Actas Dermosifiliogr. 2009;100:875-82

PRACTICAL DERMATOLOGY

Key Diagnostic Features and Treatment of Subungual Glomus Tumor

E. Samaniego,[a] A. Crespo,[a] and A. Sanz[b]

[a]Servicio de Dermatología. [b]Servicio de Anatomía Patológica, Complejo Hospitalario Carlos Haya, Málaga, Spain

Abstract. Glomus tumor was first described by Wood in 1812 and named as such by Masson in 1924. It is a rare benign vascular tumor of the neuromyoarterial glomus. The triad of cold intolerance, intense paroxysmal pain, and well-defined site of pain is characteristic of the tumor. Approximately 80% of lesions are found on the upper limbs, mostly under the nails. Between 2005 and 2008, 7 patients with this disease were seen in our department. Diagnosis was confirmed by histology after excision. We review the clinical features, complementary diagnostic tests, and main surgical techniques described..

Key words: glomus tumor, diagnosis, surgical treatment, nail dystrophy.

CLAVES DEL DIAGNÓSTICO Y TRATAMIENTO DEL TUMOR GLÓMICO SUBLINGUAL

Resumen. El tumor glómico fue descrito por primera vez por Wood en 1812, siendo Masson quien le dio su nombre en 1924. Se trata de un tumor vascular benigno raro derivado del cuerpo glómico neuromioarterial. Clínicamente es característica la tríada de sensibilidad al frío, dolor paroxístico intenso y localización exquisita del punto doloroso. Aproximadamente el 80 % de las lesiones se localiza en la extremidad superior y, de estas, la mayoría se sitúa en la zona subungueal. En el periodo 2005-2008 hemos tenido la oportunidad de ver 7 casos en nuestro Servicio, cuyo diagnóstico fue confirmado mediante el estudio histológico tras su extirpación. En este trabajo aprovechamos para revisar las características clínicas, las pruebas diagnósticas complementarias y las principales técnicas quirúrgicas descritas.

Palabras clave: tumor glómico, diagnóstico, tratamiento quirúrgico, distrofia ungueal.

Introduction

Glomus tumor was first described by Wood in 1812, and was later named by Masson in 1924. It is a rare, benign tumor derived from structures known as glomus bodies.[1,2] These are neuromyoartierial structures involved in thermoregulation and in regulating local blood flow.[3] Although they are found in the dermis throughout the body, they are more concentrated in the hands and feet.[4,5] Up to 80% of glomus bodies are found in the arms, and they are particularly numerous underneath the nails. Glomus tumors most commonly affect patients in middle age, but cases have been described in all age groups. The clinical triad of intense paroxysmal pain, exquisite point tenderness, and sensitivity to cold is a characteristic feature of the tumor.[2,6] Although these symptoms are highly suggestive of glomus tumor, diagnosis is often delayed, and as a result it is not uncommon for patients to present with intense subungual pain that has been present for many years. In the period 2005 to 2008, we saw 7 patients with glomus tumors in the subungual region, with histological confirmation of the diagnosis following excision. Here we review the management of this type of tumor.

Epidemiology

Glomus tumors are rare, accounting for 1% to 5% of tumors of the hand.[6] Of these, 25% to 75% occur in the subungual region.[2,4] This is the most frequent site in women, while the tumor occurs more commonly at other sites in men.[5]

Correspondence:
Elia Samaniego
Plaza del Hospital civil, s/n
29007 Málaga, Spain
eliasamaniego@yahoo.es

Accepted May 25, 2009.

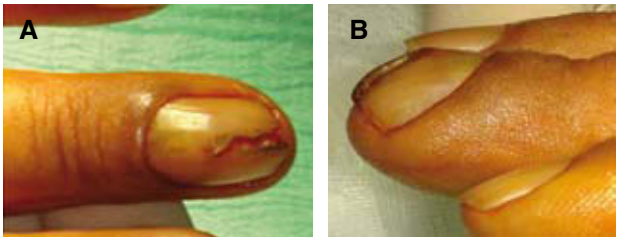

Figure 1. Glomus tumor mimicking median canaliform dystrophy.

