Radical Surgical Treatment of Recurrent Ingrown Toenail

Lean-San Teh\textsuperscript{1,2}, Chung-Sheng Lai\textsuperscript{1}, Sin-Daw Lin\textsuperscript{1}, Kao-Ping Chang\textsuperscript{1}, I-Feng Sun\textsuperscript{1}, Je-Chuan Lian\textsuperscript{2}

\textsuperscript{1}Division of Plastic Surgery, Department of Surgery, Chung-Ho Memorial Hospital, Kaohsiung Medical University, Kaohsiung, Taiwan
\textsuperscript{2}Division of Plastic Surgery, Department of Surgery, Show Chwan Memorial Hospital, Chang Hwa, Taiwan

The treatment of paronychia has usually resulted in high recurrence rates. The impingement of ingrown toenail into the lateral nail fold irritating and inducing inflammatory change of local tissue seems to be the major pathophysiology of paronychia. Traditionally, partial resection of the involved nail bed without change of the convexity of the lateral nail groove is always followed by recurrent paronychia. In our series, besides the removal of the impinged nail spur and electro-destruction of the involved germinal matrix, we reshaped the curvature of the lateral nail fold by crescent wedge resection of the edge tissue. We used this modified radical procedure on a total of sixteen patients to treat 19 lesions of recurrent paronychia, which resulted in a high cure rate. (J Plast Surg Asso R.O.C. 2008;17:145∼153)

Key words: ingrown toenail, recurrent paronychia, crescent shape excision, matricectomy

Introduction

Paronychia is one of the most common diseases met in the surgical out-patient department. The impingement of the ingrown toenail, or so-called onychocryptosis, may cause foreign body reaction and secondary infection, and usually leads to levels of discomfort and even unbearable pain to patients. The etiology of paronychia still remains uncertain; many hypothesis and suggestions have been published in previous reports.

These included the anatomic abnormalities of nail surface and groove, the over trimming of nails (especially rounding of lateral margins), poorly fitting shoes (sharp end on the forefoot), history of trauma, obesity, subungual neoplasm and hyperhidrosis. A previous study by Langford...
et al showed that the medial rotation of the hallux during weight bearing became one of the significant risk factors. From the etiology mentioned above, we can infer that the most common site of paronychia affected was lateral nail folds of the hallux due to the special anatomic structure; especially the convexity of the lateral nail fold.

The treatment modalities to solve the problem must include stopping the new nail growth from the germinal matrix and avoiding the nail impinging into the lateral nail fold by changing the direction of nail growth or by correcting the convexity of lateral nail fold. Many ideas and materials (of either surgical or non-surgical treatment) have been performed by previous authors who tried to achieve the above goals.

Various devices were used to prevent the impingement of the nail to the lateral nail fold, such as a piece of polyethylene tube, or a wedge of fabric inserted into the lateral edge of the nail plate. This procedure requires patient cooperation and is only valid in stage 1 paronychia.

The use of chemical ablation on the germinal matrix of the affected site (with nitric acid, silver nitrate and sodium hydroxide) to stop the regrowth of lateral nail has also been performed. Phenol cauterization has also been rather popular until now, and carbon dioxide laser vaporization has been reported as well.

Surgical debridement and removal of partial nail on the affected site is the most popular surgical method at present. This includes the “fish hook” nail which gives most irritation to the lateral nail fold. The radical surgical method performed by Zadik was the elimination of the germinal matrix which initializes nail growth, besides total removal of the remaining nail plate. This method did obtain a much lower recurrent rate.

An aggressive surgical treatment to reduce the recurrence of nail impingement is Bartlett’s procedure where a wedge resection on the lateral nail fold was performed; the hypertrophic groove and convexity of the lateral nail fold of the affected site can be corrected. From this point of view, we modified the Bartlett procedure to preserve more circulation in the lateral nail fold, so that exploration of the lateral site of germinal matrix for matricectomy could be performed under direct vision.

**Operative procedures**

While the patient was placed in the supine position, anesthetic block of the toe was done with 5ml of 2% Lidocaine without Epinephrine. A crescent shape was designed at least 0.5cm laterally to the nail fold. Resection of the lateral nail fold was measured usually 3cm in length (lateral border) and 0.5cm to 0.8cm in width according to the length of the toe and the depth of the lateral nail groove (Fig. 1). A small caliber of Negaton tube was used as a tourniquet for bloodless operative field. Minimal nail plate was removed as well; usually 1/5-1/4 of the involved nail plate. The removal of the infected granulomatous tissue with curettage and scissor was done after that. The excision of crescent shape skin and subcutaneous tissue was performed as designed soon after. Electrocauterization of the involved matrix through the proximal site of the lateral nail fold was performed before wound closure (Fig. 2). Wound margin was sutured with 4-0 Nylon and dressed with Better Iodine gauzes after tourniquet was released and bleeders were checked. Oral antibiotic was subscripted for 5 days for infection control. Removal of sutures was usually undergone 10-14 days after the operation according to the wound condition (Fig. 3 to Fig. 4).
Fig. 1. Design of crescent shape incision.

