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CASE REPORT

Case Report

Subacute Synovitis of the Knee After a Rose Thorn Injury

Unusual Clinical Picture

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Abstract Synovitis secondary to penetrating plant thorn injuries is not frequently reported. Historically, it is considered aseptic and treated with removal of the intraarticular foreign body and affected synovial lining. We report a 57-year-old healthy man who was admitted 2 weeks after being injured by a rose (Rosacea) thorn with subacute and mild synovitis with effusion of his right knee. No intraarticular foreign body was retained. Pantoea agglomerans was identified in the synovial fluid. Contrary to former teaching, effusions from joints violated by thorns should not be presumed sterile. Bacterial growth is reported infrequently, but when reported, Pantoea agglomerans is the most common organism found. We recommend removal of foreign bodies if present, arthroscopic total synovectomy, and beginning empiric antibiotic treatment with coverage against Gram-negative enteric pathogens in all cases of thorn synovitis until the results of culture specimens are known. Improved physician awareness can result in more rapid diagnosis and improved clinical outcome in affected individuals.

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The author certifies that his institution has approved the reporting of this case and that all investigations were conducted in conformity with ethical principles of research.

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Introduction

Plant thorn synovitis is well described but may be overlooked in the differential diagnosis of monoarticular inflammatory disease [2, 4, 15]. This type of synovitis can be difficult to diagnose because of an insidious onset after an apparently trivial injury. Earlier reports indicated the effusion is sterile and caused by foreign body reaction [15, 16], but in a more recent report, microorganisms were cited as a causative factor [28].

We report the case of a 57-year-old healthy man whose right knee was injured by a plant thorn and whose synovial fluid contained Pantoea agglomerans. We discuss the patient's treatment and review the relevant literature.

Case Report

A 57-year-old man had a rose (Rosacea) thorn prick infrapatellarly in his right knee while gardening. He was otherwise healthy, took no medications, and had no allergies. Within 48 hours, mild effusion and pain developed for which he sought medical attention. The patient's peripheral blood leukocyte (WBC) count was 15,500/cm^2, and the C-reactive protein (CRP) was 0.3 mg/dL. He was sent home.

Two weeks later, he presented again because of increasing swelling and pain in his knee and he started feeling feverish. His body temperature was 38.0°C. Physical examination revealed a swollen, warm, mildly painful right knee without erythema. His range of motion was 0° to 100°. There was a large intraarticular effusion, no skin lesions, and no other joints were involved. The patient's peripheral blood WBC count was 11,800/cm^2 with a normal differential, the CRP was 10.0 mg/dL, and the

sedimentation rate was 25 mm/hour. Plain radiographs of the knee were normal. Joint aspiration yielded 60 mL purulent fluid containing many leukocytes. No crystals or bacteria were noted on microscopic examination. Synovial fluid was sent for aerobic, anaerobic, and fungal culture.

An arthroscopy was urgently performed. A tourniquet was used without exsanguination. The joint was observed through an anterolateral, anteromedial, and lateral suprapatellar portal and showed mild and generalized synovitis. No intraarticular foreign body could be discerned. We observed cartilage thinning on the trochlea and medial femoral condyle. The menisci and cruciate ligaments were intact. Synovectomy and lavage with 9 L saline were performed.

Empiric antibiotic therapy with 2 g cefazolin intravenously three times daily was started immediately postoperatively together with 75 mg diclofenac twice daily, rest, ice, and elevation.

On the second postoperative day, the peripheral blood WBC count was 10,400/cm^2 with a normal differential, the CRP was 6.4 mg/dL, and the sedimentation rate was 35 mm/hour. On the fourth postoperative day, the culture specimen from the synovial fluid grew Pantoea agglomerans susceptible to temocillin, gentamicin, amikacin, and ciprofloxacin. Antibiotic therapy was changed to 1 g temocillin intravenously twice daily. The patient was discharged on the sixth postoperative day with oral antibiotic therapy (500 mg ciprofloxacin twice daily) for 4 weeks.

Mobilization of the knee initially was restricted and combined with local ice application. As the infectious symptoms progressively disappeared, regaining full mobility and closed chain exercises of the quadriceps and hamstrings were allowed.

Six weeks after admission, he was asymptomatic and the hematologic parameters had returned to normal.

Discussion

Arthritis caused by plant thorn penetration is well known, especially among children. Blackthorn or date palm thorns have caused most reported cases [18], but it can occur from thorns of several kinds of plants [19, 21, 33]. The most commonly affected joint is the knee, but similar processes have been described in the hand, ankle, and wrist [1, 9, 19, 21].