Etiology and Pathogenesis

Anatomically, the glomus bodies from which these tumors arise are made up of an afferent arteriole, a vascular anastomosis (the Sucquet-Hoyer canal), a collecting vein, an intraglomerular reticulum (containing glomus cells, nerve fibers, and interstitial cells), and a capsule. Although the cause of glomus tumors is unknown, some authors have proposed that a weakness in the structure could lead to reactive hypertrophy following trauma, or alternatively that they represent hamartomas in which the components are hypertrophied. The glomus cells are specialized smooth muscle cells derived from Zimmerman pericytes, and they are particularly concentrated around the dilated vascular spaces. In addition, nerve fibers and mast cells may be present in increased numbers. Changes in temperature lead to contraction of myofilaments in the glomus cells, resulting in an increase in intracapsular pressure that is transmitted by the unmyelinated nerve fibers, leading to the perception of pain.[6] It is not uncommon for patients to associate the appearance of the lesion with an injury at the same site, but no causal link has been demonstrated.

Classification

Glomus tumors can be divided into 2 variants: solitary and multiple. Solitary glomus tumors are more common, usually occur in adults, and are predominantly found in the extremities, particularly the nail bed.[5,6] The presence of multiple glomus tumors in the digits is rare but has been described on a number of occasions in patients with type 1 neurofibromatosis.[7]

Multiple glomus tumors, also known as glomangiomas or glomovenous malformations due to their angiomatous appearance, account for less than 10% of cases. Unlike the solitary forms of the tumor, these appear in younger patients and usually exhibit autosomal dominant inheritance with variable expression and incomplete penetrance. The gene responsible (the glomulin gene) has been localized to chromosome 1p21-22.[5,7] These tumors are slightly more common in men and appear as soft bluish nodules that can be subdivided according to their distribution into multiple disseminated glomangiomas, multiple localized glomangiomas, and congenital plaque-like glomangioma. Unlike the solitary forms, multiple glomus tumors tend not to be painful.[8-10]

Clinical Signs and Symptoms

Clinically, glomus tumor can present as a visible or palpable mass in the subungual region, a pinkish-red or bluish macule or spot, or an increase in curvature or deformity of the nail plate.[4,6] Occasionally, this dystrophy may be the only sign. We have seen a case mimicking median canaliform dystrophy (Figure 1), and this has also been reported in the literature.[11]

The classic triad of symptoms comprises paroxysmal pain, cold sensitivity, and exquisite point tenderness in the region of the tumor. Not all of the symptoms are present consistently, pain being the most common.

Diagnosis

Patient history and physical examination are key to diagnosis. However, diagnosis can sometimes be difficult, particularly at early stages when the lesion is very small and clinical signs are absent. Furthermore, the characteristic clinical triad may not be complete.[4] This explains the delay in diagnosis of the lesions (up to 15 years) that was apparent both in our own patients and in those cases described in the literature.[2,4] The presence of pain in most cases means the differential diagnosis must include other painful tumors that can occur in the digits (such as neuroma, eccrine spiradenoma, leiomyoma, ganglion, or exostosis) or other conditions such as causalgia (complex regional pain syndrome type 2), gouty arthritis, or calcinosis.[1,6] The diagnosis can be confirmed by histology.

In the absence of the normal clinical presentation (symptom triad), various clinical tests[7] and imaging techniques have been proposed to aid clinical diagnosis. These are discussed in the following section.

Clinical Tests

The Love test

The Love test is orientative. Probing with a needle or pointed instrument triggers pain in the affected area but not the area immediately adjacent to it. The test has a sensitivity of 100% but a specificity of 0%.[4,6,7]

Hildreth sign

The Hildreth sign refers to the occurence of pain following induction of ischemia by application of a tourniquet to the

arm. This highlights the vascular nature of the lesion. It has a sensitivity of between 77.4% and 92% and a specificity between 91% and 100%.[4,7]

Cold-sensitivity test

Application of cold water or ethanol to the affected area will also reproduce the symptoms. This test has a sensitivity and specificity of 100%.[4,7]

Transillumination test

The transillumination test is performed in a darkened room by passing light through the finger pad. An opaque red image is observed in the region of the tumor that allows estimation of its size. The test has a sensitivity of 23% to 38% and a specificity of 90%.[7,12]

Imaging Studies

Even when the lesion has been diagnosed based on symptoms and physical examination (clinical tests), it is important to localize the tumor and determine its size prior to surgery, since it is essential to achieve complete excision in order to avoid recurrence.[13]

Standard radiography, ultrasound, and magnetic resonance imaging (MRI) have been used for preoperative diagnosis. Other imaging techniques such as angiography, scintigraphy, and thermography are not currently indicated.[14]

