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Surgical treatment of subungual glomus tumors: Experience with lateral subperiosteal and transungual approaches

Fatih Kabakas[1], Meric Ugurlar[2], Ismail Bulent Ozcelik[1], Berkan Mersa[1], Husrev Purisa[1], Ilker Sezer[1]

ABSTRACT

Background: Nail bed deformity and tumor recurrence are the major complications of subungual glomus tumor surgery. Therefore, alternative methods to approach glomus tumors in the hand have been proposed in order to avoid further nail bed injury after surgical treatment.

Methods: In this study, a series of 32 patients with glomus tumors in the subungual region of the hand, treated surgically with two different types of incisions, is reported. The clinical efficacy and safety of surgical treatment of glomus tumors performed using the lateral subperiosteal or transungual approaches were analyzed.

Results: In the transungual approach, as the nail plate is extracted and the nail bed is incised, there is a high risk of postoperative nail deformity and late recovery. However, with the lateral subperiosteal approach, because only the skin lateral to the nail is incised without extracting the nail plate and incising the nail bed, nail bed injury does not occur.

Conclusion: Overall, early recovery takes place and postoperative nail deformity is improved. The main advantages of the lateral subperiosteal approach are that it permits reduction of postoperative nail deformity and early recovery. However, not every glomus tumor is suitable for the lateral subperiosteal approach. In tumors located peripherally, the lateral subperiosteal approach provides quick recovery of cosmetic appearance and less deformation of the nail.

Key words: *Glomus tumor, subungual, transungual approach, lateral subperiosteal approach*

Introduction

The histological diagnosis of glomus tumors was first described by Masson [1]. Glomus tumors are rare benign tumors derived from the neuromyoarterial canal system of the Glomus body which is found in the tip of the digits, especially beneath the nails, and regulates circulation within the capillaries of the skin [2,3]. These tumors constitute 1 - 4.5% of all hand tumors and are typically located in the subungual region in 75 to 90% of the cases based on the high concentration of glomus bodies in this area [4].

Here, a series of 32 patients with glomus tumors in the subungual region of the hand, treated surgically with two different types of incisions, is reported. The clinical efficacy and safety of the surgical treatment of glomus tumors performed by the lateral subperiosteal or the transungual approaches were analyzed.

Author affiliations : *[1]IST-EL Hand Surgery, Microsurgery and Rehabilitation Group, Istanbul, Turkey [2]Department of Orthopaedics and Traumatology, Sisli Hamidiye Etfal Education and Research Hospital, Istanbul, Turkey*

Correspondence : *Meric Ugurlar, MD, Department of Orthopaedics and Traumatology, Sisli Hamidiye Etfal Education and Research Hospital, Istanbul, Turkey e-mail: mugurlar@yahoo.com*

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Patients and Methods

A retrospective analysis of 32 patients, diagnosed clinically with glomus tumors and operated on between December 2000 and September 2012, were included in the study. There were two groups of patients - group 1 was treated by the transungual approach (Figures 1 and 2) and group 2 was treated by the lateral subperiosteal approach (Figures 3 and 4). Group 1 consisted of 14 patients (9 females and 5 males) and group 2 consisted of 18 patients (11 females and 7 males). The mean age was 39.7 years (range: 27 to 60) in group 1 and 42.8 (range: 26 to 64) in group 2. Preoperative diagnosis was made clinically by the characteristic symptoms triad consisting of spontaneous pain, point tenderness and temperature sensitivity (Table 1). All patients had at least two of the three common symptoms (Table 1). Preoperative plain radiographs were taken in all patients. All patients underwent magnetic resonance imaging (MRI) as part of the preoperative work-up, which were evaluated by a radiologist according to standard evaluation techniques [5]. Four patients in group 1 (Figure 5) and three patients in group 2 had bone lesions in the distal phalanx (Table 1).

All patients underwent excision of the glomus tumor. All operations were performed under digital nerve block anesthesia with a tourniquet placed at the base of the involved finger. Patients operated on with the transungual approach constituted group 1 and patients treated with the lateral subperiosteal approach described by Foucher [6,7] comprised group 2 (Tables 1 and 2).

