Introduction

Ingrown toenails are frequently encountered in clinical practice, and mostly occur on the lateral border of the great toenails [1]. Young men are most frequently affected [2, 3]. Ingrown toenails can negatively affect the personal and work life of patients because of chronic pain or infection. Although there are various treatments for this condition, high rates of recurrence, low rates of patient satisfaction, and poor cosmetic results are problems [1-5]. From January 2009 to December 2011, we collected and treated 138 relapse patients. In this study, we adopted a treatment of lateral nail fold and partial nail bed resection for these patients. Our approach yields low rates of recurrence and ideal cosmetic results.

Materials and methods

We retrospectively reviewed the charts of 138 patients who underwent surgical correction of ingrown toenails between January 2009 and December 2011. All surgeries were performed in the Department of General Surgery, Shanghai 9th People's Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China. All patients had recurrent problems after previous treatment for ingrown toenails by other surgeons. Among them, 57 patients were previously treated by nail avulsions, 41 patients were treated by soft-tissue nail-fold excision, 13 patients were treated by chemical matricectomy, and 27 patients were treated by surgical matricectomy. The patients were 12 to 56 years old (mean, 28.3 years), with 61 (44.20%) males and 77 (55.80%) females. 42 patients had ingrown toenails on both feet. Altogether, 180 digits of 138 patients were surgically treated. Overall, 77 digits were affected in both grooves, 103 in a single groove, 61 in outside grooves, and 42 in inside grooves. Patients who had diabetes, peripheral vascular disease, or chronic osteomyelitis were excluded from the study.

Surgical procedure

All patients were operated on under local anesthesia achieved by a proximal digital block pro-
Nail bed excision for the treatment of recurrent ingrown toenails

The procedure used 2% lidocaine without epinephrine. An elastic tourniquet was placed around the toe to maintain a clear and bloodless surgical field.

An initial oblique, 5-mm long incision was made from the proximal corner of the nail. Care was taken to leave the nail matrix intact. An arc-shaped sweep was made out to the side of the toe, extending distally to encompass all involved granulation tissue and nail-fold skin. The incision was continued superiorly, ending under the tip of the nail about 3 to 5 mm from the edge (Figure 1A). We ensured that all skin and subcutaneous tissues at the edge of the nail were removed, and a V-shaped notch was left in the front of the toe (Figure 1B).

On the ingrown side, 3 to 5 mm of the lateral nail was cut longitudinally with scissors and removed. The distal end of the toenail was cut straight back toward the cuticle beneath the nail fold. The avulsed nail was grasped and removed by twisting outward toward the lateral nail fold while pulling in a straight direction toward the end of the toe. If the digit was affected on both sides, the whole nail was avulsed (Figure 1C).

Based on the condition of the edge of the residual soft tissue at the side, the area of the nail bed to be resected (usually higher than the soft tissue) was determined. A 2- to 3-mm wide strip of nail bed, including the germinative matrix, was excised at each ingrown site (Figure 1D). The entire nail fragment and flat edge of the nail bed was retrieved to prevent the formation of a nail spicule and reduce the potential for recurrence of an ingrown toenail. According to the size of the incision, 1 to 2 stitches were placed at the proximal and distal corners of the incision. To facilitate drainage, the middle part of the incision was not stitched (Figure 1E). Vaseline gauze was placed inside the wound after surgery to minimize postoperative bleeding, and the wound was then bandaged (Figure 1F).

Oral analgesics and antibiotics were prescribed for 3 days postoperatively in each case. Dressings were changed every third postoperative day until the sutures were removed at 14 days.
Nail bed excision for the treatment of recurrent ingrown toenails

Results

In this study, 131 of the 138 patients were evaluated during the follow-up period. The mean postoperative follow-up was 13.2±4.6 months (range, 6-24 months). The mean recovery time was 18.1±5.4 days. 158 digits (92.94%) of 121 patients (92.37%) were cured (Figure 2). Only 10 patients (7.63%) had recurrent problems in 12 digits (7.06%). In these patients, 6 digits of 4 patients showed erythema and swelling, 2 digits of 2 patients showed inflammatory exudates, and 4 digits of 4 patients showed inflammatory granulation. Additionally, 15 patients (11.54%) complained about the cosmetic results. 9 patients (6.87%) reported a loss of sensation at the surgical site.

