

# Surgical Reconstruction of Severe Tophaceous Gout in the Hand: A Customized Approach

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**Summary:** Tophaceous gout can represent a major problem for hand surgeons when it turns into aggressive nodules, spreading and destroying soft tissue and bone. The combination of ablative and reconstructive surgery may also be complex when the patient refuses amputations and multiple segments are involved. We present a difficult case, where a customized approach, chosen according to the different features of the osteoarticular and tendon involvement of fingers, adopted different solutions for the four affected rays. A patient suffering from severe gout arthritis with osteoarticular destruction in both hands refused amputations and was treated with several reconstructive procedures. After excision of the tophaceous deposits, a long bone autograft, two segmental cement spacers together with distal arthrodeses, and an osteoarticular allograft were used. Functional pinches were maintained in both hands, even at a 13-year follow up, with the allograft preserved and working. On the other hand, significant osteolysis and bone resorption in all the segments that had undergone stabilization was documented, producing extrusion of both cement and distal interphalangeal joint fusion screws. Pre- and postoperation range of motion, visual analogue scale, disabilities of the arm, shoulder, and hand score, and pinch strength tests showed reduced pain and improved function. A review of literature is presented in particular regarding different reconstructive approaches. Combining different techniques in the same hand can lead to successful osteoarticular reconstruction after tophi resection, above all to avoid amputation. However, long-term follow up shows that functional osteoarticular reconstructions seem to be more stable, whereas osteolysis may damage bone grafts used for arthrodesis and produce screw extrusion. (*Plast Reconstr Surg Glob Open* 2021;9:e3912; doi: [10.1097/GOX.0000000000003912](https://doi.org/10.1097/GOX.0000000000003912); Published online 2 November 2021.)

Chronic tophaceous gout<sup>1,2</sup> may present with aggressive tophi invading the soft tissue, joints, and bones. Tophi are usually treated by simple shaving, removal, or segment resections, followed by amputation or complex reconstructions. We present a case of a 62-year-old woman with severe progressing arthritis in both hands who had no benefits from medical therapy and refused amputations.

The different reconstructive approaches may include arthrodesis or functional arthroplasties, especially for

metacarpophalangeal (MP) and proximal interphalangeal (PIP) joints. Distal interphalangeal (DIP) joints when involved should be considered for arthrodesis.

In this case, on the right hand, gout had caused the destruction of the MP of the index finger and, on the left hand, of the PIP of the index, middle, and small finger. Functional pinch in the right hand was conserved, even if weak, and we chose a functional reconstructive approach for the middle finger of the left hand, and stable reconstructions for the remaining fingers.

## CASE REPORT

A 62-year-old woman presented with a long history of chronic tophaceous gout, allopurinol intolerance, renal failure, and rasburicase treatment. Multilobular nodules in both hands caused significant pain and disability, and x-ray showed osteolysis of the right index finger across MP and of the left index, middle, and small fingers across the

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PIP joints, destroying the metaphysis and shaft of the first phalanx in the index fingers and involving the second phalanx of the middle and small finger (Figs. 1, 2).

Preoperation range of motion was 0 degrees (all involved fingers), pinch strength 0 kg (both hands), visual analogue scale (0–10) 9, and disabilities of the arm, shoulder, and hand score, 85.

The patient refused the amputations proposed for the right index and the left middle and small finger. She asked us to perform reconstructions adapting to her low-demand function.

In both hands, tophi were resected using a dorsal approach, showing prevalent dorsal compartment invasion, sparing the flexor tendons and neurovascular bundles.

A 5-cm corticocancellous bone autograft (harvested from the iliac crest, and fixated with a plate) was used to reconstruct and stabilize the right index MP joint (Fig. 3). It was protected with a postoperation volar plaster slab and later with a custom-made static splint, for 3 months.

On the left hand, the index and small fingers were chosen for stabilization, and the middle finger for functional reconstruction; autologous grafts were excluded to avoid further donor site morbidity.

A customized cadaveric allograft from the bone bank of the Careggi University Hospital, Florence was acquired, including the PIP joint and extensor apparatus.

The left middle finger PIP joint was modeled and fixed proximally with a double bar miniplate, and distally with an Acutrak screw inserted from the fingertip through the DIP joint. The extensor tendon was reconstructed with the extensor tendon of the allograft (Fig. 4).