The indications for selection of the approach toward subungual glomus tumors are summarized in Table 3. The transungual approach is the more commonly used surgical incision for distal digital glomus tumors. In the transungual incision, the nail was elevated and then a longitudinal incision to the nail bed was performed. Next, the nail bed was repaired following tumor excision. In the lateral subperiosteal approach, an incision was performed on either the radial or ulnar aspects of the finger, depending on the location of the tumor on the MRI images. After the incision, a flap was raised dorsally, including the nail, the nail bed and the soft tissues. The nail bed was elevated carefully from the periosteum of the distal phalanx [6,7]. All speci-

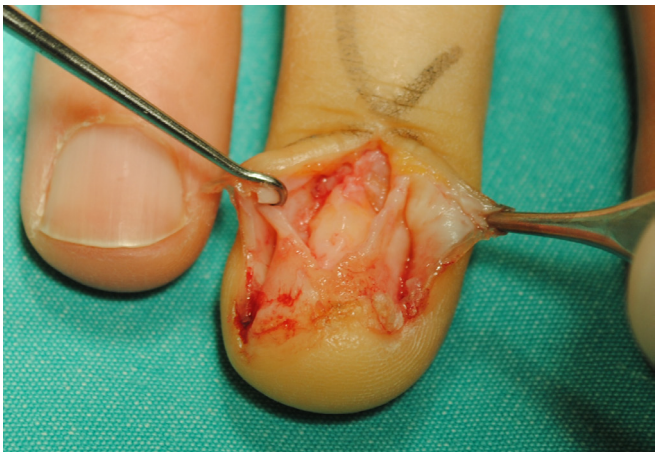

Figure 1. A 42-year-old woman with a glomus tumor on the middle finger of her right hand treated using the transungual approach.

Figure 2. A 34-year-old woman with a glomus tumor on the middle finger of her left hand. Note the well-circumscribed tumor mass popped-up from the nail bed.

Figure 3. A 33-year-old woman with a glomus tumor on the thumb of her left hand. The glomus tumor was excised with the lateral subperiosteal approach.

mens were sent for pathologic examination.

The patients were assessed by this study's authors, who specifically did not participate in the surgery, with respect to age, gender, treatment, postoperative complications and return to daily activities. Postoperative sensation was evaluated by Semmes-Weinstein monofilament and two-point discrimination (2-PD) tests. Data from the Semmes–Weinstein monofilament testing were interpreted as follows: green (filament marking: 2.83) - normal; blue (filament marking: 3.61) - diminished light touch; and purple (filament marking: 4.31) - diminished protective sensation; red (filament marking: 6.65) - loss of protective sensation [8]. Excellent results were defined as 2-PD of 6 mm or less; satisfactory results were 7–15 mm; and poor results were defined as 16 mm or greater [9]. Preoperative and postoperative pain was assessed using the Visual Analog Scale (VAS). In addition, all patients completed the Quick Disability of the Arm, Shoulder and Hand (QuickDASH) questionnaires.

Results

The mean follow-up length was 26.4 months (range 8 to 89 months) for group 1 and 26.7 months (range 9 to 75 months) for group 2. The third finger was the most commonly involved finger in both groups. There were no multiple finger involvements in either group. Twelve patients in group 1 and 11 patients in group 2 had pain in the affected finger before the operation. There was discoloration of the nail in 7 patients in group 1 and 4 patients in group 2 (Table 1) (Figure 6). Four patients in group 1 and 3 patients in group 2 had bone lesions in the distal phalanx (Figure 5) (Table 1). The glomus tumors were excised and curettage was carried out in cases with bone erosions. Postoperative radiological evaluation was not performed in asymptomatic patients.

