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Predictors of inflammatory arthritis among new rheumatology referrals: a cross-sectional study

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Abstract

Objectives: Early diagnosis and treatment of inflammatory arthritis (IA) is essential to optimize disease control. We aimed to identify variables that distinguish IA from non-inflammatory arthropathy by performing a cross-sectional study of rheumatology referral letters and visit records. Further work describes time to assessment and documentation of variables within referral letters.

Methods: We reviewed rheumatology referral letters and new patient visits over a 6-month period. The diagnosis of IA was based on the clinical judgement of the assessing rheumatologist. IA diagnoses included RA, SpAs, unspecified IA, PMR, crystalline arthropathies and remitting seronegative symmetrical synovitis with pitting oedema. Univariate analysis was performed for each variable. Multivariable logistic regression was performed on statistically significant variables.

Results: Of 697 patients referred for arthralgia, 25.7% were diagnosed with IA. Variables predictive of IA included tenderness and swelling on examination and $\geq$1 h of morning stiffness. Increasing arthralgia duration, fatigue and brain fog were negative predictors. The median time from referral to IA diagnosis was 55 days and 20.7% of these patients were seen within 6 weeks. Among referral letters, documentation of arthralgia duration, morning stiffness or joint examination findings was uncommon (31%, 20.5% and 56.7%, respectively).

Conclusion: We identified positive and negative predictors of IA. Referral letters often missed key information required for the triaging process. Future efforts will be directed towards build a triaging tool to improve the referral quality and capture of those patients with IA who need earlier access to rheumatology care.

Lay Summary

What does this mean for patients?

If left untreated, inflammatory arthritis (IA) can lead to irreversible joint damage, disability and decreased quality of life. Rural communities may have more difficulty seeing a rheumatologist and therefore the prompt identification and treatment of these conditions is essential to improve symptoms and reduce complications. To gain insights into the factors that differentiate IA from non-inflammatory arthropathy (joint disease), a study was conducted using rheumatology referral letters and visit records of a rheumatology practice serving a highly rural population. Findings predictive of IA included joint swelling, joint pain and prolonged morning stiffness. In contrast, increasing duration of joint pain, fatigue and brain fog were less likely to be associated with IA. Only one in five patients with IA was assessed within 6 weeks of referral. Factors predictive of an IA were not commonly documented in referral letters. These findings have important implications for improving the triage of rheumatology referrals. This work can streamline the referral process, improve patient access and reduce the time between symptom onset and initiation of treatment, which is particularly important in rural communities.

Keywords: inflammatory arthritis, arthritis, triage and referral.

Key messages

- The majority of patients referred to our rheumatology department for arthralgia did not have inflammatory arthritis.
- Predictors of inflammatory arthritis include joint tenderness/swelling and morning stiffness $\geq$1 h.
- Increasing duration of arthralgia and fatigue or brain fog are negative predictors of inflammatory arthritis.
- Among referral letters, the documentation of key variables was infrequent.

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Introduction

Delays in the diagnosis of inflammatory arthritis (IA) are an important obstacle to achieving optimal disease control and favourable clinical outcomes [1, 2]. It is well established that early initiation of DMARD therapy in RA and PsA is associated with a greater likelihood of disease remission and improved long-term physical function [3, 4]. The ACR and EULAR recommend that patients with suspected RA be assessed by a rheumatologist within 6 weeks of referral. However, distinguishing inflammatory from non-inflammatory arthropathy is not always a straightforward process, and the combination of a high burden of musculoskeletal disease within the population and a shortage of rheumatologists has led to long wait times for initial evaluation [5–8]. Travel distance and further workplace shortages are additional barriers that may reduce access to rheumatology in rural communities [9].

