Glomus Tumor of the Hand: Treatment and Outcomes at the Santa Fe Foundation in Bogotá. Case Series

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Project Identification

Academic Institution: Hospital Universitario Fundación Santa Fe de Bogotá

Unit: Orthopedics and traumatology

Research title: Glomus tumor of the hand: Treatment and outcomes at the Santa Fe Foundation in Bogotá. Retrospective Case Series

Participating institutions: Santa Fé de Bogotá Foundation

Research Type: Case Series Study

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1 Content

Summary

Glomus tumors represent 1% of hand tumors and are often associated with symptoms of approximately 2 years of evolution without an accurate early diagnosis that allows adequate treatment. We are not aware of reports in the Colombian literature, only of isolated cases; and we consider it important to describe our experience with the diagnosis and treatment of glomus tumor in the hand and to compare our findings with those described in the world literature. The objective of this study is to describe a series of cases of patients diagnosed with glomus tumor in the hand, its treatment and the corresponding recurrences in patients of the Santa Fe Hospital in Bogotá.

Key words: Glomus tumors, hand, fingers, resection

Abstract:

Glomus tumors represent 1% of hand tumors and are often associated with symptoms of approximately 2 years of evolution without an accurate early diagnosis that allows for appropriate treatment. We are not aware of reports in Colombian literature, only of isolated cases; and we consider is important to describe our experience with the diagnosis and treatment of glomus tumors in the hand and compare our findings with those described in the global literature. The objective of this work is to describe a case series of patients diagnosed with glomus tumor in the hand, their treatment, and corresponding recurrences in patients from the Santa Fe de Bogotá Hospital.

Keywords: Glomus tumors, hand, fingers, resection

1. Introduction

1.1 Problem statement

Glomus tumors represent 1% of hand tumors (6) and are frequently associated with symptoms of approximately 2 years of evolution without an accurate diagnosis early that allows adequate treatment.

We are not aware of reports in the literature of case series in Colombia, only of isolated cases; and we consider it important to describe our experience with the diagnosis and treatment of glomus tumors in hand, and to compare our findings with those found in the world literature.

1.2 Justification

To describe a series of cases of patients diagnosed with glomus tumor in the hand, their treatment and recurrences corresponding to patients of the Santa Fe Foundation in Bogotá.

Glomus tumors are infrequent tumors of the hand, appearing on the fingertips, with specific symptoms such as pain on acupressure, intense pain with cold, in which the diagnosis can only be clinical. Paraclinical examinations such as magnetic resonance imaging and Doppler ultrasound can be used since they also present vascular malformations that are identified with these methods. Through this case series we want to identify the diagnostic method, clinical and paraclinical, the treatment performed on the patient, the recurrence, the possible associated lesions after resection and finally the anatomopathological study.

2. Theoretical Framework

In 1812, Wood described the glomus tumor as a painful subcutaneous nodule, characterized by intense intermittent pain, susceptible to changes in temperature, of long duration, small size and firm build. He noted that excision is the cure. The name glomus comes from the Latin glomus which means ball or ball. Masson in 1920 was the first to take this tumor to pathological study, where he finally observed and described its neuromyoarterial origin. The glomus tumor is composed of an efferent arteriole, an anastomosed vessel, a primary

collecting vein, an intraglomular reticulum and a capsular portion. This injury derives from the glomus system, which theoretically regulates temperature and circulation in the skin.

Clinical manifestations (1)(3)(4)

The glomus tumor is more common in women than in men, in women they are more frequent in the hands and in men more frequent in places other than the hands. Glomus tumors are rare in children. When the tumor is in the hands, the most frequent site is the subungual bed about 90% and less frequently in the pulp of the fingers. In women they are around the fourth decade of life and in men around the fifth. Symptoms usually occur without a palpable lesion. (5)

Glomus tumors represent 1% of hand tumors and patients usually report pain for at least one to two years, associated with a previous misdiagnosis, with previous treatments such as oral analgesics, oral anti-inflammatory drugs, topicals and infiltrations without improvement of the symptoms. (6)

There is a classic triad of the glomus tumor: pain, hypersensitivity, increased pain with changes in temperature, especially in the cold. Since pain is the cardinal symptom, pain can radiate proximally, especially to the entire extremity where the tumor is located or even to the neck. Pain with temperature changes can occur in up to 70% of cases. The diagnosis is clinical.