Gross pathologic examination showed well-circumscribed, red-grey colored, round tissues with dimensions between a minimum of 0.2 x 0.3 x 0.2 cm and a maximum of 0.6 x 0.3 x 0.4 cm (Figures 3 and 4). Microscopic examination revealed solid sheets of regular rounded glomus cells with uniform nucleus and pale eosinophilic cytoplasm surrounding dilated and proliferated small vessels. All surgically excised

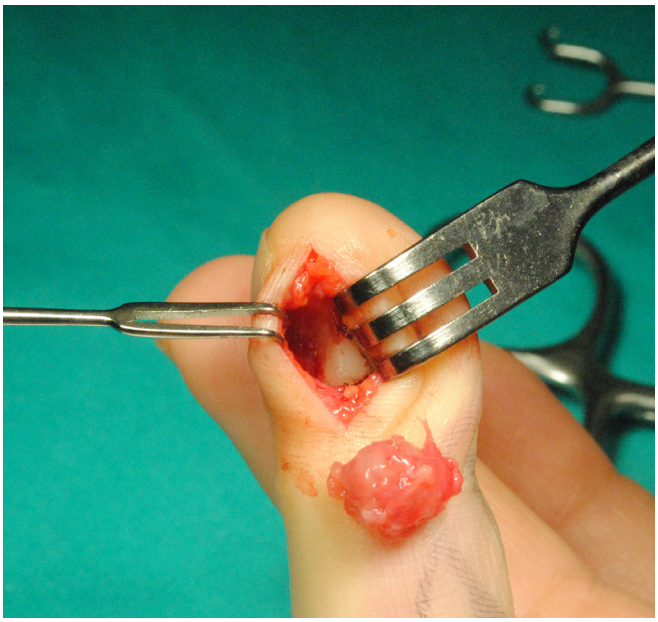

Figure 4. A 38-year-old woman with a glomus tumor on the middle finger of her left hand treated using the lateral subperiosteal approach.

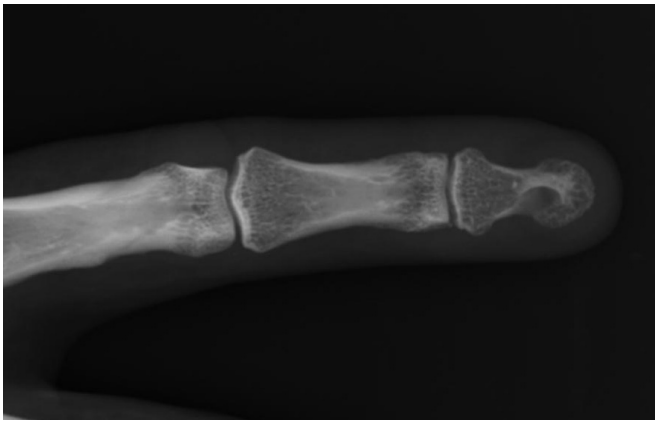

Figure 5. A 47-year-old woman with a glomus tumor on the index finger of her right hand. The anteroposterior radiograph shows bone destruction in the distal phalanx.

Figure 6. A 48-year-old woman with a glomus tumor on the middle finger of her right hand. Discoloration of the nail is seen.

Table 1. Clinical findings related to glomus tumors in groups 1 and 2.

Preoperative findings	Age	Gender	Follow-up period (months)	Bone destruction	Pain	Tenderness	Temperature sensitivity	Discoloration of the nail	Affected finger
Group 1									
1	36	w	17	–	+	–	+	+	4th
2	40	w	46	–	+	+	+	+	2nd
3	27	m	18	+	+	+	–	–	1st
4	48	w	8	–	+	+	+	+	3rd
5	34	w	33	–	+	–	+	–	3rd
6	31	m	13	–	–	+	+	+	2nd
7	51	m	89	+	+	+	+	–	3rd
8	39	w	15	–	+	+	+	+	4th
9	42	w	23	–	+	+	+	–	3rd
10	39	w	13	+	+	–	+	–	2nd
11	58	w	56	–	+	+	+	+	3rd
12	30	m	11	–	–	+	+	–	2nd
13	36	w	13	+	+	+	+	–	4th
14	45	m	14	–	+	+	+	+	1st
Group 2									
1	26	w	11	–	+	+	–	–	4th
2	57	m	9	–	+	+	–	–	3rd
3	36	m	49	–	–	+	+	+	4th
4	44	w	14	–	–	+	+	–	2nd
5	37	w	55	–	+	+	+	–	3rd
6	58	w	24	–	+	+	–	–	3rd
7	47	w	75	+	+	+	–	–	2nd
8	36	m	23	–	+	+	–	–	4th
9	46	w	16	–	–	+	+	+	1st
10	59	w	27	–	+	–	+	–	2nd
11	64	m	13	–	–	+	+	–	4th
12	33	w	34	–	–	+	+	–	1st
13	45	m	12	+	+	+	+	–	3rd
14	46	m	26	–	–	+	+	–	3rd
15	28	w	22	–	+	+	–	+	2nd
16	25	w	15	–	+	+	+	+	4th
17	38	w	43	+	–	+	+	–	3rd
18	46	m	12	–	+	+	+	–	2nd