Discussion

Ingrown toenail, or onychocryptosis, is a common condition worldwide. Ingrown toenail most commonly affects the great toe. Many anatomical and behavioral factors are thought to contribute to ingrown toenail, such as improper trimming, repetitive or inadvertent trauma, genetic predisposition, hyperhidrosis, and poor foot hygiene [6]. Various procedures have been used for treatment. Conservative therapy is a reasonable approach in patients with a mild to moderate ingrown toenail who do not have significant pain, substantial erythema, or purulent drainage from the lateral nail edge. When the lesion is more severe or conservative treatment is failing, surgical therapy is recommended. Surgical approaches include partial nail avulsion or complete nail excision with or without partial matricectomy. However, the high recurrence rate has been a difficult problem [3, 7, 8]. In cases of recurrence with pain and infection, permanent destruction of the germinal matrix is recommended.

Vandenbos and Bowers [2] suggested that pressure necrosis of the soft tissue surrounding the nail contributes to the pathogenesis of ingrown toenails. Indeed, increased nail-fold skin width in patients with ingrown toenails, greater weight-bearing on the soft tissue of the nail fold and repetitive rotation of the toe have all been suggested to be important contributing factors [9].

The nail bed can be divided into two parts: the sterile matrix and the germinal matrix. The nail grows only from the germinal matrix, which lies under the nail root and the lunula [6]. If the germinal matrix is damaged, the nail plate will not grow again. Hence, germinal-matrix ablation or resection is recommended for the treatment of ingrown toenails. Chemical ablation has been reported to give primary cure rates of >90% [10]. However, success rates of chemical ablation are not as high in patients with recurrent ingrown toenails, although nail regrowth usually consists only of spicules [11, 12]. Postoperative wound infection is another big problem [3].

The “Winograd operation” is a classical surgical procedure for ingrown toenails. It consists of partial-plate excision and subjacent growth-center destruction. Winograd noted that it was unnecessary to excise the hypertrophic folds [13]. However, for recurrent ingrown toenails, the lateral folds will have formed hypertrophic granulomas, which make the exposed deck narrower. For this reason, we suggest that the folds...
be excised as well. In this study, we used a partial nail bed and lateral fold excision procedure, including the inflammatory granulation. After operation, the healed groove will be shallower and the nail bed and the regrown nail plate will be narrower, which reduces or prevents the squeezing that can lead to problems of recurrence. In this way, recurrence can be avoided.

The proximal and distal wounds should be stitched. To drain the exudate, the middle part of the wound should not be stitched. We can therefore perform immediate surgery on those with severe infections, which is very common in relapse patients. Out of concern that the unstitched middle part of the wound might increase the risk of bleeding, we postoperatively placed Vaseline gauze inside the wound and bandaged it tightly. We found that about 10% of the cases were still bleeding at the first change of dressings, performed 72 hours after operation. These situations can be controlled by continuing to bandage the wound tightly with Vaseline gauze. Sutures should normally be removed 2 weeks postoperatively. Typically, however, it will take 3 weeks for the wound to heal completely.

In this study, ingrowth-related problems recurred in 10 patients (12 digits). Of these, 6 patients (6 digits) underwent surgery again. During these operations, we found that spicule had formed, which may be the main cause of recurrence. We inferred that the lateral germinal matrix was not excised completely. The main symptoms of the other 4 relapsed patients (6 digits) were slight pain and mild swelling of the lateral folds. We believe that these symptoms were caused by insufficient removal of the lateral fold, which then stimulated regrowth of the plate. By using conservative treatment, all of these complications were eased.

The standard of Winograd surgery is to remove one-quarter of the nail bed on the affected side [13]. Although there is a satisfactory cure rate, the too-narrow nail plate will give poor cosmetic results [1, 3], especially when both sides of the toe are affected. Therefore, in this study, we first excised the lateral fold and inflammatory granulation. Then we decided how much nail bed should be removed to ensure that the fold would not exceed the nail bed. When healed, the lateral fold remained low and tight to the side of the nail. This procedure was performed to reduce the recurrence rate but also to achieve a satisfactory cosmetic result (Figure 2).

In summary, this procedure is safe and effective, with good outcomes for the nail and lateral fold. The procedure that we developed is an inexpensive and effective technique for the treatment of ingrown toenails with a low risk of recurrence and good cosmetic results. However, long recovery time, severe pain, and bleeding after operation are all common problems of this treatment. Interestingly, most Chinese patients seem reluctant to take analgesics, even when they feel severe pain. For some rarely seen cases of tubular ingrown nail, the final appearance of the toe is not satisfactory. Therefore, we should conduct randomized controlled studies to evaluate this procedure accurately. In terms of clinical experience, we believe that this surgery is a good choice for severe or recurrent ingrown toenails.

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Nail bed excision for the treatment of recurrent ingrown toenails


