Impact of a Rheumatology Consultation Service on the Diagnostic Accuracy and Management of Gout in Hospitalized Patients

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ABSTRACT. ***Objective.*** To determine if a hospital rheumatology consultation service improves diagnostic accuracy and adherence to treatment recommendations for gout.

Methods. This was a retrospective, single-center, case-control study of consecutive hospitalized patients with gout. Demographic, diagnostic, and treatment variables were compared in patients with and without a rheumatology consultation (controls). American College of Rheumatology (ACR) preliminary criteria for the classification of acute gout and the European League Against Rheumatism (EULAR) recommendations were used to determine diagnostic accuracy. Adherence to EULAR drug management recommendations and Quality Indicators for treatment were compared between groups.

Results. In total, 138 patients were studied. The mean (SD) age was 71.3 (13.4) years and 70% were men. Forty-eight (35%) patients had gout on admission, 90 (65%) during their hospital stay, and 8 (6%) had multiple attacks. A total of 79 (57%) patients had a rheumatology consultation. These patients had more joints involved ($p < 0.001$), more frequent synovial fluid analysis ($p < 0.001$), and fulfilled ACR classification criteria more frequently than those who did not have a rheumatology consultation (65% vs 37%; $p = 0.002$). Intraarticular corticosteroid use was more common (44% vs 12%; $p < 0.001$) in patients who were seen by rheumatology. In contrast, colchicine was used more frequently in controls (63% vs 40%; $p = 0.006$). Patients seen by rheumatology were more likely to use nonsteroidal antiinflammatory drugs or colchicine for gout prophylaxis while titrating allopurinol to target ($p = 0.033$).

Conclusion. A rheumatology consultation service for hospitalized patients with gout significantly improved the diagnostic accuracy and adherence to established guidelines for short and longterm treatment. (First Release July 1 2009; J Rheumatol 2009;36:1699–04; doi:10.3899/jrheum.081296)

Key Indexing Terms:
GOUT DIAGNOSIS TREATMENT RHEUMATOLOGY CONSULTATION

Gout is a common cause of acute and chronic arthritis. It affects 1.4% of the population and up to 7% of men over the age of 65 years[1]. Gout is managed almost exclusively by primary care physicians and only 3% of patients are referred to a rheumatologist[2]. However, acute gouty arthritis is a frequent reason for inpatient rheumatology consultation.

The American College of Rheumatology (ACR) preliminary criteria for the classification of acute gout are widely used[3]. Recently, the European League Against Rheumatism (EULAR) published 10 propositions based on expert opinion and evidence-based medicine for the diagnosis of gout[4]. Although there are few randomized trials on the treatment of gout[5,6], consensus statements based on evidence and expert clinical opinion are available. The 2006 EULAR consensus recommendations for the management of acute and chronic gout[6] and a set of 10 "Quality Care Indicators" were derived by consensus review of available evidence[7].

Adherence to published standards for the management of gout has been studied most frequently in primary care[2,8,9]. Less information is available on the frequency and management of gout in hospitalized patients whose care is often complicated by comorbidities and polypharmacy. The potential benefit from involvement of rheumatologists seems obvious, but the literature is bereft of evidence to support this. Thus the objective of our study was to examine the influence of a rheumatology consultation service on the diagnosis and management of gout in hospitalized patients.

MATERIALS AND METHODS

This was a retrospective study of patients with gout documented during admission to the Queen Elizabeth II Health Sciences Centre, Halifax, Nova Scotia, between April 1, 2004, and March 31, 2006. Patients seen in consultation by one of 8 rheumatologists and those managed by nonrheuma-

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tology admitting teams without rheumatology consultation were identified through the decision support department of our hospital. Data were collected by chart review using a standardized case-record form and included patient demographics, admitting diagnosis, medication history, and major comorbidities including hypertension, coronary artery disease, diabetes and renal impairment. The diagnosis of gout was based on the ACR preliminary criteria for the classification of acute gout[3] and EULAR recommendations[4]. Compliance with EULAR-recommended treatment propositions[6] and quality of care indicators[7] was identified. Only the propositions that could be operationalized were included. The fourth and fifth EULAR diagnostic propositions were not included as they pertain to the search for urate crystals in all inflamed joints and in noninflamed joints during intercritical periods of gout. In addition, quality indicators 4 and 8[7] were not included, as they pertain to asymptomatic hyperuricemia and lifestyle recommendations, which were not identified in this retrospective study. The type and dose of medication used to treat acute gout were recorded. The study protocol was approved by the Capital Health Research Ethics Board, Halifax, Nova Scotia.