Various strategies have been developed to triage urgent from non-urgent rheumatology referrals, including using a central clinical triage pathway [10–12], pre-appointment screening by a rheumatologist [13] and the National Health Services' (NHS) Early Inflammatory Arthritis pathway. The use of 'rationing by delay' by rheumatology clinics has not been demonstrated to be detrimental to either the mental or physical health of patients with non-urgent conditions (e.g. OA, cervical spondylosis or soft tissue disorders) [14].

Triaging rheumatology referrals using single-page questionnaires has been previously studied. Evaluation of items from the personal history, family history, physical examination, laboratory tests and imaging may guide the assignment of referral urgency [15–18]. Simple screening questionnaires with good diagnostic accuracy have been developed for PsA [19, 20] and the EULAR task force has identified seven variables predictive of RA. The inflammatory arthritides are a diverse range of diseases with heterogeneous presentations [21], and it is unclear if these disease-specific tools can be used to screen the full spectrum of IA. Barbour *et al.* [15] developed an eight-item questionnaire that demonstrated 97% sensitivity and 55% specificity in identifying IA. More recent work by Thompson *et al.* [18] evaluated 696 new rheumatology referrals using a triage tool [the Comprehensive Arthritis Referral Tool (CART)] for the identification of early IA patients. The 19-question CART was reported to have 90.5% sensitivity and 69.6% specificity for identifying early IA; however, the specific diagnoses included under early IA were not defined and the tool is lengthy.

This study aimed to identify variables distinguishing IA from non-inflammatory arthropathy in a large group of new rheumatology patients referred to an academic tertiary care centre serving a highly rural population. Additionally, this study describes the time from referral to assessment and which clinical characteristics were documented within referral letters.

Methods

Patient population

We reviewed all adult patients (≥18 years old) with arthralgia who were referred to the University of Vermont Medical Center (UVMC) Division of Rheumatology and who attended one clinic appointment between 1 January 2019 and 30 June 2019. Patients were excluded if they were transferring care for an existing rheumatologic diagnosis, lacked a referral letter, were self-referred or were referred to the inappropriate department. Duplicated referral letters for the same patient were excluded. Patients were additionally excluded if, following assessment, the patient was diagnosed with any of the conditions listed in Supplementary Table S1, available at *Rheumatology Advances in Practice* online.

Data collection

Data were obtained from the electronic medical record (EMR) and stored in an encrypted Excel file (Office 365 ProPlus version 2016; Microsoft, Redmond, WA, USA). Demographics, referral sources, clinical characteristics, laboratory and imaging results (radiographs, US or MRI) were extracted from the patient's referral letter and documentation associated with the patient's initial rheumatology new-patient visit and/or follow-up visits.

Variable definition

Clinical judgement and existing literature were used to identify the initial set of variables to be examined. Subjective and historical variables included the duration of joint arthralgia, the presence of joint tenderness and swelling on examination, morning stiffness ≥1 h, patient-reported fatigue or brain fog, first-degree relative with an autoimmune disorder, past medical history of psoriasis or IBD. A history of psoriasis or IBD was extracted from the EMR. Laboratory results and imaging variables included elevated CRP, elevated ESR, elevated high-sensitivity CRP (hsCRP), positive RF, positive CCP, ANA titre ≥1:80, presence of human leucocyte antigen B27 (HLA-B27) haplotype or the presence of erosive changes on imaging.

To ensure no relevant data were lost, laboratory results and imaging were included if obtained within 6 months prior to or 1 month after the patient's rheumatology appointment. In case of multiple values for CRP, hsCRP or ESR, the highest value was chosen for the analysis. In the event an undifferentiated inflammatory arthritis was later specified, diagnoses may be used from a follow-up visit up to 3 months following the initial visit. Clinical variables were recorded from either the referral letters or rheumatology new patient visits.