J-Test, when the pain is exacerbated up to the shoulder.

Hildreth test, Pain disappears after an ischemic process when elastic tourniquet is applied at the base of the finger. Test accuracy around 76% (4)

Love's pin test: It is performed with the head of a toe pressing on the edge or symptomatic site of the finger, it is positive if there is intense pain and the patient withdraws the hand immediately. 71% sensitivity (4)

Cold sensitivity test (4) cold water is applied to the finger that has the tumor. Severe pain around the tumor must appear to say it is positive. With a specificity and sensitivity of 100%.

Another clinical finding described in the literature is discoloration in the nail plate and deformity of the nail bed, although infrequent can be added to the clinical findings. (6)

There are no associated or risk factors for developing this type of tumour

Differential Diagnosis (7)

Melanoblastoma, neuroma, neurinoma, paronychia, gouty arthritis, foreign bodies, hemangioma, melanoma, nevus pigmentosum.

Extra-Digital (3)(8)

They can occur in other sites, there are reports from the literature with appearance on the upper lip, base of the skull, nasal cavity, eardrum, jugular vein, neck, coccyx, radial nerve, sciatic nerve, rotator cuff, ulna, omentum, testicles, vagina, ankle and plantar arch.

Diagnostic methods (3)(4)(9)(10)

Of patients with subungual glomus tumor in the distal phalanx of the fingers, about 50% have lesions visible on X-rays (1)

Magnetic resonance imaging: Defines the characteristics of the lesion. In T1 mass easily identified in the subcutaneous fat, irregular in the subungual area, in T2, it is a mass easily identified in the subungual region. (5) MRI is not an indication for the diagnosis of glomus tumor. (11) There is another study published by Trehan (12) a case series of 36 patients diagnosed with a glomus tumor who were taken to magnetic resonance imaging to characterize the lesion. They report that magnetic resonance imaging gives important information about the location of the tumor, the size of the tumor and rules out other multifocal pathologies.

Angiography: Confirms the vascular origin of the lesion as well as the location.

High-resolution ultrasonography: Defines the location of the tumor, especially in atypical locations.

The recommendation made by Chou (13) given the classic triad of glomus tumor, Love pin test, Hildreth test and cold sensitivity test do not perform routine paraclinical examinations.

Treatment

Total resection of the tumor is the definitive treatment.

If the tumor is subungual, the longitudinal incision should be made over the nail bed, the tumor should be identified, and resection should be performed. Removal of the capsule is very important to prevent recurrence.

A surgical treatment technique called the double tourniquet technique may be used. First a tourniquet is placed on the arm, no limb is blown up or exsanguinated. An elastic tourniquet is then placed at the base of the affected finger performing exsanguination. Subsequently, the dissection and identification of the tumor is performed, at this time the elastic around the finger is removed and the tumor is observed to become congested. At this point, the lesion is identified and resected (4)

In the case series published by Moon (5), the masses were resected by a lateral approach to the subungual region and partial resection of the nail plate was performed. After treatment, no patient presented pain or recurrence of the pathology.

During surgical resection in the study conducted by Tomak (6) where they recommend digital anesthesia, lateral, radial or ulnar approach and as the main finding previously proposed by Moon et al., they emphasize multiple tumor lesions, which should be resected in their entirety.

Huang (14) described the treatment of 22 glomus tumors in a period of 12 years, between 2002 and 2014, surgically treated patients in whom they were diagnosed with glomus tumor, a transungual surgical approach was performed at the end of his study, described that residual deformities of the nail are close to 19%, but all patients rated the results as good and without alterations in the function of their fingers or hands.

Chou Treatment Algorithm (13)

Classic Symptoms: Intense pain, pressure pain, hypersensitivity to cold, perform clinical examination: Love pin test, Hildreth test, sensitivity to cold. If there is suspicion of glomus tumor, perform a confirmatory method such as MRI, ultrasonography or Doppler, surgery and histopathological diagnosis.

Tumor morphology (3)(7)

They are small tumors, less than 1 centimeter in diameter. The tumor is usually covered by connective tissue in its capsule, usually with multiple bundles of myelinated and demyelinated nerves, vascular lacunae aligned in the endothelial tissue, and collagen fibers. Multiple mast cells are observed. The cytoplasm contains multiple muscle fibrils. They have an efferent arteriole called the "Suquet-Hoyer canal". Depending on the predominant aspect, three types have been described. Type 1. Vascular. Type 2. Myxoid. Type 3. Solid. There is expression of CD34 receptors for actin antibodies. Chromosome studies have identified at least 3 tumor-related genes on the long arm of chromosome 11. It is an autosomal dominant disease. When they are of genetic origin they are directly linked to the father.

