Application of Murtagh' s Safe Diagnostic Strategy in General Practice Teaching Clinics: A Case Study of Polymyalgia Rheumatica (Postprint)

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Abstract

The Murtagh safe diagnostic strategy, proposed by renowned Australian general practice expert John Murtagh, is gradually being adopted by general practitioners for clinical diagnosis and treatment. It is primarily employed for preliminary diagnosis of common diseases, rapid identification of critical conditions, analysis and determination of whether easily overlooked diseases exist that may cause certain symptoms/signs, while also understanding patients' concerns and expectations. The general practice teaching clinic represents an important training method for cultivating clinical thinking among general practitioners and enhancing their diagnostic and therapeutic capabilities. This article uses a patient with polymyalgia rheumatica (PMR) as a teaching case, applying the Murtagh safe diagnostic strategy to dissect diagnostic and therapeutic reasoning, combined with literature analysis of the diagnosis and treatment process and summarization of clinical experience, to guide general practitioners in thinking about disease diagnosis and treatment from multiple dimensions, train general practice residents in general practice clinical thinking, improve the level of PMR diagnosis and treatment, and achieve the teaching objectives.

Full Text

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Abstract

The Murtagh safe diagnostic strategy, proposed by renowned Australian general practitioner John Murtagh, has been gradually adopted by general practitioners for clinical diagnosis and treatment. It is primarily used for initial diagnosis of common diseases, rapid identification of critical conditions, analysis and judgment of easily overlooked diseases that may cause certain symptoms/signs, and understanding patient concerns and expectations. The general practice teaching clinic represents an important training method for developing clinical reasoning and enhancing diagnostic and therapeutic capabilities among general practitioners. This article presents a teaching case of a patient with polymyalgia rheumatica (PMR), applying Murtagh' s safe diagnostic strategy to analyze the diagnostic and therapeutic thought process. By combining literature review with analysis of the clinical course and summarization of diagnostic and treatment experience, this study guides general practitioners to approach disease diagnosis and treatment from multiple dimensions, trains general practice residents in clinical reasoning, and improves PMR diagnostic and treatment competency to achieve educational objectives.

Keywords: Murtagh safe diagnostic strategy; General practice teaching clinic; General practice residents; Polymyalgia rheumatica

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Introduction

Murtagh' s safe diagnostic strategy, developed by the distinguished Australian general practice expert John Murtagh, has proven highly practical in clinical practice for improving diagnostic accuracy and reducing missed and misdiagnosis. The strategy encompasses five key diagnostic considerations [**?**, **?**]: (1) What common diseases present with these symptoms or signs? (2) What important conditions must not be overlooked? (3) What etiologies are easily missed? (4) Does the patient have a potentially masked condition? (5) What other unstated issues might the patient have?

Polymyalgia rheumatica (PMR) is an idiopathic inflammatory condition with significant regional variation in prevalence. Between 2000 and 2014, the incidence among individuals aged $ $50 years in Olmsted County, USA, was approximately 63.9 per 100,000 [**?**]. Currently, no epidemiological data are available for China [**?**]. PMR pathogenesis is associated with infection, genetics, immunity, and inflammation, predominantly affecting individuals over 50 years of age, with incidence rates rising annually in recent years. The clinical manifestations of PMR are diverse yet lack specific laboratory markers or pathological features, making it susceptible to misdiagnosis or missed diagnosis. Domestic research

has shown that when PMR patients initially present to non-rheumatology departments, specialists tend to focus on conditions within their own field, leading to misdiagnosis as periarthritis of shoulder, cervical spondylosis, osteoporosis, or lumbar disc herniation, with a misdiagnosis rate as high as 68.0% [**?**]. Elderly patients often have multiple comorbidities, and concurrent conditions such as osteoporosis, cervical/lumbar degenerative disease, inflammatory disorders, infections, and malignancies can obscure the clinical picture, complicating definitive diagnosis.

This article demonstrates how the Murtagh safe diagnostic strategy was applied in a general practice teaching clinic to a PMR case, training residents in clinical reasoning and guiding them through a systematic process to arrive at the final diagnosis and treatment plan.

Teaching Methods

1.1 Participants Six general practice residents undergoing standardized residency training at the General Practice Residency Training Base of Fuxing Hospital, Capital Medical University.