A patient was classified as having an inflammatory or non-inflammatory arthropathy depending on the encounter diagnosis documented by the assessing rheumatologist. The following conditions were considered to be an IA: RA (including seronegative RA), spondyloarthropathy (including AS, PsA, IBD-associated inflammatory arthritis and reactive arthritis), unspecified inflammatory arthritis, PMR, crystalline arthropathies (gout and calcium pyrophosphate deposition disease) and remitting seronegative symmetrical synovitis with pitting oedema (RS3PE). For the purpose of the current study, we included periarthritis as part of inflammatory arthritis. Non-inflammatory causes of arthritis included degenerative conditions (rotator cuff syndrome, OA and degenerative disc disease) and central sensitization syndromes (fibromyalgia or complex regional pain syndrome).

The patient time to assessment was defined as the interval between the referral letter and the initial rheumatology clinic visit.

Statistical analysis

The main analysis identified predictors of IA. Wilcoxon rank sum tests and simple logistic regression were used to test unadjusted associations with IA. Multivariable logistic

regression was performed on variables that were statistically significant ($P < 0.20$) in the unadjusted analyses. First-order interactions of all significant variables were considered. Interactions with a P-value <0.20 were included in the final model. Analysis of missing data was performed. Those variables with high levels of missing lab data were excluded from the multivariable predictive model. All tests were two-tailed. Stata 16.1 (StataCorp, College Station, TX, USA) was used for data management and statistical analysis.

Ethics

The University of Vermont Ethics Committee reviewed and approved this study in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. The committee waived requirements for written consent, as the project was retrospective and did not include patient identifiers.

Results

Patient demographics

A total of 1023 referral letters were submitted to the UVMC Division of Rheumatology between 1 January 2019 and 30 June 2019 (Fig. 1). Of those patients referred, 143 were removed because of a diagnosis of an exclusionary condition following assessment (Supplementary Table S1, available at *Rheumatology Advances in Practice* online), 142 due to a pre-existing rheumatic diagnosis, 8 due to lack of a referral letter, 3 for self-referral and 1 for referral to the incorrect division. A total of 29 duplicated referral letters were excluded. The most common sources of referrals were primary care (85.3%), followed by orthopaedic surgery (4.9%) and dermatology (2.3%) (Supplementary Table S2, available at *Rheumatology Advances in Practice* online).

The demographics of the referred patients are reported in Table 1. The median patient age was 53 years. The majority were female (70.3%), white (94.2%) and overweight (BMI 28.7). Of 697 patients referred to rheumatology with arthralgia, 179 (25.7%) were diagnosed with IA and 518 (74.3%) were diagnosed with non-inflammatory arthropathy following rheumatology assessment. On review of the referral letters of patients who were ultimately diagnosed with IA, 17.9% requested the patients be seen within 10 days.

Following rheumatology assessment, the most common diagnoses associated with IA ($n = 179$) were SpAs (27.5%, including all subtypes), RA (24.6%, including seropositive and seronegative), crystalline arthropathies (23.4%), undifferentiated inflammatory arthritis (16.2%), PMR (12.6%) and RS3PE (3%) (Table 2). The most common diagnoses associated with non-inflammatory arthropathies ($n = 518$) were OA (50.4%), fibromyalgia (20.5%), non-specific non-inflammatory arthralgia (10.6%) and degenerative disc disease (10.6%) (Supplementary Table S3, available at *Rheumatology Advances in Practice* online).

Predictors of IA

Unadjusted analysis identified morning stiffness ≥1 h, the presence of joint tenderness and swelling on examination and past medical history of psoriasis as predictive of a diagnosis of IA (Table 3). Patients with IA had a significantly shorter duration of arthralgia than non-inflammatory arthropathy patients. For each 1 month increase in the duration of a patient's arthralgia, the likelihood of a diagnosis of IA decreased by 12% (Table 3). Fatigue and brain fog were negative predictors of a diagnosis of IA (Table 3). Unadjusted analysis identified inflammatory markers (ESR and CRP) above the upper limit of normal as predictive of IA (Table 3). Similarly, positive RF, positive anti-CCP and erosive changes on imaging were predictive of a diagnosis of IA (Table 3).

