

INDIVIDUALIZED TREATMENT FOR GOUT STONES OF HAND

JIN YANG*, HUABING HE, YONGFENG TANG, YAN WANG

Department of hand and foot surgery, Yiwu Central Hospital, Yiwu, Zhejiang 322000, China

ABSTRACT

Objective: The present study aims to explore the clinical efficacy and expertise of individualized treatment for gout stones of hand.

Methods: Between January 2007 and March 2019, a total of 55 patients with gout stones in hand were enrolled to perform the following surgeries: 24 patients received the single resection of gout stones, 15 received the single resection of gout stones with tendon transplantation, 7 received the single resection of gout stones with tendon transplantation and joint fusion, while for the remaining 4 patients, finger amputation was conducted. Within one week after surgery, patients were required to take colchicine orally, three times per day, 0.5 mg/time.

Results: Following surgery, all gout stones were removed, with the correction of finger deformity and no cutaneous necrosis. Finally, 53 patients experienced primary healing, and 2 patients experienced delayed healing. Among all of the patients, 49 patients fulfilled the follow up, while 6 failed to do the follow up. During the follow-up, ranging from 6 months to 3 years, 49 patients were satisfied with the appearance and function of fingers, 3 of whom had the recurrence of gout stones in hands.

Conclusion: Appropriate protocol of surgery should be developed in light of the characteristics of gout stones of hand in different patients; this is likely to eliminate the gout stones in hand and correct the deformity and appearance of finger, with improved finger function. Besides, postoperative medical treatment is also an effective method for treating the gout stones in hand.

Keywords: Hand, gout stones, joint deformity, efficacy.

DOI: 10.19193/0393-6384_2021_5_383

Received March 15, 2020; Accepted June 20, 2021

Introduction

With the tremendous improvement in life quality and aging process of population, the number of patients tortured by the gout stones in hand has also increased⁽¹⁾. The gout stones mainly erode and destroy the bones, articular cartilage, synovium, tendon, ligament, resulting in the deformity in hand or foot and articular dysfunction. However, current medical treatment can hardly deal with the gout stones. Between January 2007 and March 2019, we adopted the individualized strategy for treatment of 55 patients with gout stones in hand, gaining the promising outcome.

Materials and methods

General data

In this study, a total of 55 patients were enrolled, including 49 males and 6 females, aged between 33 and 81 years old, with an average age of 57 years. There were 10 patients with single subcutaneous gout stones, 15 patients with the involvement of articular gout in palm or fingers, 25 with the involvement of proximal interphalangeal joint, and 12 with the involvement of distal interphalangeal joint. All patients exhibited the clinical manifestations of gout stones; 7 patients had skin effusion or rupture, 16 had joint deformity and 19 had erosion of tendon

that severely affect the normal activity of fingers. Disease course of gout ranged from 5 to 18 years, with an average of 8 years. Prior to the operation, the concentration of uric acid ranged from 453 to 629 $\mu\text{mol/L}$, significantly higher than the normal range.

As for the surgical methods, 24 patients received the single resection of gout stones, 15 received the single resection of gout stones with tendon transplantation, 7 received the single resection of gout stones with tendon transplantation along with joint fusion, while finger amputation was conducted for the remaining 4 patients. Within one week after surgery, patients were required to take colchicine orally, three times a day, 0.5 mg/time.

As for the second week, colchicine was taken twice a day, 0.5 mg/time, followed by drug withdrawal. During medication, two patients could not tolerate colchicine, and turned to take the prednisolone tablet, 10 mg/time, once per day.

Selection of appropriate surgical methods according to the tissue invasion of gout stones in hand

- The subcutaneous gout stones, a diagonal incision was made on the hand to expose the subcutaneous stones for resection in a sharp dissection to remove the gout stones. For cases where the gout stones are tightly adhered to the surrounding tissues, stones were scrubbed, followed by wound suturing. For gout stones surrounding the joint but not affecting the tendon, an arc-shaped or longitudinal wound was made, so that the subcutaneous tissues and protect the tendons would be exposed, while the gout stones were removed by sharp dissection, followed by rinsing with the normal saline to remove the residual gout stones, and the incision was sutured after a thorough hemostasis.