Symplastic glomus tumor (15) or malignant glomus tumor, is a tumor that is similar to the glomus tumor, but with a size greater than 2 centimeters, with atypical mitotic figures, they have a high replication index, but absence of other findings of malignancy. As of 2012, only 15 cases of malignant glomus tumor were published. There is another tumor called glomangiosarcoma (16) is a variety of malignant glomus tumor, as of 2016 6 cases have been reported in the literature.

Recurrence (5)

Can occur between 1 and 18% (3)

According to Bhaskaranand (4) during surgery it is difficult to identify the tumor, it is indistinguishable from the surrounding tissue, for this reason surgery can fail and then speak of recurrence.

In the case series published by Moon (5) of the four patients, none presented recurrence.

In the work published by Gandhi (2) he concluded that the recurrence of the glomus tumor is due to synchronized satellite lesions depending on the initial location of the tumor. 5 of 12 patients had recurrence.

Lin (9) had a recurrence of 14% in 13 of his 75 patients treated over 20 years. He stressed that tumors in the nail matrix or hyperpigmented lesions had a higher risk of recurrence 1 to 50%. Again, he concludes that recurrence can be associated with the surgical procedure in which the lesion is not completely resected.

Malignancy

Falleti (15) refers to the fact that there is no malignancy of benign glomus tumor, but there are primary malignant glomus tumors, with a high probability of metastasis of up to 38%.

3. Research Question

What is the experience with the diagnosis and treatment of Glomus Tumors in hand at the Santa Fe Foundation in Bogotá?

4. Objectives

4.1 General objective

To describe the diagnosis, treatment, and presence of recurrence in patients with glomus tumor of the hand at the Santa Fe Foundation in Bogotá performed by the hand surgery section

4.2 Specific objectives

1. To describe the demographic characteristics of patients who were diagnosed with a glomus tumor in the hand at the Santa Fe Foundation in Bogotá

2. To characterize the time between the patient's consultation and the diagnosis of glomus tumor in the hand.
3. To characterize the different treatments that were used prior to surgical resection.
4. To describe the surgical technique used during the resection of glomus tumor in the hand at the Santa Fe Foundation.
5. To characterize the presence of glomus tumor recurrences after surgical resection.

5. Hypothesis formulation

Our study does not have an established hypothesis, since it is a retrospective case series of patients with glomus tumor in the hand and is mainly oriented to the description of the diagnosis, treatment and presence of recurrence in patients with glomus tumor of the hand at the Santa Fe Foundation in Bogotá performed by the hand surgery section

6. Methodology

6.1 Type and design of the study

Retrospective Case Series

6.2 Population and sample

The study was conducted retrospectively. Patients operated on at the Fundación Santa Fe University Hospital in Bogotá by the hand surgery and microsurgery group were taken from 2010 to 2020, identifying the cases in which glomus tumor was diagnosed in the hand.

Universe: Cases operated on at the Santa Fe Foundation University Hospital in Bogotá by the hand surgery and microsurgery group in which glomus tumor has been diagnosed in the pathology.

6.3 Inclusion and exclusion criteria

6.3.1 Inclusion criteria:

Patients with a diagnosis suggestive of glomus tumor, by clinical and paraclinical findings

6.3.2 Exclusion criteria:

Patient in whom there is no pathology report

6.4 Sample Size

14 patients operated on at the Santa Fé Foundation with clinical and pathological diagnosis of glomus tumor

6.5 Sampling

Cases operated on at the Santa Fe Foundation University Hospital in Bogotá by the hand surgery and microsurgery group in which glomus tumor has been diagnosed in the pathology from 2010 to 2020, covering a period of 10 years.
Data were obtained from medical records at the Fundación Santa Fe University Hospital in Bogotá.

6.6 Definition and operationalization of variables

6.6.1 Definitions:

Age: This refers to the number of full years that the patient has at the time of undergoing surgery.

Date of birth: Indicates the exact date on which the patient was born, including the day, month and year.

Sex: Refers to the biological gender of the patient at the time of surgery.

Year: Represents the calendar year during which the surgical intervention was performed on the patient.