Radiography can detect large tumors, but in most cases involving smaller lesions radiographs appear normal. In long-standing lesions, there may be evidence of thinning or erosion of the cortical bone in the phalanges. The frequency of this observation ranges from less than 30% to up to 60% of cases, depending upon the series. It may be useful for differentiating between glomus tumors and subungual exostosis, which is one of the most common differential diagnoses.[7,13]

Ultrasound is a noninvasive technique that can be used preoperatively to determine the localization, size, and shape of tumors as small as 3 mm.[13,15] The tumors are visible as well-circumscribed hypoechoic masses. The limitation is found in small, flattened lesions and in the artifacts that may be generated by the nail preventing glomus tumors being distinguished from other hypoechoic masses. The technique is therefore complementary to clinical diagnosis.

Chen et al[15] reported that ultrasound with high-frequency transducers is the most useful technique when the tumor measures less that 2 mm and is in the lateral subungual region. A technique involving 5-14 MHz broadband B mode and C mode ultrasound combined with color Doppler and B-flow imaging has recently been described.[16] This noninvasive technique allows confirmation of the site, size, and depth of the tumor, providing a 3-dimensional image with good definition of vascular flow. This allows glomus tumors to be differentiated from other hypoechoic subungual tumors.

MRI is a noninvasive technique that has increased the diagnostic accuracy in assessment of glomus tumors. However, its high cost precludes routine use. The lesions appear as slightly hypointense or hyperintense T1 or hyperintense T2 images. Depending on the histologic subtype, diagnosis of glomus tumor may be more difficult and the signal can sometimes appear similar to the nail bed. The T1 image appears much more intense following gadolinium injection, allowing the lesion to be visualized more clearly. The technique can be particularly useful for the detection of early lesions, which are very small (even 2 mm lesions) and difficult to diagnose either by physical examination or using other imaging techniques.[3] It can also be useful for assessment of patients with recurrence or incomplete resolution of symptoms following surgery.[14]

Histology

Isolated tumors appear as small reddish-gray encapsulated masses 0.1 to 0.3 cm in diameter (they can reach 3 cm) (Figure 2). Glomus tumors are typically made up of 3 components: glomus cells, vascular structures, and smooth muscle cells. Therefore, according to the predominant component, they can be categorized as solid glomus tumors (few vascular structures and very few if any smooth muscle cells), glomangiomas (with a prominent vascular component), or glomangiomyomas (with a predominance of vascular structures and smooth muscle cells) (Figure 3). The most common variant is the solid tumor (75%), followed by glomangioma (20%) and glomangiomyoma (5%).[5] The presence of small concentrations of nerve fibers in the lesions accounts for the exquisite point tenderness.[4] Immunohistochemistry for these tumors involves staining

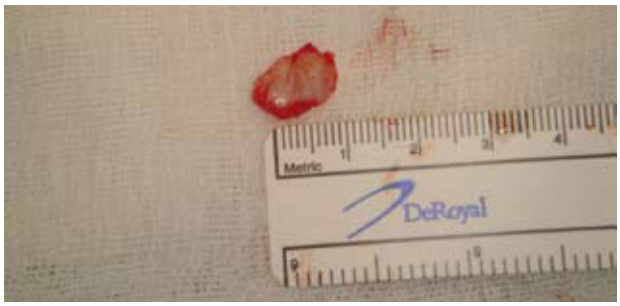

Figure 2. Macroscopic appearance of an excised glomus tumor. Rounded grayish-white mass with a smooth surface and measuring 1.2 × 0.7 cm.

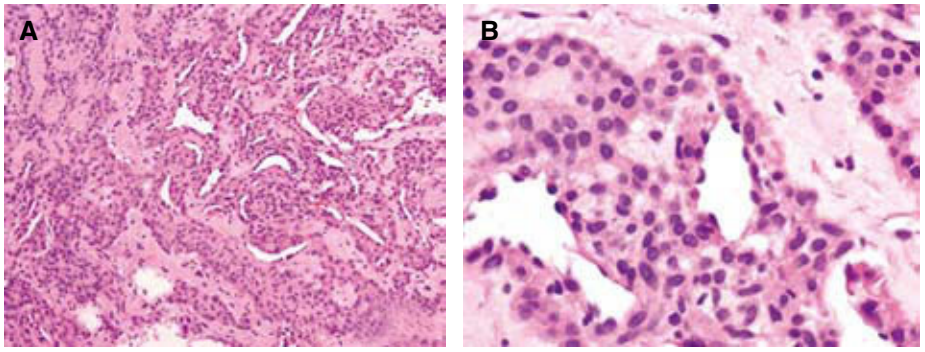

Figure 3. A. Typical glomus tumor with vascular structures surrounded by glomus cells (glomangioma) (hematoxylin-eosin, ×40). B. Detail of the glomus cells surrounding the vascular structures (hematoxylin-eosin, ×100).