Historically, failure to discover an organism in the joint fluid after a plant thorn injury led to the hypothesis, first published in 1953, that the synovitis after these injuries was an aseptic inflammatory reaction provoked by alkaloid compounds in the vegetable matter [15]. This disease at that time was known as "blackthorn inflammation" [16]. Some authors, however, noted antibiotic therapy provided temporary symptomatic relief, suggesting an infectious etiology [1, 16, 28].

It was not until 1977 that the first positive culture specimen of synovial fluid after plant thorn injury was reported with growth of Staphylococcus albus, Streptococcus hemolyticus, and Gram-negative rods [28] (Table 1). Joint infection caused by Pantoea agglomerans was first reported in 1978 [8]. Inappropriate growth media and inaccurate identification methods most likely explain the negative culture results reported in earlier publications. From the report of the first positive culture until now, 27% (15 of 56) of all reported cases of plant thorn arthritis have had positive cultures for infective organisms. Gram-negative rods, most often P. agglomerans, were the causative organism in 73% (11 of 15) of cases.

Pantoea agglomerans (earlier referred to as Erwinia herbicola, Erwinia milletiae, and Enterobacter agglomerans) is a member of the Enterobacteriaceae family. This coliform facultative anaerobic Gram-negative rod can be found on soil-encrusted objects and vegetation. The surface of plant leaves offers various habitats for bacteria and other microorganisms, including yeasts, mycelial fungi, and algae [23]. Screening of the surface of Rosa rugosa leaves isolated P. agglomerans, two Ra. aquatalis, Klebsiella terrigena, and Erwinia rhapontici. They are all facultative anaerobic Gram-negative rods. P. agglomerans was the most predominant [12]. To the best of our knowledge, there are no published studies regarding the colonization of the plant thorns specifically. Because the surfaces of plant leaves and plant thorns are in continuity and because they are exposed to the same environmental factors, it seems reasonable to assume they are colonized by the same microorganisms.

Patients with noninfectious and infectious plant thorn arthritis usually present without fever with chronic synovitis [33]. The joint is tender and warm and yields turbid fluid with a high leukocyte count and predominance of polymorphonuclear cells. Serologic blood work is usually normal [14, 16]. Thorn synovitis seems to represent a spectrum of syndromes. The common link is inflammatory arthritis with a certain percentage of cases being infected [9]. Some authors note the delay in establishing a correct diagnosis (up to 9 months), because the inflammation often develops long after the thorn injury has occurred [6, 33]. Even infectious cases have this dormant presentation that is atypical for septic arthritis but that can be explained by the indolent nature of Pantoea agglomerans [5]. The delayed diagnosis also is caused by the low level of clinical suspicion for this disease. Skin penetration by long thorns often is remembered by the patient, but even trivial trauma by small thorns like those of a rose can cause joint penetration. This probably is caused by thinning of the periarticular soft tissues under compression.

Table 1. Literature overview: all cases of plant thorn arthritis (1949–2008)

Authors	Year	Number of cases	Number of cases with intraarticular foreign body	Number of cases with positive cultures	Organism
Karshner & Hanafee [15]	1953	7	6	0	
Kelly [16]	1966	24	24	0	
Sugarman et al. [28]	1977	5	5	3	Gram-negative rods
					Staphylococcus albus
					Streptococcus hemolyticus
Flatauer & Khan [8]	1978	1	0	1	Pantoea agglomerans
Blake et al. [1]	1981	2	2	0	
Hawkins et al. [13]	1982	1	0	0	
Cahill & King [2]	1984	10		2	Staphylococcus aureus
					Enterobacter sp
Strömqvist et al. [27]	1985	1	1	1	Pantoea agglomerans
Goupille et al. [10]	1990	2	2	0	
Ramanathan et al. [22]	1990	7	1	0	
Doig & Cole [7]	1990	5	5	0	
Zoltan [33]	1991	1	1	0	
Olenginski et al. [21]	1991	7	6	1	Pantoea agglomerans
Freiberg et al. [9]	1993	1	1	1	Nocardia asteroides
De Champs et al. [6]	2000	2	1	2	Pantoea agglomerans
Miller et al. [19]	2000	1	0	0	
Stevens et al. [25]	2000	1	1	0	
Kandel et al. [14]	2001	2	2	0	
Taskiran & Toros [29]	2002	1	1	0	
Kratz & Greenberg [18]	2003	1	1	1	Pantoea agglomerans
Muschol et al. [20]	2004	1	1	0	
Ulloa-Gutierrez et al. [32]	2004	1	0	1	Pantoea agglomerans
Tung et al. [31]	2007	1	1	0	
Cruz et al. [5]	2007	1	0	1	Pantoea agglomerans
Duerinckx	2008	1	0	1	Pantoea agglomerans

The differential diagnosis consists of reactive arthritis caused by other foreign body substances, monoarticular rheumatoid arthritis, pigmented villonodular synovitis, transient synovitis, posttraumatic synovitis, and leukemia (Table 2). Plant thorn injuries also can simulate bone or soft tissue tumors [9, 14, 24].