Diagnosis: Indicates the identification of the presence or absence of a glomus tumor in the patient.

Comorbidities: Describes any additional disease or pathological condition that the patient possesses that is not directly related to the primary condition under study.

Smoking: This refers to whether the patient used tobacco before surgery.

Location of the defect - laterality: Identifies whether the tumor is located in the patient's dominant or non-dominant hand.

Location of the defect - finger: Specifies the finger of the hand that is affected by the tumor.

Type of intervention: Classifies the treatment received by the patient as surgical or non-surgical.

Time to Additional Treatment for Recurrence: Measures the time interval from the initial procedure until additional treatment is required due to tumor recurrence.

Residual nail deformity: Indicates if there is an alteration in the normal shape of the fingernail that was affected by the tumor.

Definitive diagnosis by anatomopathological study: Refers to the final result obtained through a detailed pathological analysis of the mass, specifying the type of tissue or lesion present.

6.6.2 Operationalization of variables

Table 1. Operationalization of variables

Variable Name	Definition	Nature	Scale	Units or categories
Age	Age in years of the patient at the time of surgery	Discreet	From 0 to infinity	Quantitative
Date of birth	Specific time at which the patient is born	Nominal	Day, month and year	Quantitative
Sex	Sex of the operated patient	Dichotomous	0= female 1= male	Qualitative
Year	Year of surgery	Discreet	Year	Quantitative
Diagnosis	Glomus tumor	Dichotomous	1= yes 0=no	Qualitative
Comorbidities	Concomitant pathological process not related to underlying condition	Nominal	Name of pathology	Qualitative
Smoking	Tobacco use prior to surgery	Dichotomous	1= yes 0= no/ no information	Qualitative
Location of the defect - laterality	Anatomical location of the tumor	Nominal	1 = dominant hand	Qualitative

Variable Name	Definition	Nature	Scale	Units or categories
			0= non-dominant hand	
Location of the defect - finger	Anatomical location of the tumor	Nominal	4= Thumb 3= Index 2= Medium 1= Annular 0= Pinky	Qualitative
Type of intervention	Surgical, non-surgical	Nominal	1= Surgical 0= non-surgical	Qualitative
Time for Additional Treatment for Recurrence	**Time in which reoperation was required due to tumor recurrence**	Discreet	Number of months	Quantitative
Residual nail deformity	Alteration in the morphology of the fingernail affected by the tumor	Dichotomous	1= yes 0= no/ no information	Qualitative
Definitive diagnosis by pathological study	Definitive report of mass pathology	Nominal	0= glomus tumor 1= Fibroid 2= Granuloma foreign body 3= osteophyte	Qualitative

6.7 Data collection techniques, procedures and tools

The medical records system of the Santa Fe Foundation University Hospital in Bogotá was used. In this system, the medical records of patients who underwent resection of glomus tumor in the hand during the years 2010 to 2020 were searched. Inclusion and exclusion criteria were used to determine the cases that were analyzed within this study. From each of the medical records, data will be taken from:

- Diagnostic search codes:
    - Contiguous lesions of the bone and articular cartilage ICD-10: C41.8
    - Injury to contiguous sites of bone and articular cartilage ICD-10: C49.8
    - Benign tumor of the connective tissue and other soft tissues of the upper limb, including the shoulder ICD 10: D21.1
    - Benign tumor of connective tissue and other soft tissues, of an unspecified site ICD 10: D21.9
    - Benign tumor from other specified sites ICD 10: D36.7
    - Benign tumor of unspecified site ICD 10: D36.9
    - Tumor of uncertain or unknown behavior from other specified sites ICD 10: D48.7
    - Tumor of uncertain or unknown behavior, of an unspecified site ICD 10: D48.9
- Surgical Procedure Search Codes:
    - 822201: Excision of benign tumor in hand muscle
    - 822202: Excision of malignant tumor in hand muscle
    - 864201: Resection of benign or malignant tumor of skin or subcutaneous cellular tissue of special area, up to one centimeter
    - 864202: Resection of benign or malignant tumor of skin or subcutaneous cellular tissue of special area, between 1-2 cm
    - 864203: Resection of benign or malignant tumor of skin or subcutaneous cellular tissue of special area, between 2-3 cm

  - 864204: Resection of benign or malignant tumor of skin or subcutaneous cellular tissue of special area, between 3-5 cm
  - 864205: Resection of benign or malignant tumor of skin or subcutaneous cellular tissue of special area, greater than 5 cm