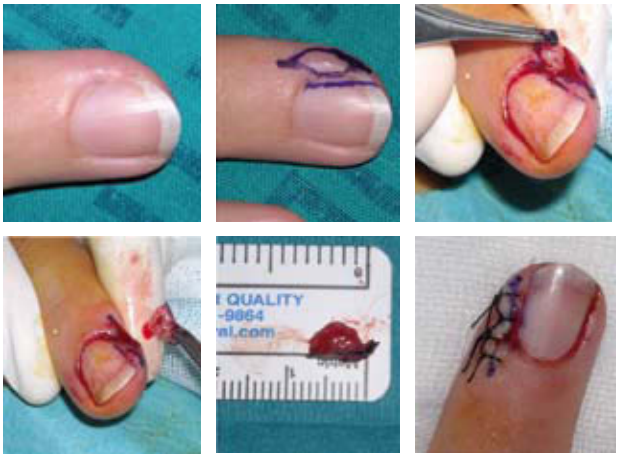

Figure 4. Excision of a recurrent glomus tumor in the periungual region. Lateral transungual approach with excision of a lateral fragment of the nail plate.

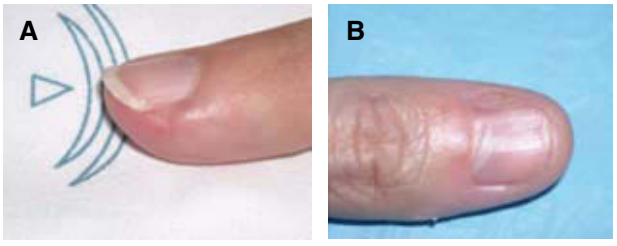

Figure 5. A and B. Nail dystrophy as a postsurgical complication.

with antibodies to actin and vimentin. The neoplastic glomus cells stain positive for CD34 and smooth muscle actin.[7]

Treatment

The treatment of choice is complete surgical excision of the tumor leading to cure.[2] Recovery usually takes 2 to 4 weeks, but the pain sometimes takes longer to disappear. In those patients who do not want surgery or in whom surgery is impossible, it has been reported that indomethacin can control the pain in 10 days.[6] The use of pulsed dye laser, argon laser, carbon dioxide laser, and sclerotherapy have also been described.

The following represent the principal complications of surgery:

1. Recurrence is described in 5% to 15% of cases in some patient series. Pain can recur after a few weeks but can take years to appear. When recurrence occurs early, it is most often due to incomplete excision of the tumor,[6,7] whereas delayed recurrence tends to be due to the appearance of a second tumor (as we believe occurred in one of our patients; Figure 4).
2. The other main complication is nail dystrophy, which occurs in the case of damage to the nail matrix (Figure 5). However, nail dystrophy can also occur when the eponychium adheres to the matrix or due to surface irregularities in the nail bed following surgery.[17] This complication is more common following transungual surgery. More recently, other techniques and solutions have been introduced to avoid this complication.

   In the following section we will briefly discuss the main surgical techniques.

Surgical Techniques

Transungual

Transungual surgical approaches have traditionally been most common.[7] The technique can be divided into 2 types:

1. If the glomus tumor is located in the most proximal subungual area (or intervention is performed "blind"), the entire nail plate is removed following digital block and 2 incisions are made adjacent to the lateral nail folds and at 90º to the eponychium. An eponychial flap