- The gout stones affecting the tendons: the large gout stones usually affect the tendons. In such cases, we dissected the gout stones into pieces in a longitudinal direction of the tendon, so as to preserve the tendon and ligatures; 4/0 Prolene suture was used to repair the residual articular sac, tendon hood and tendon tissues; 1.2 kirschner wire was used to fix the unstable joint for 3 weeks.

For extensor in complete erosion, it was repaired by transplantation of tendon palmaris longus after the residual gout stones were removed. Afterwards, joint cavity and wound were rinsed repeatedly by the normal saline, followed by a hemostasis. The originally raised skin surrounding the wound should not be incised, and a drainage tube was placed

in the wound for vacuum aspiration to guarantee the adhesion between the skin and cupped surface of wound, conducive to the non-tension union and hemostasis.

- The gout stones affecting the hand joint: In an advance stage, gout stones invade the joints, usually affecting the interphalangeal joints, resulting in the destruction of joint. Generally, a longitudinal incision or S-shaped incision was made on the dorsal side of joint, so that the subcutaneous tissues will be exposed, where extensor, joint, collateral ligaments and palm plate were eroded by gout stones.

Large gout stones could even suppress the bilateral proper palmar arterial nerve, it was thus firstly freed and protected during the resection of gout stones. Some large stones were incised longitudinally and removed, so as to preserve the residual tendons. Afterwards, interphalangeal joint that was invaded by the gout stones was rinsed repeatedly by normal saline, or joint fusion if necessary (infusion of proximal interphalangeal joint at functional position, and distal at extending position).

Then, the tourniquet was loosened, followed by a hemostasis and incision suture. Finger amputation was conducted for some senior patients whose joints had been severely damaged making it hard to restore them.

Postoperative treatment

Within 1 week after surgery, colchicine was given three times a day, 0.5 mg/time. One week later, dosage was lowered to twice a day for one week, followed by an anti-uric acid treatment.

Results

Following the surgery, 53 patients experienced a primary healing, and 2 patients experienced a delayed one, with no skin necrosis.

Correction of the finger deformity and function of the finger movement were all improved as compared with the condition the patients used to experience before the surgery.

During the follow-up ranging from 6 months to 3 years, the frequency of gout flare was reduced remarkably in comparison with that of the pre-operation.

Three patients had the recurrence of gout stones in hands, and the reason, as analyzed by us, was the irregular administration of the anti-uric acid drugs and their post-operation alcohol addiction.

Typical case

A 69-year-old patient was admitted to the hospital for having gout stones in hands and feet for decades. Physical examination showed the multiple gout stones in the metacarpophalangeal joints in right thumb, index and middle fingers, resulting in limited motion of the metacarpophalangeal joints and interphalangeal joint in ring finger. X-ray examination showed severely damaged distal interphalangeal joint. Following admission, the patient received the resection of gout stones in metacarpophalangeal joints of thumb, index, middle and ring fingers, resection of gout stones in the proximal interphalangeal joints in the index and middle finger, resection of gout stones in the palmaris of the ring and little fingers, amputation of the distal segment of the little finger and transplantation of the flexor tendon in ring finger. Following surgery, 2 drainage tubes were inserted in the wounds, and patient gained a primary healing, with significant improvement in both appearance and function of hands (Figure 1).



Figure 1: 1. Preoperative appearance of hand; 2. Gout stones in the dorsal side of metacarpophalangeal joints of the index finger; 4. Extensive invasion of the metacarpophalangeal joints in the little finger into the flexor tendon and distal interphalangeal joints; 5. Extensive invasion of the metacarpophalangeal joints in the ring finger into the flexor tendon; 6. Defect of the flexor tendon after the resection of gout stones in the metacarpophalangeal joints of ring finger; 7. Repairing the deep flexor tendon of the ring finger by transplantation of tendon palmaris longus; 8/9. Postoperative appearance of finger; 10/11. Hand appearance immediately after the surgery; i. Hand appearance 1 year after the surgery.

Discussion

Clinical significance of the surgical treatment for gout stones

The tremendous improvement in the life quality contributes to the increase in the prevalence of gout, especially the younger patients, 12 to 35%

of whom will finally develop gout stones⁽²⁾. Gout stones erode and destroy the bone, joint cartilage, synovium, tendon or ligament, represented with symptoms like tumidness, pain or limited motion of joint⁽³⁾, resulting in the ankyloses that further affects the function of joint, or even cause hand disability. However, medical treatment can only limit the attack of gout and progression of gout stones, ineffective in eliminating the existing gout stones which usually require the surgery⁽⁴⁾.