- Reason for consultation: To determine how frequent the consultation is for pain in the area of the tumor with the cold
- Evaluation of in-system images that suggest or diagnose glomus tumor
- Time from consultation to diagnosis
- Treatments performed prior to surgical resection of the tumor
- Surgical note: from which surgical technique will be taken, macro characteristics of the tumor
- Background: personal, surgical, habits, pharmacological, risk factors.
- Follow-up notes to evaluate complications.
- Histopathological diagnosis
- Need for reoperation due to recurrence

6.8 Data analysis plan

The data will be collected in a Microsoft Excel® table. The evaluation and filtering of the database will be carried out and the statistical analysis will be descriptive, for which the Stata® statistical package will be used. For categorical data, the description will be made by means of frequency distribution. As for the continuous variables, the assumption of normality will be determined, according to the result the variables of non-normal distribution are reported by their median.

6.9 Scope and limits of the research

This study provides a comprehensive overview of the management of glomus tumors in the hand in a specialized hospital setting over a ten-year period. The main scopes include the evaluation of both clinical and paraclinical diagnostic methods, the effectiveness of the

surgical treatments implemented, and the follow-up of recurrences and other postoperative complications. This research contributes to a better understanding of the clinical characteristics and long-term outcomes in patients with glomus tumors, offering a solid basis for future research and improvements in treatment strategies.

The main limitations of this study include its retrospective design and small sample size, which may affect the generalizability of the results. The lack of a control group also limits the comparability of treatments. In addition, focusing on a single specialist centre could introduce selection bias, limiting the applicability of findings to other contexts. These limitations should be considered when interpreting the results and planning future research.

7. Ethical aspects

The purpose of this study is to describe cases with a diagnosis of Glomus Tumor in the hand, its treatment and outcomes at the Santa Fe Foundation in Bogotá. The performance of this research protocol does not imply an additional intervention for patients. According to resolution 8430 of 1993, article 11, this research project is classified as a risk-free research.

According to the current Colombian legislation, the guidelines of good clinical practice and the standards of research in human beings that were determined in the Declaration of Helsinki, the affirmation is made that the information regarding the identification of the patients included in the study and what is determined from the medical records will not be revealed or used for purposes other than those of this research project. During the investigation, the privacy of patients and their medical records will be guaranteed. The inclusion of medical records and patients will be carried out once the ethics committee of the Santa Fe de Bogotá Foundation has been approved.

In addition, the authors declare that there is no conflict of interest in relation to funding by a sponsor or for the publication of this study that could alter in any way the results of the study. They also commit to include truthful and auditable information from any regulator and the Corporate Ethics Committee of the Santa Fe de Bogotá Foundation

7.1 Research Team

1. Dr. Jorge Ignacio Quintero Pérez
    a. Orthopedist, specialist in Hand Surgery and Microsurgery
    b. Institutional member of the Department of Orthopedics, Fundación Santa Fe de Bogotá
    c. Principal Investigator
2. Dr. Tatiana Almario Aristizábal
    a. Hospital orthopedist of the emergency department of the Santa Fe Foundation in Bogotá
    b. Universidad del Rosario
    c. Co-investigator
3. Dr. Paula Daniela Barragán
    a. Resident Physician of Orthopedics Santa Fe Foundation of Bogotá
    b. Universidad del Rosario
    c. Co-investigator
4. Dr. David Jesús Perea
    a. Resident Physician of Orthopedics Santa Fe Foundation of Bogotá
    b. Universidad del Rosario
    c. Co-investigator

7.2 Research category

According to resolution No. 008430 of 1993: investigation with minimal risk.

7.3 Research Target Population

The research will focus on patients operated on by the hand surgery and microsurgery group of the Santa Fe Foundation University Hospital in Bogotá between 2010 and 2020, specifically those diagnosed with glomus tumor in the hand over 18 years of age. Data from their medical records will be retrospectively analyzed. Patients are not considered vulnerable,

as the study does not require additional interventions and is based on analysis of existing medical records. Non-discrimination and confidentiality of the data will be ensured throughout the investigation process.

The research will use the database of the Santa Fe Foundation University Hospital in Bogotá. The number of participants will depend on the cases registered during the period stipulated with the diagnosis and procedure codes mentioned, ensuring that all patients treated for glomus tumor in the hand are included.