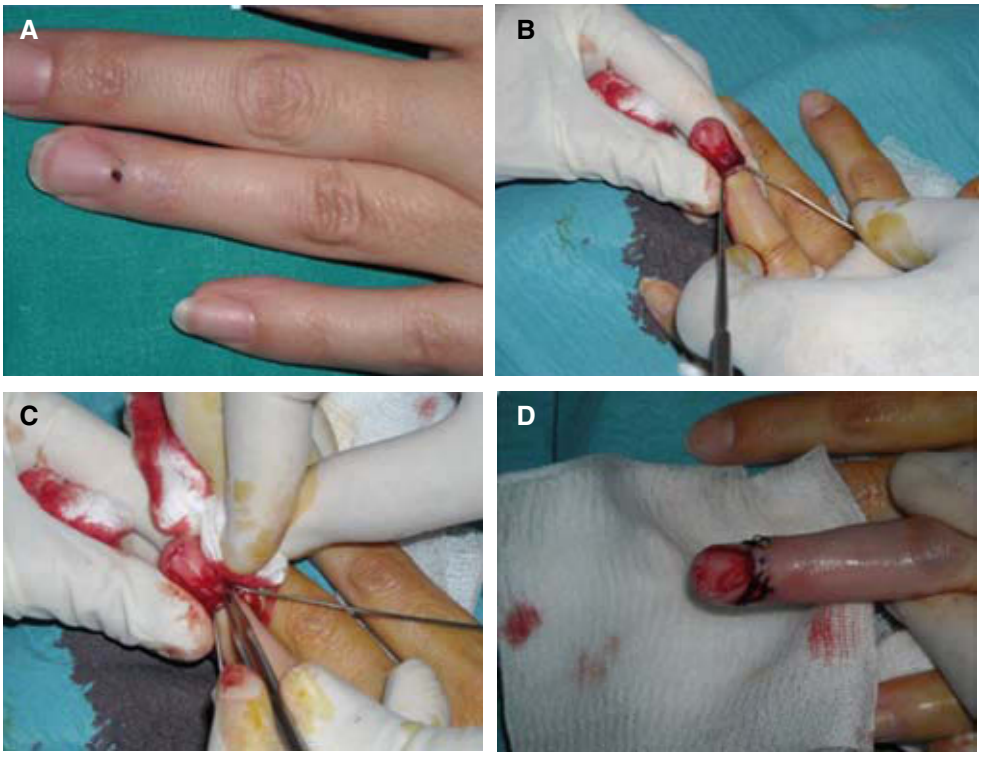

Figure 6. "Blind" surgical excision using a transungual approach. A. The painful spot located using the Love test is marked. B. Following digital block, 2 incisions are made and an eponychial flap is raised. C. The tumor is exposed as a small grayish-white encapsulated mass in the matrix and is carefully dissected. D. The nail bed and lateral incisions are sutured.

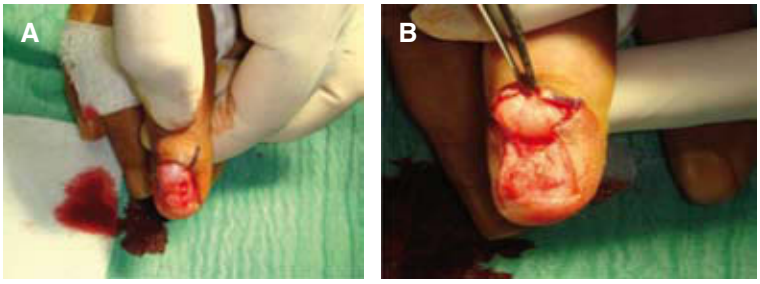

Figure 7. Transungual approach for excision of the glomus tumor shown in Figure 1.

is raised and a longitudinal incision is made in the nail bed over the area of the tumor, which is then excised. The nail bed is then closed with a 6-0 absorbable suture and the eponychial flap is sutured (Figures 6 to 8).[12] This technique is only indicated for tumors located in the central subungual region[18,19] (more proximal) and for "blind" interventions.

The advantage of this procedure is that it involves a simple technique that allows good visualization when lesions are restricted to the subungual region[2] or when the intervention is performed blind. It appears to have similar recurrence rates to those seen with other approaches.[17]

The main drawback is the high rate of nail dystrophy[14,17] (Figure 9). Repositioning of the nail on the nail bed has been proposed as a solution, since this reduces the frequency of postoperative nail dystrophy.[17] This prevents adhesion of the eponychium to the matrix, favors repair of the nail bed, and reduces the pain occurring when dressings are changed, as the wound is kept covered.[17]

2. If the tumor is located more distally in the subungual region it is excised through a window in the nail plate that is wider than the diameter of the tumor. The nail-plate fragment is then replaced over the surgical defect. This procedure is indicated in small tumors located in the distal subungual region. One of the main advantages of this technique is that it is simple and less invasive than the previous, with little risk of deformity if the nail-plate fragment is replaced.[17] It has the drawback of not being appropriate for "blind" interventions, since it does not provide good visualization; it is also inappropriate for larger tumors and for those located in the finger pad.