1.2 Educational Objectives

(1) To guide general practice residents in diagnosing and managing PMR using the Murtagh safe diagnostic strategy, with myalgia as the entry point, thereby training their clinical reasoning skills; (2) To instruct residents on PMR treatment and follow-up protocols.

1.3 Teaching Setting and Process The teaching clinic utilized one dedicated general practice consultation room equipped with a handwashing station, computer, examination table, physician and patient chairs, stethoscope, film viewing light, height and weight scale, flexible tape, ophthalmoscope, otoscope, sphygmomanometer, thermometer, and tongue depressors. An adjacent independent teaching assessment room was equipped with one-way mirrors and audio/video recording systems for teaching observation and discussion. The teaching clinic content and flow are illustrated in Figure 1 [Figure 1: see original paper].

Case Presentation

Chief Complaint Bilateral shoulder, neck, and hip muscle pain with morning stiffness for over two months.

History of Present Illness The patient, a 66-year-old female, developed bilateral neck and scapular muscle stiffness and pain upon awakening approximately two months prior. She experienced mild limitation in raising her upper limbs. Two to three days later, hip muscle stiffness and pain emerged, though squatting and stair climbing remained unrestricted. No wrist or interphalangeal

joint pain or swelling occurred, and no weakness or muscle redness, warmth, or swelling were noted. She self-administered diclofenac with temporary pain relief, but symptoms recurred within 48 hours. Ten days before presentation, an electrocardiogram at an external hospital showed sinus rhythm at 65 beats/min with ST-segment changes; cardiac enzymes were normal. She was referred to rehabilitation medicine where "fasciitis" was suspected; physical therapy provided minimal improvement. Throughout the disease course, she denied fever, worsening weakness, or muscle atrophy. Her mental status was fair, though sleep was disturbed by pain. Bowel and bladder functions were normal.

Physical Examination Vital signs: temperature 36.1°C, pulse 70 beats/min, respiratory rate 16 breaths/min, blood pressure 104/68 mmHg. Height 1.60 m, weight 50 kg, BMI 19.5 kg/m^2, waist circumference 74 cm, hip circumference 90 cm. The patient was alert with clear speech, no cyanosis of lips, and midline tongue protrusion. Pulmonary examination was unremarkable. The apical impulse was located 0.8 cm medial to the left midclavicular line at the 5th intercostal space; cardiac borders were normal, heart rate 70 beats/min with regular rhythm, and no pathological murmurs. Abdominal examination was normal; hepatojugular reflux sign was negative. No jugular venous distention, enhanced or diminished pulsation, or tenderness was observed in head and neck arteries. No lower extremity edema was present. No fixed tender points were identified in neck, scapular, or hip muscles. The spine was non-tender with normal mobility.

Auxiliary Investigations Laboratory and imaging results are presented in Table 1 .

Diagnostic Reasoning Using Murtagh' s Safe Diagnostic Strategy

3.1 What Common Diseases Present with These Symptoms? The patient' s presentation of neck, shoulder, and hip muscle stiffness and pain commonly occurs in conditions such as fasciitis, cervical spondylosis, periarthritis of shoulder, lumbar disc herniation, osteoporosis, cervical/lumbar degenerative disease, and inflammatory or infectious diseases. Differential diagnostic features are summarized in Table 2 [**?**, **?**].

3.2 What Important Conditions Must Not Be Overlooked?

3.2.1 Acute Cardiovascular and Cerebrovascular Events Sudden severe pain or new-onset neck-shoulder pain in elderly patients may herald acute cardiovascular or cerebrovascular events. Age-related sensory decline can blunt pain perception. Unprecedented severe pain, particularly accompanied by intense headache, chest pain, dyspnea, diaphoresis, motor deficits, or dizziness, warrants consideration of cerebral hemorrhage, brain tumors, hypertension, angina, or myocardial infarction. Sudden worsening or nocturnal awakening due to

neck-shoulder pain, or changes in pain location or associated symptoms, may represent prodromal manifestations of cerebrovascular disease.