Surgical resection of gout stones can not only correct the deformity, preserve and improve the joint functions in hands, but also decrease the total volume of uric acid to reduce the attack of gout stones and prevent the further damage to the joints and soft tissues⁽⁵⁾.

Indications of the surgical treatment of gout stones⁽⁶⁻¹⁰⁾

- Rupture of gout stones results in the secretion of chalky substances, and thus, gout stones should be taken into account for prophylaxis of infection;
- Gout stones cause the deformity and disturbance in limbs;
- Gout stones suppressing the nerves represent the neurothlipsis symptoms;
- Difficulty in diagnosis results in a biopsy;
- Gout stones affect the appearance of fingers;
- Gout attack is controlled by the anti-uric acid treatment. Some scholars believe that the gout stones, once developed, can only be removed by a surgery, rather than by being absorbed⁽¹¹⁾.

Administration of anti-hyperuricemia drugs usually has a poor performance in eliminating the gout stones, while the damage of gout stones to the articular surface and ligament is reversible. But some scholars hold that conservative strategy should be adopted for the gout stones in diameter smaller than 1 cm⁽¹²⁾. Others⁽¹³⁻¹⁴⁾ believed that gout stones can be treated by some non-surgical treatment, including diet control or medication, through which the acute attack of gout can be efficiently decreased, and the enlargement of gout stones is controlled as well. Larmon et al.⁽¹⁵⁾ reported 99 surgical records of 23 patients, and found that surgery is preferable to the medical treatment in terms of efficacy on gout stones, but it requires the physicians to be fully aware of the surgical indication.

For gout stone patients, we think that under the prerequisite of understanding the indications, we should also consider the patients' pre-operative demands. Moreover, evidence has shown that when

the concentration of uric acid in serum was lower than 297.5 $\mu\text{mol/L}$, some gout stones could be gradually absorbed⁽¹⁶⁾. Small gout stones, through positive medical treatment, can be controlled or even shrunk. Surgery is merely a treatment strategy for gout stones, while the subsequent inappropriate or delayed treatment for gout stones may result in recurrence.

Time for surgery

Generally, surgery for gout stones is taken in the chronic period, when the erythrocyte sedimentation rate (ESR) is maintained in the normal range. In the chronic period, gout stones are usually in solid eligible for being surgically resected, with less effusion conducive to the incision union.

However, in the acute period, the joint is surrounded by the liquid gout stones making the surgery more difficult, with an increased incidence of infection and effusion on the wound surface. For joint immobilization in the acute onset, surgery should be carried out only when the local swelling or pain symptoms disappear after treatment of colchicine and non-steroidal drugs. As for the patients with rupture or infection caused by gout stones, patients should primarily receive the primary wound reconstruction and treatment for infection management, and the wound surface will be repaired after the radical resection of gout stones.

Evidence shows no evident relationship between the concentration of uric acid in blood and the opportunity of surgery since the increased uric acid in blood may not induce the acute attack of gout, while conversely, patients with the attack of gout may exhibit normal concentration of uric acid⁽¹⁷⁾. Thus, ESR is a key indicator for evaluating the gout in active period.

Features of the gout stones in hand and attention for surgery

- Gout stones in the metacarpophalangeal joints are distributed along the joint sac and extensor tendon, so an arc incision is made on the lateral side of metacarpophalangeal joints to expose the gout stones that erode the tendon cap and tendon, and gout stones should be resected with the maximal preservation of tendons. As for large gout stones, they should be incised longitudinally for resection in pieces. As for gout stones eroding the extensor tendon completely, extensor tendon can be repaired by transplantation of tendon palmaris longus after the radical resection of gout stones. Following the removal of gout stones

in the shallow layer, gout stones in liquid status are seen in the metacarpophalangeal joint sac and surrounding the lateral ligament, with degeneration in cartilage of joint surface, or even osteogenic damage to the metacarpus. Lateral ligament should be preserved as much as possible during the resection of gout stones, including some end osseous gout stones. After the joint sac and wound are rinsed repeatedly by the normal saline, the tourniquet is loosened for a hemostasis. 4/0 Prolene suture was used to repair the residual articular sac, tendon hood and tendon tissues; 1.2 kirschner wire was used to fix the unstable joint for 3 weeks. Complete destruction of metacarpophalangeal joints is usually scarce, not requiring the joint fusion. The originally raised skin surrounding the wound should not be incised, and a drainage tube is placed in the wound for vacuum aspiration to guarantee the adhesion between the skin and cupped surface of wound, which is conducive to the non-tension union and hemostasis.