specimens were histopatologically confirmed to be glomus tumors. According to the Semmes-Weinstein test, 92.8% (13/14) of the patients in group 1 tested normal (green) and 7.1% (1/14) had diminished light touch (blue). In group 2, 88.8% (16/18) of the patients tested normal (green) while 11.1% (2/18) had diminished light touch (blue). Mean 2-PD test results were 3.5 mm (2-6 mm) in group 1 and 3.6 mm (2-6 mm) in group 2. Postoperative results regarding sensation (Semmes-Weinstein and 2-PD tests) demonstrated no significant difference between the two groups. The VAS score in group 1 was 4 (range: 0-7) preoperatively, while it was assessed to be 1 (range: 0-3) in the postoperative period. Preoperative VAS scores from group 2 were 3,5 (range: 0-8) and postoperatively 0,7 (range: 0-4). In terms of pain evaluation, VAS showed statistically sig-

Table 2. Postoperative complications and Semmes-Weinstein testing results of glomus tumors in groups 1 and 2.

Preoperative findings	Nail deformity	Recurrence	Other complications	Results of Semmes-Weinstein test Normal: Green Diminished light touch: Blue
Group 1				
1	–	–		Green
2	–	–		Green
3	+	–		Green
4	–	–	Hypertrophic scar, postoperative pain	Green
5	–	–		Green
6	–	–		Green
7	–	–		Green
8	–	–		Green
9	–	–		Green
10	–	–		Blue
11	+	+	Postoperative pain	Green
12	–	–		Green
13	+	–		Green
14	–	–		Green
Group 2				
1	–	–		Green
2	–	–		Green
3	–	–		Green
4	–	–		Blue
5	–	–		Green
6	–	–		Green
7	–	–		Green
8	–	–		Green
9	–	–		Green
10	–	–		Green
11	–	–		Green
12	–	–		Green
13	–	–		Blue
14	–	–		Green
15	+	–	Postoperative pain	Green
16	–	–		Green
17	–	–		Green
18	–	–		Green

nificant improvement in both groups between preoperative and postoperative periods ($p<0,01$), while there was no significant difference between the two groups in preoperative and postoperative comparisons ($p>0,05$). In this work's series, operation time was similar for both transungual and lateral subperiosteal approaches.

The mean return to full daily activities was 48 days (range: 32-64) for group 1 and 20 days (range: 11-31) days for group 2. The mean return to full daily activities was 28 days (range: 21-33) earlier in patients in group 2. The mean preoperative QuickDASH scores in group 1 and 2 were 24.3 and 23.4, respectively. These scores decreased to 4.5 and 4.3, respectively, after the operation.

In group 1, 3 patients developed nail deformities (Table 2). Postoperative pain was seen in 14.2% (2 patients) of the patients and tumor recurrence rate was 7.1% (1 patient) (Table 2). In group 2, a lateral subperiosteal approach without nail extraction was performed and 5.5% (1 patient) had postoperative pain and 5.5% (1 patient) had nail deformity with nail ridging (Table 2). No tumor recurrences were seen in group 2 (Table 2).

The symptoms resolved postoperatively in all patients. One patient in group 1 developed tumor recurrence in the postoperative eighth month. This patient was operated on again twelve months after the initial operation and was symptom-free at the postoperative second year. Other complications were nail deformity, postoperative pain and hypertrophic incision scarring (Table 2). One patient in group 1 had hypertrophic scar formation with redness and pruritus in the thumb. This was resolved by two corticosteroid injections six months after surgery.

Statistical analyses were carried out with the support of Fisher's exact probability test, Student t-test, Mann Whitney U-test, Yates Continuity Correction test and Spearman's Correlation Analysis.

Table 3. Robust indications of two techniques in subungual glomus tumors.