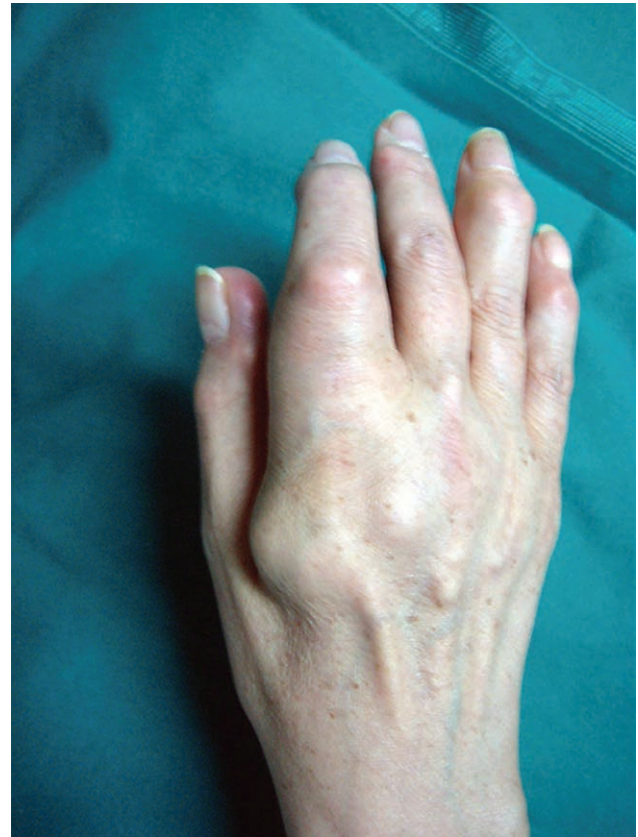
The index and small finger PIP joints were stabilized with antibiotic-impregnated cement spacers fixed proximally with plates and distally with intramedullary nailing.

At 1 year, follow-up radiographs showed successful arthrodesis and remodeling of the bone graft in the right hand, and fusion and integration of the allograft, as well as stability of the cement spacers in the left hand; functional recovery of both hands was good with high patient satisfaction; no pain or discomfort was reported. (See figure, **Supplemental Digital Content 1**, which displays the clinical result at 1 year. <http://links.lww.com/PRSGO/B830>.)

At 3-year follow up, no recurrence was registered, and postoperation range of motion was 0 degrees for the right index finger, left index, and small fingers; the middle left finger registered 10 degrees; pinch strength 1 kg (both hands), visual analogue scale (0–10) 2, and disabilities of the arm, shoulder, and hand score, 22.

In the following years, the patient underwent a liver transplantation and was no longer able to attend follow-ups. The last follow-up was performed by phone call and radiographs 13 years after, showing that cement and intramedullary nail had been extruded from the small finger DIP joint 6 years after surgery, while range of motion, visual analogue scale, and disabilities of the arm, shoulder, and hand score were unmodified, as reported by the patient.

The radiographs showed allograft function and stability; cement and DIP fixation were no longer present on the left small finger (See figure 2, **Supplemental Digital**

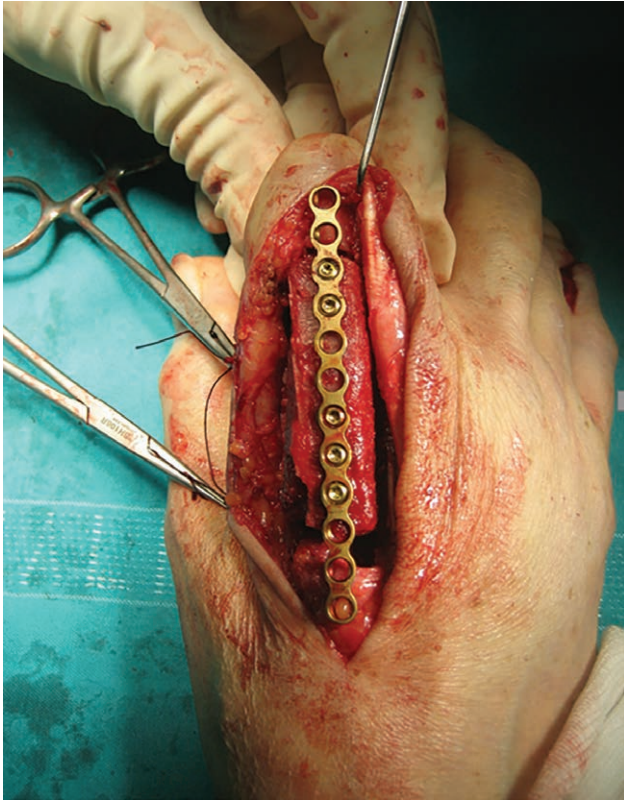


**Fig. 1.** Clinical appearance of multiple tophaceous deposits on the right hand.

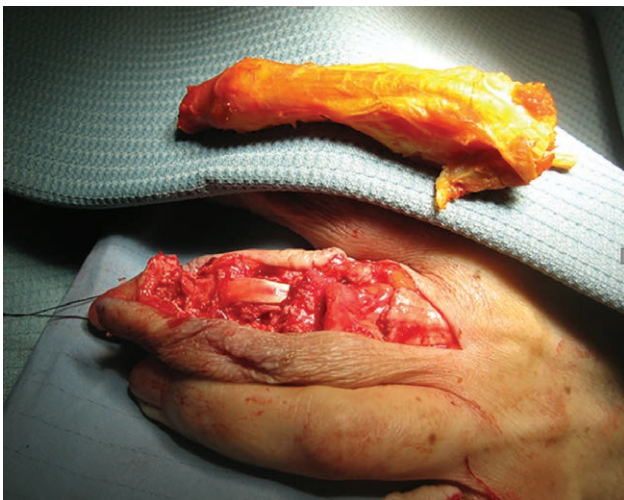
**Content 2**, which displays lateral view of the left hand 13 years after surgery, showing good integration and function of the middle finger, reconstructed with a composite allograft. Despite bone resorption, the index finger maintains stability; cement stabilizing the small finger had been



**Fig. 2.** Clinical appearance of multiple tophaceous deposits on the left hand.



**Fig. 3.** Right hand index finger: reconstruction with long cortico-cancellous iliac crest autograft after excision of tophi.