- Extensor in complete erosion: Generally, a longitudinal incision or S-shaped incision was made on the dorsal side of joint so that the the subcutaneous tissues will be exposed, where extensor, joint, collateral ligaments and palm plate were eroded by gout stones. Large gout stones could even suppress the bilateral proper palmar arterial nerve, which, it was thus firstly freed and protected during the resection of gout stones. Some large stones were incised longitudinally and removed, so as to preserve the residual tendons. Afterwards, interphalangeal joint that was invaded by the gout stones, was rinsed repeatedly by normal saline. Gout stones in proximal interphalangeal joints, after resection, usually induce the defect of central tendon, which can be repaired by the transplantation of tendon palmaris longus. For those suffering from the severe damage to the interphalangeal joints, joint fusion is optional, while amputation is appropriate for the elder patients with severely damaged phalangeal joints that are impossible to be restored.

- The palmaris gout stones are mostly accumulated subcutaneously. Thus, a diagonal incision is made to expose the gout stones that are scrubbed and the wound is sutured. For gout stones invading the flexor tendon, the tendon can be repaired by the transplantation of tendon palmaris longus. Thus, appropriate surgical protocols should be designed upon the features of gout stones, thereby eliminating the gout stones in hand and correcting the deformity and appearance of fingers, with an improved hand function.

Technique and attention in surgery of gout stones in hand

- Large gout stones that are difficult to be resected can be primarily dissected into pieces;
- Lateral ligament, tendon and tendon cap should be preserved as much as possible to stabilize the joints postoperatively and benefit the recovery;
- For patients with tendon deflection, transplantation of tendon palmaris longus is an option, but the tension of tendon should be carefully adjusted;
- For patients with severe damage to the interphalangeal joints, joint fusion, instead of the arthroplasty, should be adopted;
- For patients with the large gout stones in fingers, bilateral innate arterial nerves should be primarily protected by freeing before resection of gout stones;
- A thorough hemostasis is required, and the wound surface should be rinsed by normal saline to remove the residual stones;
- For the excessive skin on the dorsum of hand and fingers, incision should be sutured slackly to place the drainage tube for vacuum drainage, thereby guaranteeing the tight adhesion between the skin and wound surface; this can promote the postoperative hemostasis and tension-free union in wound, thereby facilitating the skin to cover the sunken wound surface.

Postoperative medical treatment

Postoperative medical treatment is one of the factors inducing the acute onset of gouty arthritis⁽¹⁸⁻¹⁹⁾. Following the surgery, patients still face the risk of fever responses that usually develop within 3 to 7 days after surgery.

Thus, colchicine is given postoperatively at a dose of 0.5 mg, three times per day. After one week, the administration is changed into twice per day, 0.5 mg/time, and the drug is withdrawn one week after the treatment⁽²⁰⁾. For patients tolerating colchicine poorly, colchicine is changed into the prednisolone tablet at a dose of 10 mg/time, once per day⁽²¹⁾.

Two weeks after surgery, regular medical treatment is advised for patients, including diet control or administration of benzbromarone to maintain the concentration of uric acid to prevent the recurrence of gout stones. The target of management in uric acid is to maintain the concentration of uric acid within 357.0 $\mu\text{mol/L}$, while for those with gout stones, the target should be set below 297.5 $\mu\text{mol/L}$ ⁽¹¹⁾. When the serum level of uric acid is

maintained below 297.5 $\mu\text{mol/L}$, some of the gout stones can be absorbed to mitigate the damage to the joints and kidney injury⁽¹⁶⁾.

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Corresponding Author:

JIN YANG

Department of hand and foot surgery, Yiwu Central Hospital, No 699 Jiangdong Road, Yiwu, Zhejiang 322000, China

Email: fanzeng236@163.com

(China)