Fig. 2. Matricectomy by using electro-cauterization.

Fig. 3. Case 3: A 40-year-old male physician with 3 times recurrence over 6 month’s duration of paronychia after partial removal of nail.

Fig. 3a. Stage III paronychia with granulation tissue.

Fig. 3b. Crescent shape excision designed.

Fig. 3c. Flap sutured after excision with local debridement.

Fig. 3d. Operative lesion after 6 months of follow up.
Fig. 3e. Wound compared with left big toe.

Fig. 3f. MRI to follow up germinal matrix 6 months after operation. White arrow show the lost of germinal matrix replaced by fibrous tissue.

Fig. 4. Case 5: A 13-year-old female student suffered from recurrent paronychia for more than 2 years, on both lateral nail folds alternatively. Received total or partial nail extraction 10 times.

Fig. 4a. Stage III paronychia, lateral site of right big toe.

Fig. 4b. Medial site, crescent shape excision designed.

Fig. 4c. Postoperative view.

Fig. 4d. Two months of follow-up.
Materials and Methods

Our cases were collected from May 2004 to December 2006, including 16 patients with 19 lesion of recurrent paronychia of big toes. All cases selected suffered from deep lateral nail fold caused ingrown toenail. They selected according to the clinical appearance of the lesions and history of recurrent paronychia. Patients excluded from this study if the paronychia lesion was the first time to attack and the lateral nail groove did not interrupted the progression of lateral nail growth. Their ages ranged from 13 to 40 with 9 males and 7 females. Twelve of them had received partial or total nail extraction up to 10 times since paronychia happened, prior to this surgical treatment. Four of them did not receive any surgical intervention except for local wound care and minimal debridement by the patients themselves. None of our patients had ever received nail splitting, phenol or electric cauterization, nor laser or any other extensive surgical procedure such as Bartlett’s or Zadik’s procedures. Among all 16 patients, 3 of them suffered from 2 lesions of paronychia. The patients were categorized by using Heifetz classification; this included 4 lesions in stage I, 7 lesions in stage II and 13 lesions in stage III.

Results

All patients who received this surgical procedure were completely relieved from paronychia. All the wounds healed well, and none of them sustained recurrence at the operative site. No flap necrosis was noted on the lateral fold. Two cases of wound infection were noted (case 10 and case 13). Prolonged wound care in the outpatient department was given and the wounds healed well without any surgical intervention. Overall cosmetic appearance of the nail plate was well preserved and postoperative results gained high satisfaction.

For the total follow-up period from 2 months to 19 months, MRI pictures of case 3 showed fibrotic formation of the matrix on 6 months of follow-up after matricectomy (Fig. 3f). The loss of germinal matrix after the electro-destruction ensured the termination of nail growth on the matricectomy region.

Discussion

After traditional use of partial or total nail extraction, regrowth of nail into the nail fold will give another episode of tissue irritation and local inflammation; this may cause recurrent paronychia. The study of Carina et al showed 21% of recurrent rate. The idea of changing the anatomical structure of the nail fold may be a key point in overcoming this problem. According to the relationships between anatomical structure of the hallux and ingrown toenails, a study of Pearson et al showed that the ingrowth is not commonly associated with an abnormal shape of the nail. Their study of 23 patients of ingrown toenails and 23 in the control group found no differences in shape between the toenails of the patients and those of the controls. However, in our cases, we found that the anatomical structure of the lateral nail groove and depth of lateral nail fold highly affected the recurrence rate of ingrown toenail and hence induced another paronychia. The severity of convexity and deepness of lateral nail groove cannot be measure accurately due to the inflammatory change of surrounding tissue. Somehow, the deep lateral nail groove interrupted the progression of nail plate while the nail was growing. The nail lastly impinged into the lateral fold and created tissue reaction afterwards. The inflammatory change began with intractable pain present.
fold turned hypertrophic if the inflammatory reaction persisted. Finally, the patient was unable to wear shoes, and was sometimes unable to walk due to the severe pain. The creation of crescent shape excision and formation of a local flap may change the lateral fold angle. As a result, the progression of nail growth became smoother without obstruction. Tissue reaction and inflammatory change of nail groove will not exist after that. The idea of wedge incision to change the convexity of nail fold created by Bartlett successfully solved the problem of ingrown toenail. Nevertheless, from the study of Jemec et al, there was still a recurrence rate of 19% without matricectomy. An additional matricectomy with phenol as performed by Issa et al, did improve the rate, but partial necrosis of the reconstructed lateral nail groove was another complication of this resection method.

