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ORIGINAL ARTICLE

Relationship Between Hallux Valgus Interphalangeus Deformity and the Recurrence of Ingrown Toenail in Children

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Background: An abnormal hallux interphalangeal angle may be an important risk factor for the recurrence of ingrown toenails.

Methods: In this study, sixty pediatric patients who underwent surgery for an ingrown toenail were evaluated retrospectively in terms of recurrence. The patients were divided into two groups. Group 1 included 30 patients (22 male, 8 female) with hallux valgus interphalangeal deformity. Group 2 included 30 patients (20 male, 10 female) without toe deformity.

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Results: The mean age was 12.8 ± 1.42 years and 12.5 ± 1.45 years for patients in Group 1 and in Group 2 respectively. There was no statistically significant difference between the patient and control group in terms of age and gender ($p > 0.05$). The mean follow-up time was 40 months.

We observed recurrence in six patients (20%) in Group 1 and in 2 patients (6.6%) in Group 2.

Conclusion: We concluded that the recurrence of an ingrown toenail may be associated with increased hallux interphalangeal angle in pediatric patients. Factors related to the hallux interphalangeal angle abnormality, which increases the risk of ingrown toenails, also increase the recurrence rate in these patients. Therefore, it is surmised that hallux valgus interphalangeal deformity should be evaluated before surgery, and patients and their families should be informed about the risk of increased recurrence.

Ingrown toenails are a common problem for people of all age groups (1,2). The prevalence in the general population has been reported to be between 2.5% and 5% (3). However, ingrown toenails are most common in people aged between 11 and 30 years (3). Pain and discomfort complaints while walking and during other daily activities are common. Although; many conservative, as well as surgical techniques of treatments, have been used, the recurrence rate is still reported to be high (1,2,4-8). Many risk factors have been identified as associated with ingrown toenails. Tight-fitting shoes, trauma, abnormal nail shape, and incorrect trimming of

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toenails have been listed as extrinsic risk factors (2,9). In addition, congenital and hereditary risk factors have been associated with ingrown toenails (9).

Although many studies have been done on the treatment methods of this problem, there are fewer studies and data on its etiology and relationship with recurrence. Darwish et al, reported that an ingrown toenail can be caused by the internal pressure of the distal phalanx on the lateral edge of the nail. It has also been reported that an increased hallux interphalangeal angle may be an important risk factor for ingrown toenails (3,5,9).

It is also possible that an abnormal hallux interphalangeal angle may be an important risk factor for the recurrence of ingrown toenails.

In this study, we aimed to observe the relationship between the recurrence of ingrown toenails and hallux valgus interphalangeal deformity in pediatric patients with hallux valgus interphalangeal deformity to those who had no deformity.

Our secondary aim was to emphasize the need to inform patients and their families that relapses may be more common in adolescents with hallux valgus interphalangeal deformity.

Materials and Methods

Sixty pediatric patients who had undergone surgery for an ingrown toenail between 01 January 2010 and 01 January 2017 were evaluated in terms of recurrence and sorted into two groups.

The study was performed in line with the principles of the Declaration of Helsinki.

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The great toe was unilaterally affected for all patients, it was the first presentation and the lateral edge of the toe was affected. Group 1 included 30 patients (22 male, 8 female) with hallux valgus interphalangeal deformity. Group 2 included 30 patients (20 male, 10 female) without toe deformity. The mean age was 12.8 ± 1.42 years and 12.5 ± 1.45 years for patients in Group 1 and in Group 2 respectively. There was no statistically significant difference between the patient and control group in terms of age and gender ($p > 0.05$).

The patients who were between 10-16 years, underwent the same surgical technique, only the lateral edge of the toe was affected, and only displayed hallux valgus interphalangeal deformity. The control group consisted of children having no deformity who were operated on and whose hallux interphalangeal angle was 10 degrees or less. Patients who had previously undergone surgery due to an ingrown toenail, trauma and patients with any other foot or toe deformity and neurologic disorders were excluded from the study.

Stress (standing) X-ray view was done as part of the treatment protocol in patients with an ingrown toenail. The angle which was measured on the radiograph was the interphalangeal angle of the great toe and no other variables were measured. The interphalangeal angle was formed by the intersection of two lines, one line along the long axis of the proximal phalanx and the other line along the long axis of the distal phalanx (5). Any value more than 10 degrees was considered abnormal (5,10). (Figure1).

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Wedge excision with diathermy ablation was applied to all patients as a surgical technique. This technique was advocated as the primary treatment for ingrown toenails in children (2). All patients used a prophylactic antibiotic after surgery.

All postoperative cases were followed up clinically in the outpatient clinic on the 3rd and 7th days for pain, infection, healing, and dressing. Soaking was allowed after one week. The patients started normal ambulation on the seventh day and resume their normal activities in three weeks was possible. Healing was inspected for the complete re-epithelialization of the nail bed and regression of edema. The patients were checked for spike formation, nail edge dystrophies, recurrence, and postoperative patient satisfaction with the new general shape of their healed nails. We defined the presence of symptomatic ingrown toenails following surgical treatment as a local recurrence. The mean follow-up time was 30.2 ± 13.46 months and 31.3 ± 12.86 in both groups ($p=0.286$).

SPSS for Windows version 20.0 software (SPSS Inc., Chicago, Ill., USA) was used for statistical analysis. Descriptive statistics of the data were used to describe the study population. Independent Sample T-test and Chi-Square test were used to compare qualitative variables. $P \leq 0.05$ was considered statistically significant.

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Results

Patients' demographics and follow-up data were summarized in Table 1. The postoperative infections rate were 13.3% (n=4) in Group 1 and 10% (n=3) in Group 2. All patients improved with antibiotic use and dressing.