Statistical analysis. The information was entered into a database written in Access 2000 and exported to SAS version 9.1 for analysis. Descriptive statistics were used to characterize the patient populations, with summary data expressed as mean and standard deviation. When variables were not documented in the chart, the denominator was adjusted in the analysis. Differences between groups were analyzed by Wilcoxon rank-sum test (continuous variables) and chi-square test or Fisher's exact test (categorical variables). P values ≥ 0.05 are reported as not significant (NS). An adjusted p value to account for multiple comparisons was derived for the diagnostic (p = 0.004) and treatment (p = 0.003) variables.

RESULTS

Patients. One-hundred fifty patients were identified and 138 were included in the study. Eleven patients were excluded as they did not have a diagnosis of gout and one chart was unavailable for review. In 6 patients with more than one admission complicated by gout only data from the first admission were included to avoid bias in data collection.

The mean age was 71.3 (SD 13.4) years and the male:female ratio was 92:46. Forty-five (32.6%) patients had acute gout on admission to hospital and 3 had chronic tophaceous gout without active joint disease. The remaining 90 (65.2%) patients developed acute gout during their hospital stay. Eight (5.8%) patients had more than one episode of gout during their hospital stay.

Seventy-nine patients (57.2%) were seen by the rheumatology consultation service and 59 (42.8%) were not. There were no differences between the 2 groups with respect to baseline comorbidities such as hypertension, coronary artery disease, congestive heart failure, diabetes, and renal failure (Figure 1). Baseline medications were similar between groups (Table 1). Sixty-seven percent (93/138) of patients were taking a diuretic at the time of admission. Patients consulted to rheumatology had a higher number of involved joints compared to those who did not have a consultation [3.8 (4.3) vs 1.9 (2.0), respectively; p < 0.001] and both groups of patients were equally likely to have had a previous diagnosis of gouty arthritis [50/78 (64.1%) seen by rheumatology and 39/50 (78.0%) controls].

Diagnosis of gout. Patients consulted to rheumatology were more likely to meet preliminary ACR criteria for the classification of acute gout[3] [51/79 (64.6%) patients versus 22/59 (37.3%) controls; p = 0.002]. Only 5 (3.6%) patients had a clinical description of recurrent podagra in the setting of hyperuricemia, but 65 (47.1%) patients had a classical description of an acute attack with rapid development of pain, swelling, and overlying erythema developing over 6–12 hours; however, there was no difference between groups in the frequency of these clinical events (Table 2).

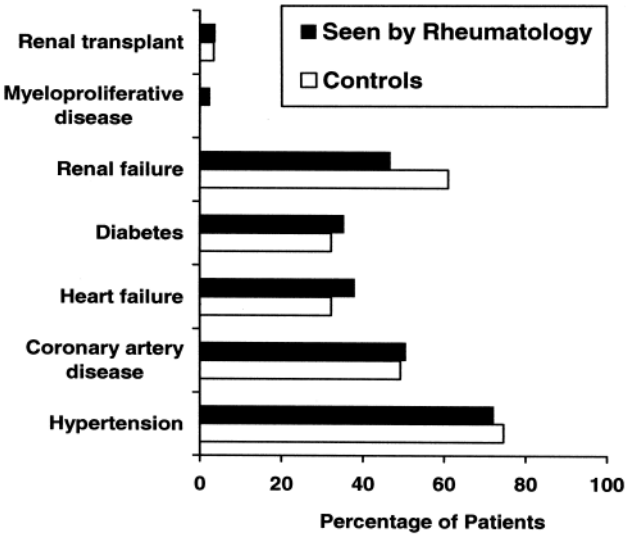

Figure 1. There were no statistically significant differences in the frequency of risk factors for gout and comorbidities between patients seen by a rheumatology consult service compared to patients not seen by rheumatology (controls).