Using multivariable analysis, morning stiffness [odds ratio (OR) 9.1 (95% CI 4.4, 18.7)] and the presence of joint tenderness and swelling on examination [OR 3.4 (95% CI 2, 5.9)] remained significant as predictors of IA. The increase in the duration of a patient's arthralgia by 1 month [OR 0.89 (95% CI 0.85, 0.94)] and fatigue or brain fog [OR 0.1 (95% CI 0.02, 0.7)] were confirmed to be negative predictors of IA

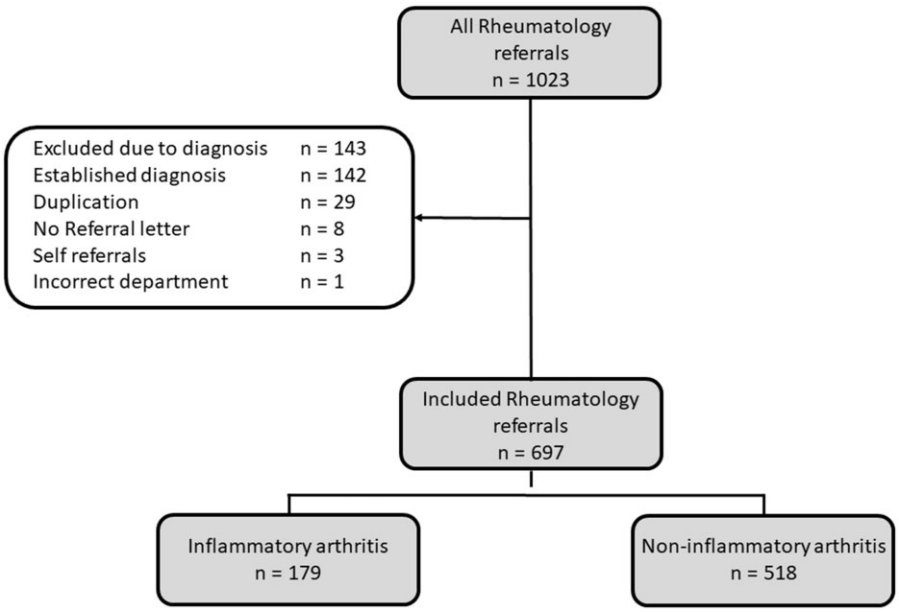

Figure 1. Disposition of patient referrals to UVMC rheumatology between 1 January 2019 and 30 June 2019 and primary outcomes

Table 1. Patient demographics, referral source and priority of patient referrals

Characteristics	Overall ($N = 697$)	IA ($n = 179$)	Non-inflammatory arthropathy ($n = 518$)
Female, *n* (%)	490 (70.3)	96 (53.6)	394 (76.1)
Age, years, median (IQR)	53 (40–64)	59 (45–70)	51 (38–61)
Caucasian, *n* (%)[a]	637 (94.2)	169 (96.6)	468 (93.4)
BMI, median (IQR)[b]	28.7 (24.6–33.7)	28.9 (25.5–33.4)	28.7 (24.3–33.7)
Referred by primary care provider, *n* (%)[c]	595 (85.3)	152 (79.4)	443 (84.0)
Priority per referring provider, *n* (%)[d]			
Routine	629 (92.0)	144 (81.8)	485 (95.5)
3–10 business days	30 (4.4)	16 (9.1)	14 (2.8)
Urgent	25 (3.7)	16 (9.1)	9 (1.8)

IQR: interquartile range.
Race self-reported by patient. BMI is calculated as weight (kg) divided by square of height (m^2). Percentages may not total 100 due to rounding.
[a] Inflammatory, $n = 175$; non-inflammatory, $n = 501$.
[b] Inflammatory, $n = 177$; non-inflammatory, $n = 508$.
[c] Inflammatory, $n = 160$; non-inflammatory, $n = 438$.
[d] Inflammatory, $n = 176$; non-inflammatory, $n = 508$.