3.2.2 Brain Injury and Intracranial Pathology Neck-shoulder pain accompanied by psychiatric or neurological symptoms or convulsions suggests brain injury or intracranial lesions, which may present with altered consciousness, coma, or paralysis. Convulsions generally indicate intracranial disease or tetanus.

3.2.3 Trauma-Related Neck-Shoulder Pain Severe neck-shoulder pain following trauma may indicate cervical fracture, dislocation, or cervical-shoulder sprain.

3.2.4 Malignancy Cervical spine tumors can cause progressive neck-shoulder pain with limb numbness. Certain malignancies present with musculoskeletal pain, typically accompanied by additional clinical manifestations.

3.3 What Diseases Are Easily Missed? Potentially missed conditions are listed in Table 3 [**?**].

3.4 Does the Patient Have a Potentially Masked Condition?

3.4.1 Systemic Lupus Erythematosus (SLE) SLE is characterized by positive multiple autoantibodies and multi-system organ involvement including skin, joints, serosa, heart, kidneys, central nervous system, and hematologic system [**?**]. Early disease may involve only one organ with positive autoantibodies (especially antinuclear antibodies, ANA). Clinical manifestations are variable, with simultaneous or sequential multi-organ involvement. Common precipitating factors include infection, sun exposure, and emotional stress. Initial symptoms most frequently include fever, arthritis (pain), fatigue, and weight loss; other common manifestations include skin lesions, polyserositis, renal involvement, hematologic abnormalities, gastrointestinal symptoms, and central nervous system damage.

3.4.2 PMR and Giant Cell Arteritis (GCA) PMR predominantly affects elderly individuals, presenting with bilateral symmetrical pain and stiffness in scapular, pelvic girdle, and neck muscles, markedly elevated ESR, and nonspecific systemic symptoms. The etiology remains unclear, generally follows a benign course, and shows strong age association with rare occurrence before age 50. Women are affected 2-3 times more frequently than men, and glucocorticoid therapy yields dramatic improvement. PMR is closely associated with GCA, and the two conditions frequently coexist. PMR patients requiring evaluation for concurrent GCA include those with poor response to low-dose steroids, temporal artery distention with enhanced or diminished pulsation or

tenderness, and accompanying headache, scalp pain, or visual abnormalities. Temporal artery color Doppler ultrasound, angiography, or biopsy should be performed [**?**].

3.5 What Other Unstated Issues Might the Patient Have? Through communication, the patient expressed concerns about persistent myalgia and poor response to analgesics, questioning whether she had a rare or complex disease and even suspecting bone cancer or leukemia. She hoped for prompt clarification of the etiology, pain relief, and return to normal life.

Diagnosis and Treatment

4.1 Key Diagnostic and Therapeutic Points A 66-year-old female presented with bilateral shoulder, neck, and hip muscle pain and morning stiffness for over two months, with poor response to NSAIDs. Community laboratory tests showed elevated ESR and CRP, negative RF, and negative tumor markers. PMR was suspected and the patient was referred to rheumatology. Rheumatology investigations (Table 4) supported a diagnosis of PMR. She received an intramuscular injection of compound betamethasone 1 mL (betamethasone dipropionate 5 mg plus betamethasone sodium phosphate 2 mg), with rapid response—self-reported 80% pain reduction within 24 hours—confirming PMR. Oral glucocorticoids were initiated the following day.

4.2 PMR Diagnostic Criteria Currently employed classification criteria include Healey's criteria (1984) and the 2012 American College of Rheumatology (ACR)/European League Against Rheumatism (EULAR) criteria. Diagnosis relies primarily on clinical experience and exclusion of other conditions.

4.2.1 Healey' s Classification Criteria (1984)

(1) Pain lasting $ $1 month involving at least two of the following regions: neck, shoulders, and pelvic girdle; (2) Morning stiffness >1 hour; (3) Rapid response to prednisone (<20 mg/day); (4) Exclusion of other diseases causing musculoskeletal symptoms; (5) Negative ANA and RF; (6) Age >50 years; (7) ESR >40 mm/h. Fulfillment of all seven criteria establishes a PMR diagnosis.