Patients seen by rheumatology were more likely to have synovial fluid analysis [41/79 (51.9%) vs 11/59 (18.6%) controls; p < 0.001]. Thus these patients were more likely to have had a definitive diagnosis of gout as defined by urate crystals in synovial fluid [32/79 (40.5%) vs 11/59 (18.6%) controls; p = 0.006], and to have had a gram-stain and culture performed to exclude septic arthritis [35/79 (44.3%) vs 11/59 (18.6%) controls; p = 0.002][4]. Patients consulted to rheumatology were also more likely to have had documentation of serum urate levels [68/79 (86.1%) vs 40/59 (67.8%) controls; p = 0.010; Table 2]. There was no difference between groups in the mean serum urate [501.0 (SD 167.0) μmol/l in patients seen by rheumatology vs 476.9 (SD 170.0) μmol/l in controls]. Only one patient consulted to rheumatology had renal uric acid excretion documented. Radiographs were obtained in nearly half of the cases, with comparable representation between the 2 groups, and only 12 showed findings in keeping with gout, with no difference between groups (Table 2).

Although a high burden of disease was seen in both groups with respect to risk factors for gout and comorbidities, no statistically significant differences were observed between them (Table 2).

Table 1. Medications on admission for patients with gout seen by rheumatology service and controls.

Variable	Seen by Rheumatology		p
	No = 59, n (%)	Yes = 79, n (%)	
Diuretics	42 (71.2)	51 (64.6)	0.411
Colchicine	2 (3.4)	9 (11.4)	0.116*
NSAID			
Nonselective COX inhibitor	5 (8.5)	5 (6.3)	0.744*
COX 2 inhibitor	2 (3.4)	4 (5.1)	1.000*
ASA	28 (47.5)	43 (54.4)	0.418
Corticosteroids	4 (6.8)	9 (11.4)	0.359
Azathioprine	1 (1.7)	1 (1.3)	1.000*
Allopurinol	15 (25.4)	15 (19.0)	0.365
Losartan	3 (5.2)	2 (2.5)	0.650*
Fenofibrate	2 (3.5)	1 (1.3)	0.574*

* Fisher's exact test. NSAID: nonsteroidal antiinflammatory drug; COX: cyclooxygenase; ASA: acetylsalicylic acid.

Table 2. Compliance with the European League Against Rheumatism (EULAR) diagnostic propositions for gout[4] in hospitalized patients with gout seen by rheumatology service compared to controls. EULAR propositions 4 and 5 were not included as they recommend searching for crystals in all joint aspirates and in noninflamed joints during intercritical periods, respectively.

EULAR Diagnostic Propositions	Variable	Seen by Rheumatology		p
		No = 59, % (n)	Yes = 79, % (n)	
1. "In acute gout the rapid development of severe pain, swelling, and tenderness that reaches its maximum in 6–12 hours especially with erythema is highly suggestive of gout..."		25 (42.4)	40 (50.6)	0.336
2. "For typical presentations such as recurrent podagra with hyperuricemia, a clinical diagnosis alone is reasonably accurate..."		2 (3.4)	3 (3.8)	1.000*
3. Demonstration of urate crystals permits a definitive diagnosis of gout	Synovial fluid analyzed	11 (18.6)	41 (51.9)	< 0.001
	Crystals present	11 (18.6)	32 (40.5)	0.006
6. Was a Gram stain or culture done?		11 (18.6)	35 (44.3)	0.002
7. Was serum urate level done?	Serum urate	40 (67.8)	68 (86.1)	0.010
	Mean serum urate μmol/l	476.9 ± 170.0	501.0 ± 167.0	0.547
8. Was renal uric acid excretion documented?		0	1 (1.3)	1.000*
9. Were radiographs taken?	Radiograph	25 (42.4)	41 (52.0)	0.268
	Findings in keeping with gout	2 (8.0)	10 (24.4)	0.113*
10. Risk factors and comorbidities should be assessed	Hypertension	44 (74.6)	57 (72.2)	0.543
	Hyperglycemia	18 (30.5)	28 (35.4)	0.543
	Hyperlipidemia	22 (37.3)	26 (33.0)	0.593
	Obesity	22 (37.9)	26 (33.8)	0.617

* Fisher's exact test.

