

Images in clinical medicine: Tophi

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ABSTRACT

Tophi (plural of tophus, Latin for “stone”) are stone-like deposits of monosodium urate in the soft tissues, synovial tissues, or in bones near the joints. They are pathognomonic for gout, the most common inflammatory arthritis in the United States, with an estimated lifetime prevalence of 4%. It is usually the end result of loss of the balance between uric acid production and excretion. It can be found anywhere in the body especially in areas of friction or trauma. It is usually painless and rarely to present as the initial manifestation of gout. It is diagnosed mainly clinically. Imaging is mainly used to assess the complication like bony erosions. The American College of Rheumatology (ACR) guidelines currently indicate that urate-lowering therapy should be initiated in patients with the presence of tophi visible on examination or imaging (ACR Evidence A). First-line therapy for urate lowering remains the xanthine oxidase inhibitor allopurinol. The ACR currently recommends colchicine, 0.6 mg (or 0.5 mg) once or twice daily, or low dose NSAIDs should be continued to reduce gout flare incidence for six months after resolution of the tophus. Daily prednisone ≤ 10 mg has been endorsed as an acceptable second-line prophylactic agent.

Abbreviations: ACR: American College of Rheumatology; NSAID: non-steroidal anti-inflammatory drug

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1. Introduction

Tophi (plural of tophus, Latin for ‘stone’) are stone-like deposits of monosodium urate in the soft tissues, synovial tissues, or in bones near the joints. They are pathognomonic for gout, the most common inflammatory arthritis in the United States, with an estimated lifetime prevalence of 4%, and increasing in prevalence with age to over 7% by age 65 [1,2]. The care of patients in the United States with gout in the ambulatory setting has been estimated to cost over one billion dollars per year [3]. Therefore, the recognition of a tophus is a vital skill for medical providers.



2. Pathophysiology

Uric acid is the end product of purine metabolism arising from nucleic acid breakdown during cellular destruction and as a consequence of exogenous intake (e.g., alcohol, shellfish, legumes, and brassica vegetables) [2]. Due to the evolutionary loss of the uricase gene, which converts uric acid into the water soluble allantoin, under normal human physiologic conditions uric acid exists primarily as its ionized form, urate [2]. Loss of the balance between production and secretion of uric acid will precipitate hyperuricemia; approximately 10% of patients have genetic aberrancies causing

excessive uric acid production [4]. Monosodium urate (MSU) crystals are unlikely to form below serum urate concentration 6.8 mg/dL (0.40 mmol/L), but with lower body temperatures or a more acidic pH, solubility decreases and crystal formation may begin [5]. These conditions explain the predilection of the lower extremities for crystal formation and gout attacks [6]. Once crystals form, tissue macrophages phagocytize them to initiate the inflammatory cascade [2,5]. Typically, after years of hyperuricemia, a foreign body granulomatous reaction will occur, leading to the development of the tophus [7]. Recent research indicates the neutrophil extracellular trap mechanism may be implicated in the formation of the tophus, but the exact pathway has yet to be established [7].

3. Clinical presentation

Tophi may be found anywhere, especially in areas of friction or trauma, and have even been reported affecting the spine, mimicking an epidural abscess [7,8]. Typically insidious in onset, they rarely represent the initial manifestation of gout [9]. Tophi will usually present as a painless visible or palpable soft tissue masses with whitish or yellowish deposits; overlying skin may be pulled taut (Figure 1). Occasionally, a tophus may become inflamed and painful.

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Figure 1. Tophi at the plantar surface of the 1st metatarsal joint.

4. Diagnosis

A tophus is a clinical diagnosis, made on the basis of physical findings and supported by an elevated serum uric acid level. Radiographs might be helpful in tophaceous gout where they can demonstrate punched-out lesions [10]. Tophi may appear as hypoechoic to hyperechoic homogenous areas surrounded by a small anechoic rim on ultrasound [10]. Computed tomography may detect changes of early disease that are not visible on plain radiography [10].

5. Treatment

The American College of Rheumatology (ACR) guidelines currently indicate that urate-lowering therapy should be initiated in patients with the presence of tophi visible on examination or imaging (ACR Evidence A) [11]. Treatment to a target serum urate level of less than 6.0 mg/dL (0.35 mmol/L) is considered optimal with consideration to treat to lower targets to improve symptoms or signs of gout or to resolve tophi and improve joint function [11]. First-line therapy for urate lowering remains the xanthine oxidase inhibitor allopurinol. Febuxostat is an appropriate alternative with less hypersensitivity but significantly increased cost. The uricosuric non-steroidal anti-inflammatory drug probenecid may be added to, or substituted for, a xanthine oxidase inhibitor. For those with genetic predisposition leading to under-

excretion of uric acid, it is the first choice [11]. Prophylactic therapy to reduce gout flare incidence is recommended and to be continued for more than six months after the resolution of the tophus [11]. Large tophi may rarely have to be removed surgically. If untreated, tophi can burst and discharge chalky masses of uric acid crystals through the skin and may eventually cause deformities.

Disclosure statement

No potential conflict of interest was reported by the authors.

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