**Fig. 4.** Left hand middle finger; after excision of tophi, showing an osteoarticular allograft, including extensor apparatus for middle finger reconstruction and a tenorrhaphy of allograft extensor tendon to residual tendon stumps.

previously extruded. <http://links.lww.com/PRSGO/B831>); and significant resorption of the long autologous graft was documented in the right index finger.

### DISCUSSION

Tophaceous gout osteoarthritis, unresponsive to medical therapy, may progress to clinical manifestations

requiring surgery. Treatment includes tophi excision, curettage, shaving, arthrodesis, and ray amputation,<sup>3-7</sup> and is tailored according to functional recovery and patient's request.

We believe that when patients refuse amputations and ask for reconstruction, two options can be proposed: either stabilization with long bone grafts, plates, and screws, together with distal joint arthrodeses, or functional reconstruction with composite functioning osteoarticular transfers.

Indeed, even in functional low-demand patients, bone resorption together with recurrence should be taken into consideration, especially when a medium/long life expectancy is present. Our experience clearly shows that these long-term complications are present, especially in stabilization and arthrodesis. It may be that the effect of time is tempered in the case of functional reconstruction, as in our allograft.

In our patient, the refusal of multiple digit amputations and a low functional demand led to a customized reconstruction. Both index fingers and the left small finger were stabilized: on the right index finger, a long cortico-cancellous iliac graft was used, obtaining MP joint fusion while restoring metaphyseal lengths. No further autograft was taken, so as to reduce donor site morbidity. On the left index and small fingers, antibiotic-impregnated cement implants fixed with plates proximally, and intramedullary wires distally, were chosen.

Finally, an osteoarticular functional reconstruction for the left middle finger (fundamental for left hand pinch) was achieved with a composite allograft, including extensor tendon, producing a certain degree of functional joint mobility. As a result, the patient achieved a painless pinch between the thumb and the third fingers in both hands. (See Supplemental Digital Content 1, <http://links.lww.com/PRSGO/B830>. See figure 2, Supplemental Digital Content 2, <http://links.lww.com/PRSGO/B831>.)

In reconstructive surgery after a wide excision of tophaceous gout, we believe that each reconstruction has a specific indication. Autogenous cortico-cancellous bone graft has the qualities for new bone growth, namely osteoconductivity, osteogenicity, and osteoinductivity.<sup>8</sup> However, the iliac crest bone autograft does not include joints and may raise concerns about donor site morbidity<sup>9</sup> (as in this case) and graft availability. Furthermore, an autograft can be resorbed due to tophaceous disease progression. Our long-term follow-up shows significant autograft resorption.

The antibiotic-impregnated cement spacer is a simpler reconstructive tool and, associated to rigid fixation, may obtain a medium-term result for low-demand cooperative patients, particularly with a stable fixation in moderate stress segments and in low-demand patients, as in our case. However, as previously pointed out, long-term follow-up may show bone resorption and loss of both cement and fusion screws, even if extrusion of the cement spacer and distal fixation from the left small finger, documented in the last follow-up, did not condition

functional results in the left hand. Progressive osteolysis indeed, as a combined effect of ageing demineralization and possibly also gout local recurrence, should always be taken into account when performing stabilization procedures together with osteoarticular reconstructions in these patients. Small joints, such as DIP, may be more affected by this complication.

A composite allograft allows segmental bone, tendon, and joint reconstruction of complex skeletal gaps.

Literature highlights the incidence of resorption, delayed nonunion, stress fracture, and cartilage erosion of osteoarticular allografts over time.<sup>10</sup> This is, to our knowledge, the first report of a composite allograft for reconstruction in invasive tophaceous gout<sup>11</sup> and shows satisfactory results at medium and long term with regard to maintenance and integration of the reconstruction.

The last follow-up showed that the best reconstructed ray is the middle in the left hand, possibly due to the maintenance of use and function: the allograft indeed appears to be the most stable and the least reabsorbed.

## CONCLUSIONS

Our experience has highlighted that less common procedures such as large cortico-cancellous bone autograft, osteoarticular allograft, and custom-made cement bone spacers may be associated and represent an effective strategy, at least in the medium term, for functional recovery in the advanced stages of gouty arthritis of the hand. This customized reconstructive approach avoided amputations, providing a satisfactory result after a 13-year follow up.

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