The recurrence was observed in 6 patients (20%) in Group 1 and in 2 patients (6.6%) in Group 2. The recurrence rate in Group 1 was significantly higher than in Group 2 ($p=0.003$).

The mean hallux interphalangeal angle was 12.8 ± 1.61 and 8.13 ± 1.07 degrees in patients with hallux valgus interphalangeal deformity and the patients without deformity respectively ($p=0.00$).

The recurrence rate was significantly higher in patients with a hallux interphalangeal angle of $14 \geq$ degrees (high grade) as compared to the other group ($p=0.00$). In addition, the recurrence rate was significantly higher in children who were older than 14 years with hallux valgus interphalangeal deformity ($p=0.005$) (Table 2).

Re-operation was performed on patients who had a recurrence. There was no second recurrence in these patients during the follow-up time.

Discussion

Ingrown toenails are among the most commonly encountered conditions in orthopedics which result in pain and disability (3,11). In particular, they are a significant problem in pediatric and

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especially adolescent patients (1). It was reported that the majority of patients treated with surgery were in the 11-13 years age range of the pediatric population (1).

Although many surgical and conservative methods have been reported, the recurrence rate is still very high. The recurrence rate was reported between 4% and 59% in different studies depending on the surgical technique have been reported (1,12,13). Ramanath et al. reported no recurrence in a study that used nail–fold excision as a surgical technique (4). Farrelly et al. reported a 10% recurrence rate in 302 patients treated with wedge nail excision and diathermy ablation (14). No recurrence was reported in seven patients treated with this method by Kaleel et al (2). In our study, we preferred wedge excision with diathermy ablation as a surgical technique. This technique was advocated as the primary treatment for ingrown toenails in children (2).

It has been reported that an incomplete understanding of the etiologic factors associated with the development of ingrown toenails is the underlying cause of inadequate success in treatment despite various available surgical and conservative techniques (5). Because of the biomechanical imbalance between the first and second toe, external pressure from shoes may contribute to the development of an ingrown toenail mainly on the lateral edge. (5,11). It has been reported that abnormalities in the interphalangeal angle and hallux valgus angles can also cause this condition (5). Darwish et al. reported that the incidence of an abnormal hallux interphalangeal angle was higher in patients with an ingrown toenail (5). Higher hallux

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interphalangeal angles were also reported in patients with ingrown toenails in a study by Cordoba and Fernandez (9). Kuru and Olçar reported that ingrown toenails were associated with an increased first interphalangeal angle (3). Kose et al. however, reported no correlation between the ingrown toenail and increased hallux interphalangeal angle (11). In this study, we found a significant difference in recurrence rate between the two groups, 20% the recurrence rate in hallux valgus interphalangeal deformity patients and 6% in patients without deformity. The literature has supported the relationship between the increased hallux interphalangeal angle and ingrown toenail etiology, (3,5,9) however, to the best of our knowledge, there is no study that represents a possible correlation between an increased hallux interphalangeal angle and an increased rate of recurrence of ingrown toenails. Therefore, the goal of this study was to determine whether an increased hallux interphalangeal angle was associated with the recurrence of ingrown toenails in children. Ingrown toenails are most common in people aged between 11 and 30 years (3). In this study, we observed that the rate of recurrence was higher in patients with hallux valgus interphalangeal deformity than in the patients in the control group. We also observed a significantly increased recurrence rate in patients who had hallux valgus interphalangeal deformity angle of 14 degrees and above. It was also found to be significantly higher recurrence rate in patients who were older than 14 years old.

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Our study has some limitations. First, it was retrospective in design, and secondly, the number of patients was relatively low. Thirdly, surgical interventions were not performed by a single team.

Conclusions

We conclude that the recurrence of ingrown toenails may be associated with an increased hallux interphalangeal angle in pediatric patients. Factors related to hallux interphalangeal angle abnormality, which increases the risk of ingrown toenails, also increase the recurrence rate in these patients. Therefore, hallux valgus interphalangeal deformity should be evaluated before surgery, and patients and their families should be informed about the risk of increased recurrence. A prospective study with more patients and the values obtained as a result of follow-up may be more valuable.

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Table 1 Patient demographics and follow-up data (N=60 toes in 60 patients).

		Group 1 (n=30)	Group 2 (n=30)	P value
Mean Age (years)		12.8± 1.42	12.5± 1.45	0.495
Gender	Male (n/%)	22(%73,3)	20(%66,6)	0.554
	Female (n/%)	8(%26.7)	10(%33,4)	
Mean follow-up (months)		30.2 ± 13.46	31.3 ± 12.86	0.286
Mean Hallux Interphalangeous Angle (degree)		12.8±1.61	8.13±1.07	0.00*
Postoperative infection rate (%)		13.3	10	0.138

*Descriptive statistics were used for analysis. *p<0.05 considered as significant*

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Table 2 Comparisons of the patients according to puberty stage and Hallux Interphalangeous Angle Degree (N=60 toes in 60 patients).

		Reccurrence		P value
		Absence (n)	Presence (n)	
Hallux Interphalangeous Angel Degree	Normal (7-10°)	28	2	0.00*
	Low Grade (11-13°)	21	1	
	High Grade (14°≤)	3	5	
Puberty	14 years old below	41	2	0.005*
	14 years old above	11	6	

*Chi Square Test was used for statistical analysis. *p<0.05 is considered as significant*

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Figure 1. Measurement method of hallux valgus interphalangeal angle (The interphalangeal angle was formed as the intersection of the lines drawn along the long axis of the distal phalanx and proximal phalanx).