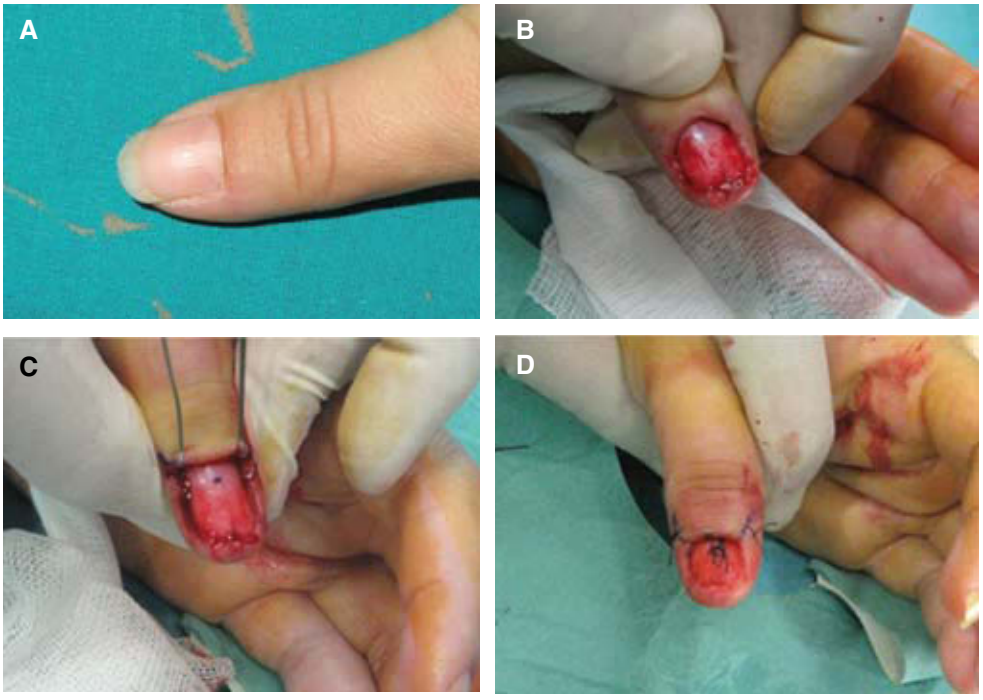

Figure 8. "Blind" surgical excision using a transungual approach in the thumb of the left hand.

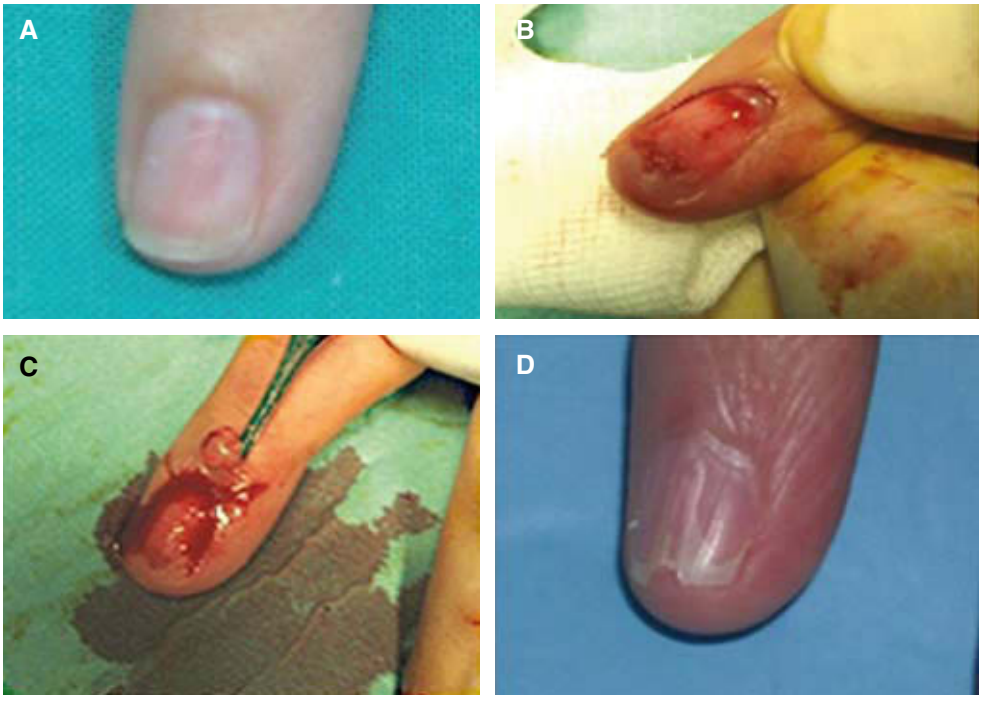

Figure 9. Transungual approach (A-C) with postsurgical nail dystrophy (D).