Table 2. Diagnoses of patients ($N = 167$) identified as having an IA following a rheumatology appointment

IA diagnosis	*n* (%)
RA	30 (18.0)
Seronegative RA	11 (6.6)
AS	5 (3.1)
PsA	28 (16.8)
IBD-associated IA	3 (1.8)
Reactive arthritis	10 (6.0)
Unspecified IA	27 (16.2)
Crystalline arthropathy (gout or pseudogout)	39 (23.4)
PMR	21 (12.6)
RS3PE	5 (3.0)

(Table 4). A past medical history of psoriasis was not statistically significant on multivariable analysis. Multivariable analysis of laboratory and radiographic findings was not performed due to a high proportion of missing data.

Given the different clinical presentations of crystalline arthropathies (acute to subacute), multivariable analysis was repeated with the exclusion of crystalline arthropathy patients and there was no change in the variables identified (results not presented).

Time to assessment

The median time between the referral letter and initial rheumatology appointment was 8 weeks for patients ultimately diagnosed with IA and 16 weeks for patients diagnosed with non-inflammatory arthropathy. Of all referrals, 10.9% received a rheumatology appointment within 6 weeks. Of the patients ultimately diagnosed with IA, 20.7% were assessed by rheumatology within 6 weeks, while 7.5% of patients with non-inflammatory arthropathy were seen within 6 weeks (Supplementary Table S4, available at *Rheumatology Advances in Practice* online).

Documentation of variables in referral letters

Among referral letters, documentation of the duration of arthralgia or morning stiffness was uncommon (31% and 20.5%, respectively) (Table 5). A joint examination was documented in 56.7% of referral letters. ANA was frequently checked prior to patient referral (48.2%). ESR and CRP were checked in 31.9% and 36.9% of patients, respectively, prior to referral. RF (38.5%), anti-CCP (18.5%) and HLA-B27 haplotype (4.3%) were rarely checked prior to referral. A total of 1.3% of referral letters contained details of appropriate imaging studies (e.g. radiograph, US or MRI).

Discussion

We report that joint pain is the most common reason for referral to rheumatology, and almost three in four of these patients were ultimately diagnosed with a non-inflammatory condition. The presence of joint tenderness and swelling on examination and morning stiffness $\geq$1 h was predictive of IA. An increasing duration of arthralgia and fatigue or brain fog were negative predictors of IA. Elevated acute phase reactants (ESR and CRP), RF positivity, anti-CCP positivity and erosive changes on imaging were predictive of IA on unadjusted analysis, but this was not confirmed on multivariable logistic regression.

The identification of joint tenderness and swelling on examination as a predictive variable for IA is unsurprising. Additionally, with the exception of severe inflammatory OA or septic arthritis, there are few presentations that mimic synovitis. Our findings are consistent with previous studies reporting synovitis as associated with IA [15, 18, 22], however, we acknowledge that the physical exam is a skill not universally consistent, making other aspects of referral information, such as history, more attainable.

Morning stiffness $\geq$60 min for $\geq$6 weeks was used in the 1987 classification of RA, and the duration of morning stiffness is associated with RA disease activity [23, 24]. Morning stiffness has been previously identified as a predictor of IA and is frequently used in referral questionnaires for RA and PsA [15, 18, 19, 22, 25]. In contrast to our findings, a review of 220 patients by Arndt *et al.* [16] did not identify morning stiffness as being associated with either RA or SpAs. Importantly, morning stiffness may be associated with OA and fibromyalgia and is not part of the 2010 ACR/EULAR classification criteria for RA [26]. In the author's experience, however, morning stiffness may help classify joint pain as inflammatory and is easily obtainable by history taking.