Lateral subperiosteal approach	Transungual approach
Peripherally located tumors without preoperative nail deformity	Centrally located tumors
	Preoperative nail deformity
	Wide nail discoloration
	Tumors extend proximally from the subungual region
	Tumors which necessitate graft reconstruction

Discussion

In general, the diagnosis of subungual glomus tumors has been established clinically. Spontaneous pain, point tenderness and temperature sensitivity constitute the classical diagnostic triad of glomus tumors. Besides this, there can be red or blue discoloration of the skin or nail. Nail discoloration in glomus tumors is related to the depth of the lesion [10]. The authors believe that dark discoloration on the nail, especially when it has a radius greater than 1 mm, is another finding that would lead to employment of the transungual approach because of the need for nail bed repair subsequent to tumor removal. In these patients, the nail bed is almost always perforated or paper-thinned by the tumor and requires reconstruction by either direct closure or grafting, neither possible with the lateral subperiosteal approach. Additionally, contact produces a sharp pain that radiates diffusely. Pain according to temperature variation can impair one's quality of life and also be a clue for diagnosis. In this series, pain was evaluated by VAS analysis. The patients' VAS scores demonstrated statistically significant improvement in both groups between the preoperative and postoperative periods ($p<0,01$), while there was no significant difference between the two groups in preoperative and postoperative comparisons ($p>0,05$). Both techniques of excision provided adequate pain relief, however the difference between both was not significantly significant.

In the work-up of the suspicious lesions, bone erosions seen on plain radiographs were very helpful. In this study, seven (21.8%) patients showed bony erosions on plain radiographs (Figure 5). MRI was the most useful diagnostic tool as it supplied details about the tumor location and its relationship to the adjacent

Table 4. Results of using the glomus tumors approaches with no nail extraction in the literature.

Authors	Patients (n)	Approach	Follow-up period (months)	Postoperative nail deformity (%)	Recurrence (%)
This study	18	Lateral approach	26.7	5,5	0.0
Roan	17	Transungual with no nail extraction	8.9	0.0	0.0
Braga Silva & Teixeira	16	Lateral approach	66	0.0	0.0
Fong	4	Modified periungual approach	18	50	0.0
Vasisht	19	Lateral subperiosteal	20	0.0	15.7
Foucher	55	Lateral approach	81	0.0	12.7

Table 5. Results with the transungual approach from the literature.

Authors	Patients (n)	Follow-up period (months)	Postoperative nail deformity (%)	Recurrence (%)
This study	14	26.4	21.4	7.1
Roan	29	70	24.1	13.8
Song	21	34	0.0	5.0
Moon	16	–	19.0	0.0
Tomak	14	22	21.4	7.1
Ekin	9	–	0.0	0.0
Van Geertruyden	30	–	3.3	6.6
Varian & Cleak	22	–	–	33.0
Carroll & Berman	28	36	–	21.4
Cooke	24	–	10.0	20.8
Lee	17	10	0.0	0.0

structures. Angiography, thermography, ultrasonography, and scintigraphy are other diagnostic tools described for glomus tumors [11]. However, the definitive diagnosis of glomus tumors was established here by histopathological evaluation.

Surgical removal of glomus tumors is often curative and recurrence is rare [4,12]. However, recurrence rates in the literature differ from 5% to 50% depending on the series [13]. Complete surgical excision is the recommended treatment for glomus tumors. As a consequence of these tumors being encapsulated, the capsule must be excised to avoid tumor recurrence [14]. In the present series, there was one (3.1%) recurrence and this patient had been treated with the transungual approach (group 1).

Nail bed deformity and tumor recurrence are the major complications of subungual glomus tumor surgery. Therefore, alternative methods to approach glomus tumors in the hand have been proposed in order to eliminate further nail bed injury after surgical treatment. Although the transungual approach is the more commonly used method, the lateral approach along with unilateral or bilateral approaches utilizing an eponychial flap through the nail plate are other surgical options reported in the literature. The results of such studies using the transungual approach and various methods without extracting the nail plate are described in Table 4 and 5 [15-18].