Management of acute gout. Rheumatology consultation resulted in changes in treatment in 71/79 (89.9%) patients. Significantly fewer patients in the group who had a rheumatology consultation were treated with either colchicine or a nonsteroidal antiinflammatory drug (NSAID) [35/79 (44.3%) seen by rheumatology vs 44/59 (74.6%) controls; p < 0.001; Table 3]. The average daily dose of colchicine was 1.3 (SD 1.0) mg in the group seen by rheumatology compared to 1.8 (SD 1.5) mg in the control group. Patients seen by rheumatology were more likely to receive an intraarticular corticosteroid injection for acute gout [35/79 (44.3%) vs 7/59 (11.9%) controls; p < 0.001; Table 3]. Overall, 11 of 79 (13.9%) patients were treated with an NSAID in the presence of a contraindication (6 in the group seen by rheumatology and 5 in the control group): 8 had renal failure, one had a recent gastrointestinal bleed, one had significant heart failure, and one had > 2 contraindications.

Management of chronic gout. On admission, 30 patients were taking allopurinol (15 in each group). Eight of 79 (10.1%) patients consulted to rheumatology and 13/59 (22.0%) controls were taking allopurinol at the time of their acute gout in hospital, and 9 patients had allopurinol stopped in hospital prior to their attack, with no significant difference between groups. Allopurinol was started in hospital in 12 patients [10/79 (12.7%) who were seen by rheumatology and 2/59 (3.4%) controls; p = nonsignificant]. Five patients started on allopurinol while in hospital were given prophylaxis with colchicine (4 seen by rheumatology and one con-

Table 3. Concordance with European League Against Rheumatism (EULAR) propositions for management of gout[6] in hospitalized patients seen by a rheumatology service compared to controls. EULAR propositions 1–3 were not included as they could not be assessed in a retrospective study.

EULAR Management Propositions	Seen by Rheumatology		p
	No = 59, n (%)	Yes = 79, n (%)	
4. Was an NSAID or oral colchicine used first?	44 (74.6)	35 (44.3)	< 0.001
Used in presence of a contraindication?	5 (8.5)	6 (8.6)	1.000
5. Was oral colchicine used?	37 (62.7)	31 (39.2)	0.006
Used at low dose?	27 (73.0)	27 (87.1)	0.151
Colchicine daily dose, mg	1.8 ± 1.5	1.3 ± 1.0	0.070
6. Intraarticular steroid	7 (11.9)	35 (44.3)	< 0.001
7. Documentation that urate-lowering drug would be prescribed in patients with recurrent attacks, tophi, or radiographic changes?	26/40 (65.0)	46/57 (80.7)	0.082
8. Documentation that urate-lowering drug would be titrated to achieve a goal urate level?	8 (30.8)	24 (53.3)	0.066
9. Was allopurinol used as a urate-lowering drug (or plan to start?)	26 (44.1)	45 (78.9)	0.134
10. Uricosuric agents prescribed	0	2* (2.5)	0.507*
11. Prophylaxis against acute attacks during the first month of urate-lowering therapy?	5/17 (29.4)	23/38 (60.5)	0.033
12. Was patient on a diuretic at the time of the attack?	40 (67.8)	50 (63.3)	0.583
Was the diuretic stopped?	6 (15.0)	4 (8.0)	0.330
Was the patient on losartan?	4 (6.8)	2 (2.5)	0.402*
Was the patient on a fenofibrate?	1 (1.7)	1 (1.3)	1.000*

* One patient was taking probenecid with a plan to start allopurinol at a later date and a second was taking sulfinpyrazone. * Fisher's exact test. NSAID: nonsteroidal antiinflammatory drug.

trol), and one patient seen by rheumatology was taking prednisone at the time allopurinol was started. Two patients seen by rheumatology and one patient in the control group had documented flares after starting allopurinol in hospital; however, none were on prophylaxis to prevent gouty flares at the time of starting allopurinol[6,7].

Appropriate urate-lowering therapy was started either during admission or following discharge as per a documented plan in both groups of patients [46/57 (80.7%) patients seen by rheumatology and 26/40 (65.0%) controls; Table 3]. Allopurinol was the drug of choice in the majority of cases [45/57 (79%) patients seen by rheumatology vs 26/40 (65%) controls]. There was no significant difference in the mean allopurinol dose used in either group [98.3 (SD 70.1) mg/day in the group seen by rheumatology vs 113.3 (SD 48.1) mg/day in the control group). No patient was started on an inappropriately high dose of allopurinol based on renal function (Tables 3 and 4). Only 2 patients, both seen by rheumatology, had uricosuric agents prescribed (Table 3); one was treated with probenecid to delay excretion of an antibiotic with a plan to institute allopurinol at a later date; the second was treated with sulfinpyrazone (Table 4).