Compared with IA, non-inflammatory causes of joint pain have a longer duration of arthralgia; for each additional month of joint pain, the likelihood of a diagnosis of IA decreased by >10%. These findings are consistent with the more acute presentation of the inflammatory arthritides. Previous work reports the onset of symptoms within

Table 3. Clinical characteristics of patients and variables predictive of IA on unadjusted analysis

Category	IA($n=179$)	Non-inflammatory arthropathy ($n=518$)	OR	95% CI	*P*-value
Pain score (0–10), median (IQR)[a]	4 (2–6)	4 (2–6)	–		0.814
Arthralgia duration, weeks, median (IQR)[b]	24 (8–52)	208 (52–520)	–		<0.001
Arthralgia duration increased per month[b]			0.88	0.8, 0.9	<0.001
Evidence of joint tenderness and swelling on examination, *n* (%)[c]	97 (54.2)	17 (3.3)	34.7	19.7, 61.0	<0.001
≥1 h morning stiffness, *n* (%)[d]	77 (51.0)	134 (30.0)	2.4	1.7, 3.5	<0.001
PMHx of psoriasis, *n* (%)	19 (10.6)	23 (4.4)	2.6	1.4, 4.8	0.004
PMHx of IBD, *n* (%)	4 (2.2)	8 (1.5)	1.5	0.4, 4.9	0.543
PMHx of obesity, *n* (%)[e]	79 (44.4)	213 (41.3)	1.1	0.8, 1.6	0.470
First-degree relative with an autoimmune disorder, *n* (%)[f]	34 (19.0)	90 (17.5)	1.1	0.7, 1.7	0.655
Fatigue or brain fog, *n* (%)[g]	62 (35.0)	280 (54.6)	0.4	0.3, 0.6	<0.001
ESR >1, *n* (%)[h]	47 (40.9)	45 (18.1)	3.1	1.9, 5.1	<0.001
ESR >1.5, *n* (%)[h]	36 (31.3)	20 (8.0)	5.2	2.9, 9.5	<0.001
ESR >2, *n* (%)[h]	22 (19.1)	8 (3.2)	7.1	3.1, 16.8	<0.001
CRP >1, *n* (%)[i]	81 (60.5)	73 (24.8)	4.6	3.0, 7.2	<0.001
CRP >1.5, *n* (%)[i]	63 (47.0)	46 (15.6)	4.8	3.0, 7.6	<0.001
CRP >2, *n* (%)[i]	53 (39.6)	34 (11.5)	5.0	3.1, 8.3	<0.001
hsCRP >1, *n* (%)[j]	1 (33.3)	11 (68.8)	0.2	0.01, 3.1	0.268
RF positive, *n* (%)[k]	39 (28.3)	34 (10.6)	3.3	2.0, 5.6	<0.001
Anti-CCP positive, *n* (%)[l]	26 (22.0)	3 (1.3)	20.8	6.1, 70.5	<0.001
ANA ≥1:80, *n* (%)[m]	44 (37.2)	155 (33.3)	1.0	0.6, 1.5	0.939
ANA ≥1:160, *n* (%)[m]	22 (20.2)	64 (18.6)	1.1	0.7, 1.9	0.705
HLA-B27 positive, *n* (%)[n]	9 (52.9)	10 (27.0)	3.0	0.9, 10.1	0.069
Erosive changes on imaging, *n* (%)[o]	43 (38.1)	27 (11.1)	4.9	2.8, 8.6	<0.001

Continuous variables evaluated using the Wilcoxon rank sum test, categorical variables using logistic regression. Obesity defined as a BMI ≥30 kg/m^2. Laboratory results were recorded from routine patient care including: peak ESR, CRP and hsCRP 6 months prior to and 1 month after rheumatology visit. Positive RF, CCP, ANA, HLA-B27 6 months prior to and 1 month after rheumatology visit. ESR, CRP and hsCRP reported as upper limit of normal = 1. Imaging studies include radiographs, US and MRI studies 6 months prior to and 1 month after rheumatology visit. ORs are calculated as associated with a diagnosis of IA. Percentages may not total 100 due to rounding.