As a result of the high incidence of postoperative nail deformity with the transungual approach, in 1964, Littler defined the lateral approach through the high midlateral line below the paronychial fold for the excision of glomus tumors [19]. Littler described a distal phalangeal ligament that supports the nail plate which was retracted for the exposure of a glomus tumor [19]. In 1971, Johnson reported a lateroungual incision, which is an eponychial incision that elevates the nail bed flap from proximal to distal [20]. Carroll and Berman later described a lateral incision in 1972 but did not detail the approach [4]. Vasisht proposed a lateral subperiosteal approach where there were no nail deformities, though a 15.7% tumor recurrence among 19 patients occurred. Paronychia and complete loss of the nail plate were other complications from that series [21].

In the patients here, the longitudinal transungual approach, which is the standard surgical incision for distal digital glomus tumors, and the lateral subperiosteal approach described by Foucher et al [6], were used. During the lateral subperiosteal approach, the ulnar or radial aspect of the digit is chosen for the incision according to the location of the tumor. In centrally located tumors, it is difficult to reach the tumor with the ulnar or radial lateral subperiosteal approaches. In this situation, it was preferable to employ the longitudinal transungual approach. With that, in this series, the return to full daily activities was 28 days earlier in patients in group 2. It is the opinion of the authors that this was because of the removal of the nail in patients in group 1. Minimal nail ridging postoperatively was observed in 2 patients. One of these patients was in group 1 and

the other one was in group 2. As the patients did not complain about the nail deformity, no surgical intervention was proposed. The nail ridging, seen after the transungual approach, is generally related to the surgical repair technique. Thus, the surgeon should prevent stepping at the primary repair site by using loupe magnification. The loss of nail shine can be seen in patients who underwent nail matrix reconstruction with a graft. This occurred in one patient in group 1 in whom the nail matrix was reconstructed with a graft. The loss of nail shine was not related to preoperative discoloration of the nail.

Braga Silva and Teixeira observed that the lateral subperiosteal approach allows robust visualization of the central, radial and ulnar tumors of the digit [7]. On the contrary, many authors believe that the lateral approach to a subungual tumor is suitable only for tumors located at the marginal subungual region. Fong et al. emphasized that the lateral periungual approach is not appropriate for centrally located lesions because it yields limited exposure [22]. Song stated that the transungual approach permits a better visualization but the possible major postoperative complication of this approach is nail deformity [23]. Van Geertruyden is another author who recommended the transungual approach if the lesion was completely subungual [2]. Lee et al. also reported excellent results with the transungual approach, operating on 17 patients and reported no cosmetically unacceptable nail bed deformities and no tumor recurrences. They concluded that this was the result of careful dissection using an operating microscope [24]. Finally, sensation of the digits was evaluated in both groups. The postoperative results regarding sensation (Semmes-Weinstein and 2-PD test) showed no significant difference between two groups. The transungual technique was performed on the dorsal side of the finger, where it is absolutely safe in terms of avoiding nerve injury. The lateral subperiosteal approach is very safe, as well, when the incision is applied dorsal to the digital nerve.

Based on the data from this work, it appears that both techniques work well for proper indications (Table 3). There were no significant postoperative differences between the two groups in light sensation, 2-PD or postoperative pain, though patients treated through the lateral subperiosteal approach returned to full daily activities 28 (mean) days earlier.

Ultimately, with the transungual approach, as the nail plate is extracted and the nail bed is incised, there is a high risk of postoperative nail deformity and late recovery. However, with the lateral subperiosteal approach, because only the skin lateral to the nail is incised without extracting the nail plate and incising nail bed, nail bed injury does not occur. Consequently, early recovery occurs and postoperative nail deformity is not an issue. The main advantages of the lateral subperiosteal approach are the reduction of postoperative nail deformity and early recovery. However, not every glomus tumor is suitable for this approach. Every patient must have an MRI in order for a decision to be made on which approach to use. The exact location, size and extent of the tumorgoverns the type of incision. In centrally located tumors, it is very difficult to access and excise the tumor totally with the lateral subperiosteal approach. Therefore, the transungual approach should be selected for tumors which are centrally located and extend proximally from the subungual region, and in tumors which necessitate graft reconstruction when primary repair of the nail matrix is not possible after excision. In peripherally located tumors, the lateral subperiosteal approach provides rapid recovery of cosmetic appearance and less deformation of the nail.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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