4.2.2 2012 ACR/EULAR Classification Criteria These criteria are presented in Table 5 . Diagnostic sensitivity and specificity are 68% and 78%, respectively, without ultrasound findings; with ultrasound, sensitivity is 66% and specificity 81%. Overall specificity ranges from 57.7% to 81.5% and sensitivity from 68% to 92.6% [**?**], providing good discriminatory ability to differentiate PMR from rheumatoid arthritis, shoulder osteoarthritis, and myopathy [**?**].

PMR Treatment

The patient received compound betamethasone injection 1 mL on the day of diagnosis, achieving 80% pain relief within 24 hours. Oral methylprednisolone 16 mg/day was started the next day. At one-week follow-up, ESR was 45 mm/h and CRP 23 mg/L; pain essentially resolved by two weeks, with ESR and CRP normalizing by three weeks. Methylprednisolone was gradually tapered after four weeks, reaching a maintenance dose of 4 mg/day by three months. At nine months, the immunosuppressant tripterygium glycosides 20 mg three times daily was added at the comprehensive hospital rheumatology follow-up. Treatment followed the 2023 "Diagnostic and Treatment Guidelines for Polymyalgia Rheumatica and Giant Cell Arteritis."

5.1 Glucocorticoids Glucocorticoids are first-line therapy. No standardized dosing regimen exists; treatment should follow the principle of minimum effective dose.

5.1.1 Initial Therapy The usual starting dose is prednisone acetate 12.5-25.0 mg/day as a single morning dose. Higher doses within this range may be used for severe disease with marked myalgia, significant functional limitation, high recurrence risk, and low adverse event risk. Lower doses are appropriate for patients with comorbidities (e.g., diabetes, hypertension) or high-risk factors for steroid-related adverse effects. Prednisone $ $7.5 mg/day is discouraged as initial therapy, and doses >30 mg/day are strongly discouraged. Pain typically improves rapidly within one week, with CRP normalizing shortly thereafter and ESR gradually declining; disease control is usually achieved within 2-3 weeks.

5.1.2 Tapering Regimen PMR recurrence peaks within six months of treatment initiation. Slow tapering, patient education, and close ESR monitoring reduce relapse risk. Recurrence is primarily attributed to premature or overly rapid tapering or early discontinuation. Management of recurrent disease involves gradually increasing oral prednisone to the pre-relapse dose, then tapering over 4-8 weeks to the dose at which relapse occurred. After successful initial tapering and relapse treatment, a recommended regimen involves reducing prednisone by 1 mg every 4 weeks (or alternating 10 mg/7.5 mg doses) while maintaining clinical remission until discontinuation. The guidelines also suggest slow tapering by 2.5 mg weekly after 2-4 weeks, with maintenance doses of 5-10 mg/day; some patients may achieve maintenance doses of 3-5 mg/day with prolonged disease stability.

If symptoms fail to improve with glucocorticoids, the diagnosis should be reconsidered. No specific treatment duration is recommended; decisions must balance benefits against risks, considering risk factors for adverse effects, comorbidities, concomitant medications, relapse risk, and prolonged therapy requirements. The tapering course should not be <12 months; most patients can discontinue steroids within 2 years. International studies indicate average

maintenance duration is approximately 3 years, with some patients requiring low-dose maintenance for many years. Long-term follow-up after discontinuation is recommended, with disease considered fully resolved if no relapse occurs within 5 years.

5.2 Nonsteroidal Anti-inflammatory Drugs (NSAIDs) NSAIDs such as diclofenac or indomethacin may be trialed in newly diagnosed or mild cases. Approximately 10-20% of patients achieve adequate pain control with NSAIDs alone. Glucocorticoids should replace NSAIDs; short-term NSAID use may be considered for concurrent pain from other causes.

5.3 Immunosuppressive Agents Long-term glucocorticoid use carries potential adverse effects. Strategies to improve disease control and reduce steroid requirements include early combination therapy with immunosuppressants such as methotrexate, particularly in patients with steroid contraindications, inadequate steroid response, high recurrence risk, or difficulty tapering steroids. Adjunctive methotrexate may benefit certain patients while preserving glucocorticoid efficacy [**?**]. PMR patients with concurrent GCA require higher initial glucocorticoid doses and may also benefit from combined immunosuppressive therapy, with gradual tapering after disease remission.