We modified Barlett’s procedure to a crescent shape excision for better angle creation and to preserve more skin on the medial part of the lateral fold including subcutaneous soft tissue for prevention of flap necrosis. The skin excised should be wide enough to create a larger angle, but not be hazardous to the circulation of flap on the lateral border after skin suture. Furthermore, the wedge excision designed by Bartlett couldn't approach the lateral germinal matrix under direct vision to perform matricectomy. The wound created by crescent shape excision can expose the lateral germinal matrix closed to the proximal nail fold enabling performance of the matricectomy more easily.

Although Zadik’s procedure had a low recurrence rate, the avulsion of the whole nail plate and complete elimination of the germinal matrix may end up with unbearable complications of this method, including bone exposure, osteomyelitis and prolonged wound healing. This method is not commonly performed currently.

In this series, total nail extraction during the debridement procedure was not performed. Instead, we performed partial nail extraction on the lesion side; approximately 1/5 or 1/4 of the nail included the “fish-hook” nail which was buried under the proximal part of the nail groove. Persichetti et al have suggested that total extraction of the nail may gain a better cosmetic result than partial nail extraction after nail regrowth. In our experience, the regrowth of a complete nail plate after total nail extraction will take about 12 months. The patients suffered from longer post-operative pain without the protection of the nail plate. The cosmetic result of partial nail extraction is still acceptable anyway, compared with total nail extraction especially on the toenails. Owing to the benefits of quick recovery and better life quality, minimal toenail extraction was performed in our series.

**Conclusion**

The shape of toenail may not affect the recurrent rate of paronychia, but in our preliminary report, our result showed that changing the convexity of lateral nail groove and ablation of matrix over the proximal site of lateral nail bed obtained a much lower recurrence rate after more than 1 year of follow-up. The direct view on performing matricectomy through the extended crescent shape incision and prevention of necrosis on the lateral nail fold has become our new modification on this radical surgical treatment for recurrent ingrown toenail.
Table 1. Summary of cases

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Sex</th>
<th>Occupation</th>
<th>Location*</th>
<th>Stage</th>
<th>Previous Nail Extraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19</td>
<td>F</td>
<td>student</td>
<td>LL</td>
<td>III</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>F</td>
<td>official</td>
<td>RM</td>
<td>I</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>40</td>
<td>M</td>
<td>physician</td>
<td>RM</td>
<td>III</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>F</td>
<td>student</td>
<td>LL</td>
<td>III</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>13</td>
<td>F</td>
<td>student</td>
<td>LML</td>
<td>III, III</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>26</td>
<td>M</td>
<td>official</td>
<td>RL</td>
<td>III</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>13</td>
<td>M</td>
<td>student</td>
<td>LM</td>
<td>III</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>19</td>
<td>M</td>
<td>student</td>
<td>LL</td>
<td>III</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>19</td>
<td>M</td>
<td>student</td>
<td>RML</td>
<td>I,III</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>27</td>
<td>F</td>
<td>student</td>
<td>RM</td>
<td>II</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>26</td>
<td>M</td>
<td>official</td>
<td>RM</td>
<td>III</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>16</td>
<td>F</td>
<td>student</td>
<td>LM</td>
<td>I</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>17</td>
<td>M</td>
<td>student</td>
<td>LL</td>
<td>III</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>20</td>
<td>M</td>
<td>student</td>
<td>RML</td>
<td>III, III</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>M</td>
<td>student</td>
<td>LL</td>
<td>I</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>18</td>
<td>F</td>
<td>student</td>
<td>LM</td>
<td>I</td>
<td>0</td>
</tr>
</tbody>
</table>

(*LM: Left medial nail fold, LL: Left lateral nail fold, RM: Right medial nail fold, RL: Right lateral nail fold)

Reference


J.P.S.A.R.O.C. 2008. Vol 17 • No.2


復發性嵌入性指甲的廣泛性外科療法

鄭良珊 賴春生 林幸道
張高評 孫一峰 連傑權

甲溝炎的治療常面臨高復發率。嵌入性的指甲會刺激甲側緣而導致炎症反應已成為甲溝炎的主要病理機轉。經由半月狀之切割法而形成一個皮瓣來改變側面甲溝的角度可使甲側緣免於再受到擠壓，從延伸的刀口也可直接破壞側面之生發基質(germinal matrix)，復發率也因此新改良的廣泛性手術而隨之降低。從十六位患者當中，我們對患處進行了十九個半月狀切割加上生發基質之電燒破壞，所有患者的甲溝炎都免於再發。