Prophylaxis when starting allopurinol was recommended or started in 23/38 (60.5%) patients seen by rheumatology compared to only 5/17 (29.4%) cases in the control group (p = 0.033; Table 3). Patients seen by rheumatology were also more likely to have allopurinol titrated to target serum urate concentrations, although this group difference did not reach statistical significance (Table 3). There was more frequent documentation of a plan to check serum urate within 6 months in patients consulted to rheumatology [24/45 (53.3%) vs 4/26 (15.4%) controls; p = 0.001; Table 4].

Only 10 patients had diuretics stopped after the diagnosis of gout, with no difference between groups (Table 3).

DISCUSSION

Gout is a common disorder and in outpatient populations is frequently managed by primary care physicians[10]. Studies[2,8,9,11] suggest that despite recent consensus recommendations on the diagnosis and treatment of gout, the disease continues to be poorly managed. Much of this work has been done in primary care settings and very little information is available on the management of this disorder in hospitalized patients.

In contrast to outpatient populations, experience suggests that management of gout in hospitalized patients is frequently performed by rheumatologists. Our hypothesis was that involvement of a rheumatology service in the care of hospitalized patients with gout would improve diagnostic accuracy and management of this disorder compared to usual care (i.e., without rheumatology input). The results of our retrospective review provide evidence to support this hypothesis.

The "gold standard" for the diagnosis of acute gout is the presence of urate crystals in synovial fluid aspirated from a clinically inflamed joint. Although ideal, this is not always an attainable goal. For example, Petersel and Schlesinger found that only 25% of 184 hospitalized patients with gout underwent diagnostic arthrocentesis[12]. In our study, rheumatologists were more likely to perform arthrocentesis

Table 4. Compliance with Quality Indicators for gout management[8] in hospitalized patients seen by rheumatology service and controls. Quality Indicators 4 and 8 were not included as they pertain to asymptomatic hyperuricemia and lifestyle recommendations that were not identified in this retrospective study.

Quality Indicator	
1. If estimated creatinine clearance < 50 ml/min then initial daily dose of allopurinol should be < 300 mg/day	No patient in either group was started on a higher dose
2. If on allopurinol and concomitant azathioprine then dose of these agents should be adjusted	No patients were taking both agents concomitantly
3. Prophylactic anti-inflammatory medication should be prescribed in absence of a contraindication if allopurinol is prescribed	5/17 (29.4%) controls versus 23/38 (60.5%) of those seen by rheumatologists (p = 0.033)
5. If a patient had a history of nephrolithiasis or significant renal impairment then allopurinol rather than a uricosuric agent should be prescribed	No patients in either group were inappropriately prescribed a uricosuric agent
6. If a patient has hyperuricemia and gouty arthritis with any of the following (1) tophaceous gout (2) gouty erosive changes on radiographs, or (3) > 2 gout attacks per year they should be offered urate-lowering therapy	No difference between groups in the number of patients who met these criteria (12/19, 63.2% of controls and 28/39, 71.2% of patients seen by rheumatologists); of these, 10 (83.3%) controls and 25 (89.3%) of those seen by rheumatology were offered urate-lowering therapy (p = nonsignificant)
7. If a patient is given urate-lowering therapy, the serum urate level should be checked in 6 months	Four (15.4%) patients in the control group compared to 24 (53.3%) of those seen by rheumatology had a plan to check serum urate level (p = 0.001)
9. If a patient has gouty arthritis and does not have renal failure or peptic ulcer disease then they should be treated with an antiinflammatory (NSAID colchicine, steroid)	Thirty-seven patients (46.6%) seen by rheumatology and 19 controls (32.2%) had at least one contraindication to antiinflammatory medication (p = NS). Fourteen patients seen by rheumatology and 12 controls were treated with an NSAID for acute gout (p = NS)
10. If a patient receives longterm prophylaxis with colchicine and has renal failure the CBC and CK should be checked every 6 months	No patient with an estimated creatinine clearance < 50 ml/min was prescribed longterm colchicine

CBC: complete blood count; CK: creatine kinase.

(51.9% vs 18.6% of controls; p < 0.001), leading to greater diagnostic accuracy. The diagnostic accuracy of the preliminary ACR criteria for classification of acute gout was recently evaluated by Malik, *et al*, who found 70% sensitivity and 78.8% specificity using the results of synovial fluid analysis as the gold standard[13]. There are likely a variety of reasons why arthrocentesis is not performed in hospitalized patients, including physician comfort and expertise with the procedure and patient preference. Our own practice is to perform arthrocentesis whenever possible to confirm the diagnosis of gout and to exclude other possible causes of acute synovitis, especially infection.