7.4 Process for obtaining informed consent

Retrospective information obtained from patients' medical records was used to conduct this study. This procedure is in accordance with the general consent given by patients upon entering the Santa Fé de Bogotá Foundation for surgical procedures, where they authorize the use of their clinical data for future research. This prior agreement eliminates the need to obtain additional consent for this particular study.

In situations where additional information needed to be collected directly from patients, patients were contacted by telephone. During these interactions, they were provided with a detailed explanation about the specific nature of the current research, reaffirmed the voluntariness of their participation, and assured that the continuation of their medical care would not be affected by their decision to participate or not to participate in the study.

The institution's ethics committee has reviewed and approved this approach, recognizing that the study does not involve direct interventions on patients and that established ethical regulations are respected, including the protection of privacy and confidentiality of patient data.

7.5 Use of personal data

In this study, the privacy and confidentiality of the personal data of all participating subjects is guaranteed through anonymity and de-identification of the information collected. Although

the overall results of the study will be published and shared with the scientific community, individual results of the participants will not be provided.

7.6 Risks and Benefits

In the conduct of this study, potential risks have been identified for both the research subjects and the research team. For participants, the main risks include the possible breach of confidentiality of their personal data and in case they are contacted, emotional stress when remembering or discussing past medical experiences. For the team of researchers, the risks are mainly related to the management and protection of sensitive data.

In terms of confidentiality, all data collected will be anonymized and encrypted to ensure that personal information is not accessible.

Study participants will not receive direct benefits in terms of medical interventions or financial compensation; however, their contribution will be essential to advance knowledge about the effectiveness of treatments for glomus tumors of the hand. This breakthrough has the potential to improve medical practices and future treatment outcomes for patients with similar conditions. In addition, participants can experience a sense of personal satisfaction by contributing to science and helping in the improvement of health care for others.

7.7 Ownership of information

All data collected and generated during the study are the exclusive property of the Santa Fe Foundation University Hospital in Bogotá, specifically the Hand Surgery and Microsurgery section. This ownership includes all medical records, clinical data, test results, and any other information generated throughout the research. The hospital has full rights over the use, distribution and publication of such data, ensuring that it is handled in accordance with applicable ethical and legal regulations. This arrangement ensures the protection of confidential patient information and the integrity of the study.

7.8 Criteria to be taken into account in defining the authorship of research products

In this study, the authorship criteria recommended by the International Committee of Medical Journal Editors (ICMJE) have been strictly followed. The four co-authors of this manuscript met the following criteria: 1) Substantial contribution to the conception, study design, data acquisition, or analysis and interpretation of the data; 2) Writing and critical review of the intellectual content of the manuscript; 3) Final approval of the version to be published; and 4) Assume the ethical responsibility related to ensuring the integrity of the work. Each co-author has participated sufficiently in the work to take public responsibility for appropriate portions of the content and agrees to be responsible for all aspects of the work.

8. Results

In the review of the Santa Fe Foundation database, 14 patients with glomus tumors diagnosed by biopsy were found. Of the 14 patients, 5 were men and 9 were women. The age of the patients ranged from 20 to 72 years. The most frequent location was the fingers of the hand, with 5 cases in the middle finger, 4 in the thumb, followed by the index and ring fingers with 2 cases each. No lesions were found on the little finger and a lesion was found in the thenar region. 9 of the 14 patients had a clinical diagnosis of glomus tumor that was later confirmed by biopsy.

The main reason for consultation was pain, reported in 13 of 14 patients. One patient consulted for a painless middle finger mass, with a pathology report resembling a glomus tumor lesion. 3 patients reported sensitivity to cold, and the Hildreth test was documented in 1 patient. The time elapsed from initiation to consultation ranged from 5 months to 5 years. No patients with previous surgeries on the affected finger were reported. The most frequent locations of the lesion were 4 in the nail bed, 4 subungual and 2 in the nail matrix.

Diagnostic imaging was performed in 8 patients. X-rays were performed in 5 patients, and radiological findings were normal in all cases. Magnetic resonance imaging was performed in 5 patients, with findings consistent with glomus tumor in 2 patients, inconclusive findings in 2 patients, and 1 patient underwent MRI, but no report was available. Ultrasound was performed on 2 patients, and both reported findings compatible with glomus tumor.