[a] Inflammatory, $n=175$; non-inflammatory, $n=497$.
[b] Inflammatory, $n=158$; non-inflammatory, $n=391$.
[c] Non-inflammatory, $n=515$.
[d] Inflammatory, $n=151$; non-inflammatory, $n=446$.
[e] Inflammatory, $n=178$; non-inflammatory, $n=516$.
[f] Non-inflammatory, $n=514$.
[g] Inflammatory, $n=177$; non-inflammatory, $n=513$.
[h] Inflammatory, $n=115$; non-inflammatory, $n=249$.
[i] Inflammatory, $n=134$; non-inflammatory, $n=295$.
[j] Inflammatory, $n=3$; non-inflammatory, $n=11$.
[k] Inflammatory, $n=138$; non-inflammatory, $n=322$.
[l] Inflammatory, $n=118$; non-inflammatory, $n=224$.
[m] Inflammatory, $n=109$; non-inflammatory, $n=345$.
[n] Inflammatory, $n=17$; non-inflammatory, $n=37$.
[o] Inflammatory, $n=113$; non-inflammatory, $n=244$.

12 months as suggestive of IA, but an increasing duration of joint pain has not been previously validated as a variable that negatively predicts IA [18]. This finding is important since it would be feasible for a referring provider to quickly obtain such information and may contribute to a future referral tool.

Fatigue and cognitive symptoms (e.g. difficultly concentrating and brain fog) were negative predictors of IA. Fibromyalgia may be associated with central processing abnormalities, including low mood, unrefreshing sleep, fatigue and cognitive deficits [27, 28]. Identification of this variable in patients may be helpful in the development of future triage tools.

Elevated ESR and CRP are non-specific markers of an inflammatory state that may be seen in autoimmune disease, infection, trauma, ischaemia, malignancy or metabolic syndrome. ESR may increase with age and in females [29, 30]. Twelve patients were referred for evaluation with elevated hsCRP, which is classically a cardiovascular disease risk assessment tool [31]. hsCRP has been previously reported as a marker of RA disease activity, however, we did not identify it as a predictor of IA, perhaps because of the small number of patients [32]. Positive RF and positive anti-CCP were strongly predictive of IA on unadjusted analysis, consistent with previous work [15, 18].

A 'family history of autoimmune disease' is commonly cited by patients as a cause of concern and may prompt a referral to rheumatology. Familial studies support the heritability of RA and PsA [33, 34], however, given the diversity of autoimmune diseases, this study may provide reassurance to patients and primary care doctors that a family history of unspecified autoimmune disease is not necessarily predictive of IA.

The median wait time for evaluation of patients with new IA was 55 days, which is comparable to that in Canada (66 days) and longer than in the UK (33 days) [8, 35]. Given the greater number of rheumatologists per capita in the USA compared with the UK (1/73 000 *vs*. 1/127 000, respectively), this may reflect regional differences in access to services or differences between healthcare systems. Patients with IA were seen quicker than patients with non-inflammatory arthropathy (55 *vs*. 108 days), however, only one in five patients with a new diagnosis of IA were assessed within 6 weeks of their referral. This highlights our current suboptimal referral

Table 4. Predictors of IA on multivariable analysis

Category	OR	95% CI	*P*-value
Age	1.0	0.98–1.02	0.895
Arthralgia duration increased per month	0.89	0.85–0.94	<0.001
Evidence of joint tenderness and swelling on examination	9.1	4.4–18.7	<0.001
≥1 h morning stiffness	3.4	2.0–5.9	<0.001
Fatigue or brain fog	0.1	0.02–0.7	<0.022

Multivariable logistic regression was performed on predictors that were statistically significant on unadjusted analysis.