Lateral

More recently, techniques have been proposed that employ a lateral approach, thereby removing the need for incisions in the matrix and the subsequent risk of nail dystrophy:

1. *Lateral subperiosteal*. An incision is made dorsally to the midlateral line.[7,17,20] The incision is continued down to the distal phalanx and a dorsal flap is raised containing the skin, nail bed, and germinal matrix. After the tumor has been visualized and excised, the flap is replaced in its original position.

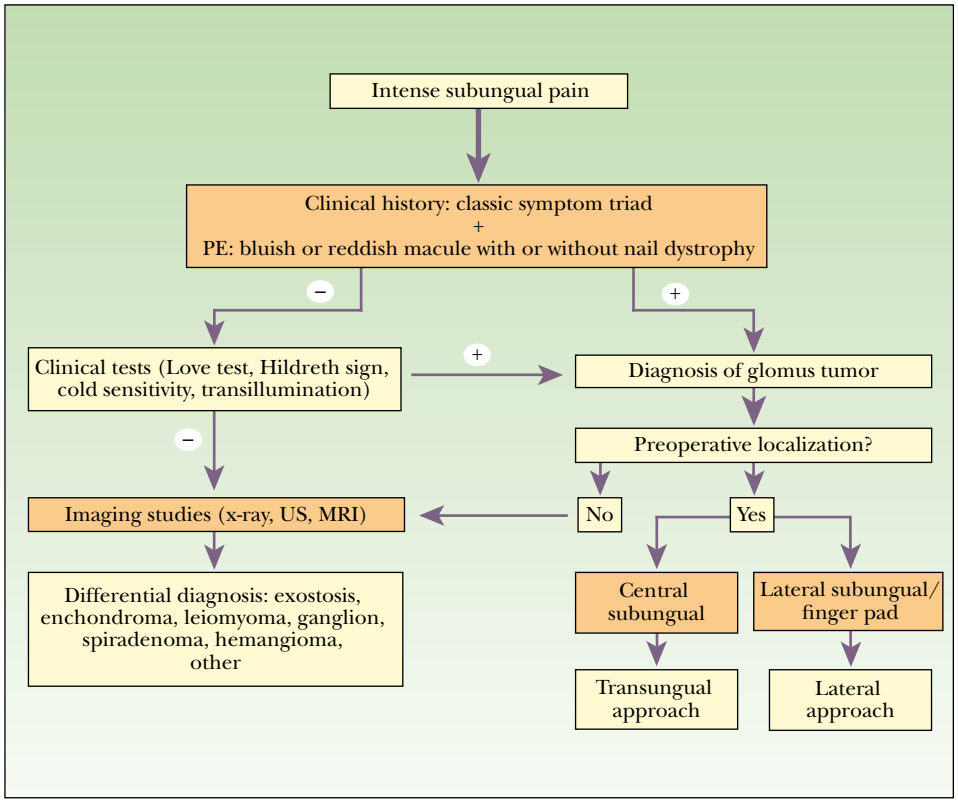

Figure 10. Treatment algorithm for the management of a patient with suspected glomus tumor. Abbreviations: MRI, magnetic resonance imaging; PE, physical examination; US, ultrasound.

2. *Lateroungual or laterodigital (Keyser-Littler).* The Keyser-Littler approach is also lateral but in this case higher, below the lateral nail fold. The interosseous ligament of the distal phalanx, which provides lateral support to the matrix and nail plate, is identified and retracted, lifting the matrix over the ligament and periostium of the distal phalanx.[7] Following excision of the tumor, the flap is replaced and sutured.

The procedure is indicated for tumors located in the peripheral subungual region and the finger pad.[18,19] It has the advantage that a lateral approach is less-commonly associated with nail dystrophy and the recurrence rates are similar to other techniques. The lateral subperiosteal approach does not require dissection and retraction of the interosseous ligament of the distal phalanx, and the postoperative recovery time is shorter than with the transungual approach (1-2 weeks compared with 4-6 weeks). The disadvantage is in the lesser degree of exposure of the nail bed in tumors restricted to the subungual region, particularly in the case of very small tumors or "blind" procedures.

