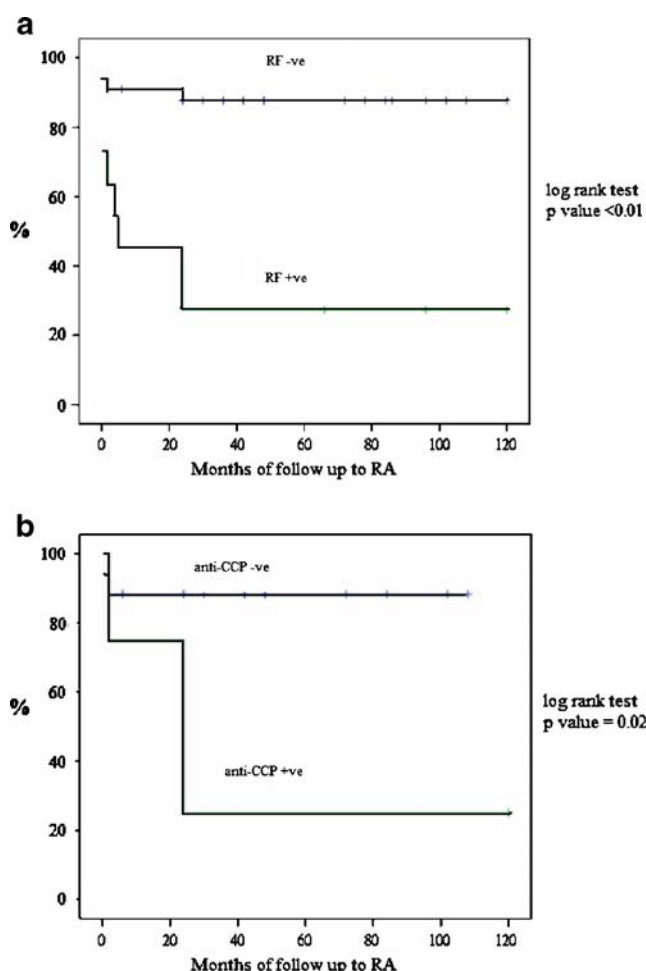


Fig. 1 Kaplan–Meier survival curve showing evolution of PMR patients into RA among patients who were seropositive for RF (a) or anti-CCP antibodies (b)

been found to present with PMR features at disease onset with prevalent involvement of the girdles, high ESR levels, and good response to low-dose steroid treatment [7]. These patients were typically seronegative for RF. A Japanese group has attempted to refine criteria for detection of PMR with higher sensitivity and specificity among their elderly subjects if the patient fulfills all of the following: persistent bilateral muscular pain for >2 weeks involving ≥ 2 of the neck, shoulder girdle, upper arms, pelvis girdle, and thighs; normal muscle enzyme level; ESR >40 mm/h; and absence of hand joints involvement [16]. However, the sensitivity of diagnosing PMR using such criteria on our cohort was 70% only.

We have explored the role of RF and anti-CCP antibodies as predictive serological markers for subsequent evolution into RA. We found a high frequency of 67% of RF in those PMR patients who developed into RA, comparable to that observed in elderly onset RA [13]. RF is still present in 9.4% of those patients who had not evolved into RA and is likely related to the increased prevalence of RF in the aged. Indeed, 10–15% of subjects

older than 65 years of age have been reported to have positive RF [12]. On the other hand, anti-CCP antibodies were not present in 93.8% of patients who had not evolved into RA during the time of observation suggesting a high specificity and a role to predict development of RA. In this study, only a marginally better sensitivity and positive predictive value of anti-CCP antibodies was demonstrated compared to RF which is probably related to the small sample size of our study. Anti-CCP antibodies have recently been found to be a specific serological marker for RA. The second-generation anti-CCP antibodies assay has comparable sensitivity as serum RF (80%) while demonstrating almost absolute specificity for the diagnosis of RA [17]. The production of anti-CCP antibodies has been found to be an early process in RA development, and their presence is predictive of the development of the disease [10]. Our result complemented the conclusions from a previous study which showed that anti-CCP antibodies were useful in the differential diagnosis of elderly onset RA and PMR [13]. In that study, 65% elderly onset RA patients showed increased serum titer for anti-CCP antibodies compared to none of the healthy subjects and PMR patients. Thus, anti-CCP antibodies may be a clinically useful marker to be tested at the onset of patients with PMR such that these patients can be followed up for the development of RA which requires different treatment modalities and carries different prognosis.

The average annual age- and sex-adjusted incidence of PMR aged 50 and older has been quoted as 54.8 per 100,000 population in the USA [18]. There has not been any large scale epidemiological study in the Chinese population. However, in the small number of patients we were able to retrieve from the clinical data analysis and reporting system involving databases in two large public hospitals over an 11-year-period, PMR does not appear to be a common condition in our locality. It remains possible that we are under diagnosing the condition given the lack of awareness at the levels of both patients and doctors and the absence of biomarker to aid clinical diagnosis. Education on the public, carers, and health care professionals is needed to raise awareness of this condition and the associated giant cell arteritis among different rheumatic problems encountered in the elderly so that they can be brought to medical attention earlier in their disease course. In conclusion, our study demonstrated that the spectrum of clinical features of PMR in Chinese patients is similar to that of the Caucasian counterpart. Larger prospective studies are warranted to delineate the role of clinical usefulness of anti-CCP antibodies in the early diagnosis and differentiation of PMR and RA.

Acknowledgment We would like to thank Prof. N.G. Patil for his kind help to furnish the English of this paper.

Disclosures None.

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