Table 5. Variables in referral letter at time of referral to rheumatology from primary care provider or subspecialty service

Variable	*n* (%)
Documented duration of arthralgia	216 (31.0)
Documented physical examination of joints	395 (56.7)
Documented duration of morning stiffness	143 (20.5)
Document presence or absence of fatigue or brain fog	635 (91.1)
ESR checked prior to referral	222 (31.9)
CRP checked prior to referral	252 (36.2)
hsCRP checked prior to referral	30 (4.3)
RF checked prior to referral	268 (38.5)
Anti-CCP checked prior to referral	129 (18.5)
ANA checked prior to referral	336 (48.2)
HLA-B27 checked prior to referral	30 (4.3)
Imaging at time of referral	9 (1.3)

screening process and represents an opportunity to improve the referral and triaging process. By standardizing the referral process using a short referral tool and educating primary care providers about predictors of inflammatory disease, we can improve access time for patients with IA.

Only one in four patients referred to outpatient rheumatology for joint pain had IA. A paucity of relevant information within referral letters makes it difficult to appropriately triage IA patients. Referral letters often lack documentation of the duration of arthralgia, morning stiffness or the findings from a joint exam. These findings are consistent with previous smaller studies by other groups [36, 37]. Of 206 rheumatology referral letters reviewed by Graydon and Thompson [36], 47% did not document the duration of the current symptoms, 80% did not document morning stiffness and 64% did not include a joint examination. The absence of documentation may reflect a lack of awareness or education among primary care doctors or it may reflect the high volume of patients seen in primary care clinics, with time constraints affecting documentation quality even if thorough musculoskeletal examinations are performed.

The high frequency of ANA testing despite its lack of correlation with IA is challenging to explain, but we suspect it is related to the possible misunderstanding among primary care providers of the utility of the test as a general screening tool for joint pain of an inflammatory aetiology. A positive ANA may be present in autoimmune conditions, advanced age and malignancy. On a review of 1023 referrals, 33 patients were diagnosed with either SLE, myositis, SS, SSc or UCTD (Supplementary Table S5, available at *Rheumatology Advances in Practice* online). Of 147 general practitioners in their final year of training, 46% reported either being 'not at all confident' or 'lacking confidence' concerning knowledge of IA [38]. Graduating family medicine residents expressed low levels of confidence in the diagnosis of musculoskeletal conditions, and even among experienced rheumatologists there can be disagreements concerning the diagnosis of synovitis [39, 40]. Primary care providers in our area may benefit from rheumatology educational workshops, multidisciplinary patient consultations or educational materials.

The strengths of our study include the large sample size, the detailed assessment of referral information and our rural patient population. Moreover, the patient population was heterogeneous and reflective of the real-life daily rheumatology referral population. We acknowledge the limitations of our work, which used retrospective data restricted to a single centre and had missing laboratory results for many patients, thereby limiting the multivariable regression analysis. Additionally, clinical data was only recorded from either referral letters or initial visits. Data were not captured if clinical signs (e.g. swollen joints) developed at follow-up visits or if IA presented in a patient with presumed non-inflammatory arthritis.

Conclusion

The majority of patients referred to our rheumatology division did not have IA. Predictors of IA included joint tenderness and swelling on examination, prolonged morning stiffness and the duration of arthralgia, but these details were infrequently documented in rheumatology referral letters. Patients with IA were seen sooner than patients with non-inflammatory arthropathy, although only a minority were seen within the target of 6 weeks. These data suggest that a few key aspects of the history and exam are of utmost importance to adequately triage patients in the rheumatology clinic but are often missing. Building on the predictors identified in this study, we aim to create and validate a referral tool to streamline our referral process, improve access and enable rapid diagnosis of patients with new inflammatory arthritis/periarthritis who would benefit from prompt initiation of therapy.

Supplementary material

Supplementary material is available at *Rheumatology Advances in Practice* online.

Data availability

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

Authors' contributions

L.N. and B.T. analyzed and interpreted the data. B.L.T., A.N. and C.C.L. were a major contributors in writing the manuscript. All authors read and approved the final manuscript.

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