5.4 Other Therapies Studies on biologic agents have been conducted. No evidence supports the efficacy of tumor necrosis factor-α (TNF-α) antagonists in PMR, and their use is not recommended [**?**]. The IL-6 receptor antagonist tocilizumab, used alone or with glucocorticoids for PMR or recurrent PMR, has shown benefits in symptom control, steroid sparing, and relapse reduction, though further clinical research is needed [**?**, **?**].

Follow-up and Monitoring

Timely diagnosis and treatment of PMR generally lead to rapid symptom resolution and favorable prognosis, though some cases may persist or recur. Late-stage complications such as disuse muscle atrophy require individualized physical exercise and rehabilitation programs to reduce fall risk and improve outcomes in elderly osteoporotic patients receiving long-term glucocorticoids.

7.1 Cancer Surveillance This patient underwent chest, abdominal, and pelvic CT, rheumatologic tests, and tumor markers at 6 and 12 months of follow-up, with no malignant findings. Studies report significantly elevated cancer detection rates within 6 months of PMR diagnosis, necessitating imaging surveillance [**?**, **?**]. A meta-analysis of Colombian and Latin American populations revealed latent polyautoimmunity (PolyA) in 24% of patients and malignancy in 7.59%, suggesting that routine clinical follow-up should consider malignancy, GCA, and latent PolyA [**?**].

7.2 Osteoporosis Prevention One month after initiating oral glucocorticoids, this patient' s 25-hydroxyvitamin D level was 12.94 ng/mL (>20 ng/mL indicates sufficiency; 12-20 ng/mL indicates insufficiency; <12 ng/mL indicates deficiency). She received vitamin D2 soft capsules 800 IU twice daily, calcium carbonate/vitamin D3 tablets 600 mg twice daily, and calcitriol soft capsules 0.25 g twice daily for osteoporosis prevention, with bone metabolism and dual-energy X-ray absorptiometry (DXA) reassessment at 3-6 months. Patients with higher body mass index and those receiving higher glucocorticoid doses are at increased risk for low 25(OH) vitamin D levels; oral calcifediol supplementation achieves adequate 25(OH) vitamin D levels more effectively than cholecalciferol. Glucocorticoids alter calcium/phosphorus metabolism through effects on intestine, parathyroid, gonads, and kidneys; these patients require oral calcium, vitamin D, and potent bisphosphonates, with intravenous bisphosphonates as an alternative if oral agents are not tolerated [**?**].

Discussion

In the general practice teaching clinic, residents systematically and comprehensively obtained patient history and performed careful physical examinations following Murtagh' s safe diagnostic strategy. They selected appropriate auxiliary investigations to guide diagnosis or exclude certain diseases, and through comprehensive analysis, progressively excluded common diseases, serious conditions, and psychological disorders to ultimately identify the elusive diagnosis of PMR, which responded dramatically to glucocorticoid therapy. The teaching clinic utilized general practice clinical reasoning to guide practice and enhance residents' diagnostic and therapeutic competence for PMR.

PMR is a diagnosis of exclusion without specific markers, requiring elimination of chronic infection, malignancy, and other rheumatic diseases before confirmation [**?**]. Misdiagnosis and missed diagnosis are common in clinical practice, partly due to failure to promptly perform ESR, CRP, and RF testing. PMR typically presents with symmetrical neck, shoulder, hip, and limb muscle stiffness and pain, though unilateral onset may occur. Severe cases may develop functional limitation, difficulty turning in bed or rising from bed, and markedly elevated ESR. Beyond myalgia, patients may experience fever, fatigue, anemia, weight loss, joint pain, headache, and other nonspecific manifestations. Therefore, when community general practitioners encounter patients with neck, shoulder, hip, or limb muscle stiffness, they should assess whether the pain is symmetrical, whether it is accompanied by limited upper limb elevation, difficulty with squatting/standing or stair climbing, and whether systemic symptoms such as fever, weight loss, headache, arthralgia, or fatigue are present. After excluding trauma, overexertion, statin adverse effects, inflammation, and malignancy, community-available resources should be utilized to promptly complete ESR and CRP testing to enable early diagnosis and treatment. Patients requiring autoimmune antibody testing unavailable in the community should be promptly referred to rheumatology.

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Note: Figure translations are in progress. See original paper for figures.