Conclusion

Subungual glomus tumors are rare, benign neoplasms that are often seen by dermatologists after months or years of intense pain that becomes unbearable for the patient. Clinical presentation and physical examination are key elements of the diagnosis. Imaging studies can be of use, particularly in the differential diagnosis with other lesions and in determining tumor dimensions and localization prior to excision. In all of the cases we have treated, we used a transungual approach, since in most cases the procedure was performed blind due to an inability to locate the lesion with imaging techniques. The most common postsurgical complication is nail dystrophy, which is well tolerated by the patient but for which we suggest replacing the nail plate. In cases of intense subungual pain of unknown cause, a diagnosis of glomus tumor should be considered in order to avoid further delay in treatment. Finally, we propose a treatment algorithm for the management of glomus tumors (Figure 10).

Conflicts of Interest
The authors declare no conflicts of interest.

References

1. Garman M, Orengo I, Netscher D, Schwartz M, Rosen T. On glomus tumors, warts and razors. Dermatol Surg. 2003;29:192-4.

2. Tomak Y, Akcay I, Debak N, Eroglu L. Subungual glomus tumors of the hand: diagnosis and treatment of 14 cases. Scand J Plast Reconstr Surg Hand Surg. 2003;37:121-4.
3. Koç O, Kivrak A, Paksoy Y. Subungual glomus tumor; magnetic resonance imaging findings. Australas Radiol. 2007;51:107-9.
4. Pater T, Marks R. Glomus tumor of the hallux: case presentation and review of the literature. Foot Ankle Int. 2004;25:434-7.
5. Gombos Z, Zhang P. Glomus tumor. Arch Pathol Lab Med. 2008;132:1448-52.
6. Rohrich R, Hochstein L, Millwee R. Subungueal glomus tumors: an algorithmic approach. Ann Plast Surg. 1994; 33:300-4.
7. Kale S, Rao V, Bentz M. Glomus tumor of the index finger. J Craniofac Surg. 2006;17:801-4.
8. Monteagudo B, de las Heras C, Requena L, Ginarte M. Glomangioma solitario congénito en placa telangiectásica. Actas Dermosifiliogr. 2007;98:649-51.
9. Monteagudo B, León A, Durana C, De las Heras C, Used M, Álvarez J, et al. Manifestación segmentaria tipo 1 de glomangiomiomas múltiples. Actas Dermosifiliogr. 2006;97: 358-9.
10. Redondo P. Malformaciones vasculares (I). Concepto, clasificación, fisiopatogenia y manifestaciones clínicas. Actas Dermosifiliogr. 2007;98:141-58.
11. Verna S. Glomus tumor-induced longitudinal splitting of nail mimicking median canaliform dystrophy. Indian J Dermatol Venereol Leprol. 2008;74:257-9.
12. Ekin A, Ózkan M, Kabaklioglu T. Subungual glomus tumours: a different approach to diagnosis and treatment. J Hand Surg. 1997;22B:228-9.
13. Takemura N, Fujii N, Tanaka T. Subungual glomus tumor diagnosis based on imaging. J Dermatol. 2006;33:389-93.
14. Drapé J, Idy-Peretti I, Goettmann S, Wolfram-Gabel R, Dion E, Grossin M, et al. Subungual glomus tumors: evaluation with MR imaging. Radiology. 1995;195: 507-15.
15. Chen S, Chen Y, Cheng M, Yeow K, Chen H, Wei F. The use of ultrasonography in preoperative localization of digital glomus tumors. Plast Reconstr Surg. 2003;112:115-9.
16. Matsunaga A, Ochiai T, Abe I, Wamura A, Muto R, Tomita Y, et al. Subungual glomus tumour: evaluation of ultrasound imaging in preoperative assessment. Eur J Dermatol. 2007; 17:67-9.
17. Tada H, Hirayma T, Takemitsu Y. Prevention of postoperative nail deformity after subungual glomus resection. J Hand Surg. 1994;19:500-3.
18. Özdemir O, Coçkunol E, Özalp T, Özaksar K. Glomus tumors of the finger: a report on 60 cases. Acta Orthop Traumatol Turc. 2003;37:244-8.
19. Takata H, Ibuta Y, Isluda O, Kimori K. Treatment of subungual glomus tumor. Hand Surg. 2001;6:25-7.
20. Vasisht B, Watson K, Joseph E, Lionelli G. Digital glomus tumors: a 29-year experience with a lateral subperiosteal approach. Plast Reconstr Surg. 2004;114:1486-9.