In total, 9 of the 14 patients were taken to surgery with a preoperative diagnosis of glomus tumor, 2 patients with a preoperative diagnosis of soft tissue mass, and the others were taken to surgery with a preoperative diagnosis of benign tumor in the finger, subcutaneous mass, and mucoid cyst. Of the 13 patients with finger lesions, a similar procedure was performed in 8, consisting of local anesthesia, tourniquet, nail plate removal, tumor resection, nail bed repair, and nail reinsertion. 13 biopsies were reported as glomus tumor and 1 was reported as a glomus tumor-like lesion.

It should be noted that the patient who reported having a lesion similar to a glomus tumor did not report pain as a reason for consultation. In all cases, histologic findings were reported as benign lesions.

Of the 14 patients, 12 had complete follow-up and no recurrences were reported in 12 patients. Two patients reported nail abnormalities, one reported occasional pain with cold and a mild nail deformity. Two did not respond at the end of the study. 10 of 12 patients denied residual symptoms.

9. Conclusions

Given the low incidence of this type of lesion, the timely and effective diagnosis of glomus tumor of the hand requires high clinical suspicion. A detailed medical history and a complete clinical examination, including a meticulous examination of the nails and evaluation of cold hypersensitivity, are of utmost importance for an accurate diagnosis. The relevance of magnetic resonance imaging as a diagnostic support tool and for the evaluation of differential diagnoses is emphasized. Complete resection of the tumor is crucial to prevent recurrence, and it is essential to inform the patient about the possibility of developing nail deformities as a consequence of surgical treatment, since this is the primary location of the tumor.

10. Project management

8.1 Budget

This study did not receive external funding. All research-related activities, including study design, data collection, analysis, and interpretation, and manuscript writing, were carried out with the researchers' own resources and the Santa Fe de Bogotá Foundation.

Table 2. Budget

ITEM	QUANTITY	TIME (Months)	UNIT VALUE	TOTAL
A. PERSONNEL				
Investigator Fees	1	6	0	0
Research Assistant	2	6	0	0
Statistical	0	0	0	0
B. EQUIPMENT				1.470.000
Computer and internet services	1	6	120.000	1.320.000
Statistical tools	1	6	150.000	150.000
C. JOURNALS AND CONFERENCES				
International Congress				To be agreed
Application and Publication in an indexed journal				To be agreed
Translation				To be agreed
D. MATERIALS				

Printing and photocopying				To be agreed
E. TECHNICAL SERVICES				
Editing, Images and Tables				To be agreed
TOTAL				1,470,000+disclosure costs

8.2 Timeline

Activities	**2021 JUNE - DEC**										2022 JAN -DEC				**2023 JAN DEC**					2024 JAN - MAY			
Implementation of the Research Protocol																							
Submission of the protocol to the technical, scientific and ethics committee																							
Pilot of information collection formats																							
Information Collection																							
Tabulating the data																							
Data analysis																							
Writing of the final report																							

Submission of the first draft of the article																						
Final Item Delivery																						

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12. Annex

Annex 1. Data collection format

Name	Telephone	Document	Age in years	Sex 1: Male 2: Female	Previous diagnosis: 1. Glomus tumor 2. Another one?	Hand 1: Right 2: Left	Finger: 1: 2: e 3: 4: 5: 6:	Cold 1: Positive 2: Negative	Pain/Pressure 1: Positive 2: Negative	Hildreth Test 1: Positive 2: Negative	Diagnostic Images: 1: Yes 2: No	X-ray 1: Yes 2: No	Ultrasound / Doppler 1: Yes 2: No	MRI 1: Yes 2: No	Date of surgery	Pathology diagnosis: 1. Glomus tumor 2. Another one?	Recurrence 1: Yes 2: No	Complications 1: Yes 2: No	Nail Deformity 1: Yes 2: No	Other complications	Comorbidities 1: Yes 2: No	HTA 1: Yes 2: No	DM 1: Yes 2: No	Obesity / Overweight 1: Yes 2: No	Ex/ Smoking 1: Yes 2: No	Another one, which one? 1: Yes 2: No	Specialist: 1:2: 3:4: 5:6: 7:e 8:	Call

Specialist: 1: De Bedout 2: Bermúdez 3: Pinilla 4: Moreno 5: Camacho 6: Quintero 7: Latorre 8: Sastre

Finger: 1: Thumb 2: Index 3: Middle 4: Ring 5: Pinky 6: Another location Which one?