Plant thorns are not detected radiographically, but pseudotumor formation caused by chronic synovial proliferation can result in periosteal new bone formation or osteolytic radiographic changes [19, 21]. The efficacy of ultrasound, CT, and MRI to identify the presence and localization of a plant thorn is emphasized in the literature [17, 18].

Histologic findings of thorn synovitis include formation of multiple granulomata with multinucleated giant cells, hypertrophic synovitis, hyperemia, and granulation tissue. This can mimic sarcoidosis, tuberculosis, and fungal infections [9, 21], but thorough microscopic examination of the synovial fluid or involved synovial lining can contain small fragments of birefringent vegetable material. Birefringent materials may be derived from other sources, for example, pyrophosphate or intraarticular steroid preparation, and the vegetative nature of this birefringent material must be established [1].

In earlier reports, treatment consisted of arthrotomy and removal of all thorn fragments [15, 16, 28]. In 1980, the advantages of arthroscopy became clear [3]. Arthroscopy may allow complete observation of the joint and extraction of the foreign body, but there still are several pitfalls. Plant fragments usually are too small to be seen and a reactive hypertrophic plica can obscure the presence of an intraarticular foreign body for the inattentive surgeon [20]. This led to the recommendation to remove all the macroscopically abnormal synovial lining. In most instances, this will involve complete synovectomy. Recurrence otherwise is probable [2, 7, 20, 21, 28].

Table 2. Differential diagnosis for plant thorn arthritis

Diagnosis	Symptoms	Joint fluid	Radiograph	Blood examination
Plant thorn arthritis	Monoarticular Subacute/chronic Usually no systemic symptoms	Turbid, yellow	Possible periosteal new bone formation or osteolytic changes	Usually normal
Foreign body arthritis	Monoarticular Subacute/chronic No systemic symptoms	Turbid, yellow	Possible periosteal new bone formation or osteolytic changes	Usually normal
(juvenile) Rheumatoid arthritis	Pauci-/polyarticular Chronic (greater than 6 weeks) Morning stiffness Progressive joint deformity Systemic disease (eye, skin, internal organs, recurrent fever)	Turbid, yellow	Erosion of juxtaarticular bone	Erythrocyte sedimentation rate, C-reactive protein elevated Anemia Leukocyte count normal Rheumatoid factor Antinuclear antibody
Pigmented villonodular synovitis	Monoarticular Acute episodic attacks of pain and swelling Possible mechanical symptoms	Hemorrhagic, dark brown	Bone changes are rare	Normal
Transient synovitis	Monoarticular History of previous respiratory or bowel infection	Clear, yellow	Normal	Normal
Posttraumatic synovitis	Monoarticular History of trauma	Blood	Possible fracture	Normal
Leukemia	Young children Monoarticular involvement or bone pain Chronic Systemic illness (fever, weight loss, bleeding, easily swollen and painful lymph nodes, liver, and spleen)	Clear, yellow	Generalized osteoporosis Skeletal changes mostly in long bones and skull Diffuse osteolytic lesions in metaphyseal area Metaphyseal bands	Erythrocyte sedimentation rate, C-reactive protein elevated anemia Leukocyte count elevated thrombocytopenia

Multiple antibiotic resistance, in particular to ampicillin, and first- and second-generation cephalosporins are common in Pantoea agglomerans and other coliforms [11]. They produce a beta-lactamase with predominantly cephalosporinase activity [30]. This explains their refractory behavior to conventional empiric antibiotic therapy for septic arthritis that aims at Gram-positive cocci. Coliforms are capable of developing antibiotic resistance most efficiently [26], but very good to full sensitivity to semisynthetic penicillin, ciprofloxacin, gentamicin, third-generation cephalosporins, amikacin, meropenem, and trimethoprim-sulfamethoxazole can be expected [5, 11, 30]. Because of the previously mentioned infection rate with coliform Gram-negative rods after plant thorn injury and the typical delay before culture specimens become positive with this slow-growing bacteria, we recommend starting appropriate empiric antibiotic therapy immediately postoperatively in all cases. When culture specimens remain sterile, antibiotic therapy can be discontinued. In the case of infection, additional antibiotic treatment depends on the antibiogram.

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