Other diagnostic tests include serum urate concentrations and conventional radiography. Although urate level may be normal during acute gout[14], it should be measured to guide the titration of urate-lowering therapy if indicated. In our study rheumatologists were more likely to order measurement of serum urate level compared to nonrheumatologists; and overall the measurement of serum urate level was higher than in the Petersel and Schlesinger study of hospitalized patients with gout, where only 27% had documented serum urate levels[12]. Conventional radiographs are rarely helpful in diagnosing acute gout, especially early in the disease course[4].

The inpatient population in our study had a higher burden of comorbidity compared to populations of nonhospitalized patients with gout[2,8]. This translates into a higher risk of drug toxicity with the use of agents commonly prescribed for gout including NSAID and colchicine. In view of this risk profile, intraarticular corticosteroid injection may be the most appropriate and effective treatment for acute gout in such patients[15]. Rheumatologists in our study were more likely to use this treatment modality compared to nonrheumatologists. Although this may reflect differences in specific joint involvement, a more likely explanation is that nonrheumatologists were less comfortable performing arthrocentesis.

Colchicine was more likely to be prescribed in patients seen by nonrheumatologists. Although a recent systematic review concluded that colchicine is one of the only agents with evidence of effectiveness for treatment of acute gout, every patient treated at the recommended dose of 1 mg initially, then 0.5 mg every 2 hours until resolution of pain, developed toxicity and less than half achieved relief of pain prior to developing toxicity[16,17]. Thus, this therapeutic regime may not be the appropriate choice in hospitalized patients considering their age and the high burden of comorbid disease. Alternatively, lower total doses of colchicine (i.e., 1.8 mg) may be as effective as high doses (4.8 mg) for treatment of acute gout with less toxicity, as supported by a recent randomized trial[18].

Allopurinol was the most commonly recommended or prescribed urate-lowering therapy for management of chronic gout in our study, in keeping with other reports[2,9]. Although the optimal dose of allopurinol in renal insufficiency is not known, both the EULAR guidelines[6] and the

Quality Indicators for gout management[11] suggest that the dose of allopurinol should be adjusted in patients with renal insufficiency to minimize the potential for toxicity. We did not observe inappropriately high dosing in the setting of renal failure, as reported previously[19]. Current guidelines[6,7] recommend prophylactic antiinflammatory agents while increasing the dose of allopurinol to achieve a serum urate level < 360 μmol/ml[20]. Patients seen by a rheumatologist in our study were more likely to be treated with a prophylactic agent and to have a plan to repeat serum urate determinations within a reasonable timeframe. Unfortunately, a number of patients who were started on allopurinol while in hospital had gout flares. The current guidelines[6,7] do not specify an optimal time for institution of urate-lowering therapy. We would suggest that institution of allopurinol during hospitalization is not appropriate in the majority of cases.

There are a number of limitations to our study. First, the retrospective study design precluded assessment of lifestyle modification recommendations, patient and physician compliance with treatment recommendations after hospital discharge, and time to resolution of gout attacks. Second, the multiple rheumatologists involved in the consultation service and the lack of formal diagnostic and treatment protocols could potentially have resulted in variability in treatment strategies. However, we did not observe significant practice variability and the influence of a consultation service rather than a single rheumatologist is closer to what occurs in clinical practice. Third, as a high number of patients had a previous diagnosis of gout, this may have led to less rigorous investigations of subsequent episodes of acute joint inflammation. Finally, the lack of blinding may have biased our assessment of outcomes, although these were defined prior to the start of the study and utilized internationally accepted criteria for diagnosis and treatment of gout. Further, evaluation of both diagnosis and management of gout in our patient cohort contrasts with many previous studies, in which either diagnosis or treatment was examined in isolation[2,8].

Although a prospective randomized study would best address the question of whether involvement of a rheumatology service improves the management of gout in hospitalized patients, our data suggest that such involvement has a significant beneficial effect on diagnostic accuracy and adherence to established treatment guidelines. Certainly, not all guidelines were followed by individual rheumatologists and thus the introduction of a formal protocol or "care map" in suspected cases may improve the diagnostic accuracy and minimize inappropriate treatment in this patient population.

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