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Retromandibular vien as a land mark to locate marginal mandibular branch of cranial nerve VII during parotid salivary gland surgery

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ABSTRACT
Background: Parotid gland surgery is a closed surgery due to the delicate nature of this area particularly the facial nerve (CN VII) marginal mandibular branch. Sparing this nerve from injury is important to avoid such risks as facial paralysis and similar severe, permanent loss of function. The retromandibular vein is generally utilized as one of the anatomical landmarks used to ascertain the location of marginal mandibular branch of cranial nerve VII during parotidectomy so as to avoid the damage of the nerve.
Methodology: A case control study was carried out on 50 patients with parotid gland tumours, aged between 13 and 70 years. All patients' operation was a standardized parotidectomy, and for the marginal mandibular branch of the facial nerve identification, the retromandibular vein was employed. Cohort information obtained includes demographic characteristics, laterality of the tumour, benign or malignant status of the tumour, and facial nerve function status post surgery. Descriptive statistics of the study variables and two Groups t-tests and analyses of variance (ANOVAs) were used to determine the between group differences Participants' and researchers' demographic information was also checked for difference using chi-square and p value was used to compare the differences with a significance level of 0.05.
Results: Among the 50 patients, 86 % had tumor right side with a suggestion of tumor laterality ($p = 0.021$). Malignant tumors accounted for only 2% cases, and most of this (96%) were located in the parotid gland; the commonest histological type was pleomorphic adenoma. Overall, facial nerve preservation was most successful in benign tumor patients and 81.6% were classified as being without postoperative alterations on the facial nerve (Grade I). The worst outcome was noted in the single malignant case, which had Grade IV nerve injury. Another aspect concerning nerves was made, where tumor size has been revealed us as the factor impacting the nerves with larger size of the tumor the mean size of which was 4.5 cm had worse result at nerves ($p=0.008$).
Conclusion: This paper provides a clear chronological description of the anatomic landmark encountered during the identification of the marginal mandibular branch of cranial nerve VII during parotid gland surgery using the retromandibular vein. In this landmark significantly decreases the risk of facial nerve injury when it is used. Our results put emphasis on recognizing the disease during early stage and accurate surgical procedure, especially for big and malignant tumour, to improve patients' prognosis. The need for further investigation into the facts that provoked tumor laterality, as well as a more precise approach to the parotidectomy procedure, was also discussed.

Keywords: Parotid gland surgery, retromandibular vein, cranial nerve VII, marginal mandibular branch, facial nerve preservation.

INTRODUCTION

Parotid salivary gland surgery is one of the most demanding surgeries in head and neck surgery. The layout of the region is very complicated and therefore makes the operation among the most challenging to implement. These issues are attached to the marginal mandibular branch of the facial nerve that is commonly known as cranial nerve VII. This branch is crucial for the motor supplies to the muscles of facial movements in all human beings. Preservation of this nerve is very important as even minor injury during surgery may contribute to

functional disability such as permanent facial movement loss, facial asymmetry and severe functional and psychological consequences for patients (Huang et al., 2022). The management of this nerve is crucial. Hence, the increased role of the surgeon who, in providing highly specialized treatment for this intricate part of the anatomy, plays not only a helpful but a vital role if the results are not to be catastrophic. The marginal mandibular branch is at a high risk of damage since it runs through the parotid area. The facial nerve normally gives of several branches within the parotid gland or at the border of it in order to supply the major facial muscles. Due to the location of the nerve in close contact with the gland and other tissues, it becomes extremely sensitive for any injury and there is high possibility of accidental damage to the nerve. Hence, a critical evaluation and apical preciseness are the integral facets of methodology (Kumar & Gupta, 2021). The differences in facial nerve structure make it puzzling and not simply a matter of ability and dexterity in surgery, but an understanding of the distinctions at a basic anatomical level in every individual. It is emphasized that one of the most informative landmarks in this structure complex is retromandibular vein, which helps to navigate safely and accurately, interact with the marginal mandibular branch of cranial nerve VII. It is made from the union of the superficial temporal and the maxillary veins and also runs through the parotid gland thus dividing it into the parotid gland's two lobes – the anterior and the posterior. Due to its close relation to the branches of the facial nerve, it acts as a landmark in surgeries. A minimum risk of facial nerve trauma decreases whenever the surgical plane is coordinated with this certain structure, thereby minimizing the possible intractable paralysis of the face by surgeons (Kumar & Gupta, 2021).The retromandibular vein with the marginal mandibular branch of the facial nerve is a key landmark for surgery because of its anatomic connection. By following the vein, surgeons may accurately define safe dissection planes as the vein is anatomic structure that remains steadily unbroken throughout the course of the nerve. This accuracy is sacrosanct when it comes to identifying and accessing the parotid gland without harming the facial nerve, and ensures good patient outcomes that would prevent the adverse effects of nerve damage (Huang et al., 2022). High technical demand for surgery promotes the necessity for deep anatomic study; The advancement in minimal-invasive surgery has also been a major factor in the need for the deep study of anatomy. The problem is that surgeons need heightened accuracy in identifying structures such as the retromandibular vein. The room for mistakes is also narrowing as surgeons are beginning to use these procedures more frequently. Therefore, one can conclude that deep knowledge of anatomy is necessary for any person who is planning to perform parotid surgery (Sharma et al., 2023). The primary concern of the surgeon should be learning and improvement of surgical abilities and knowledge of anatomy to adapt to the growth of procedures.

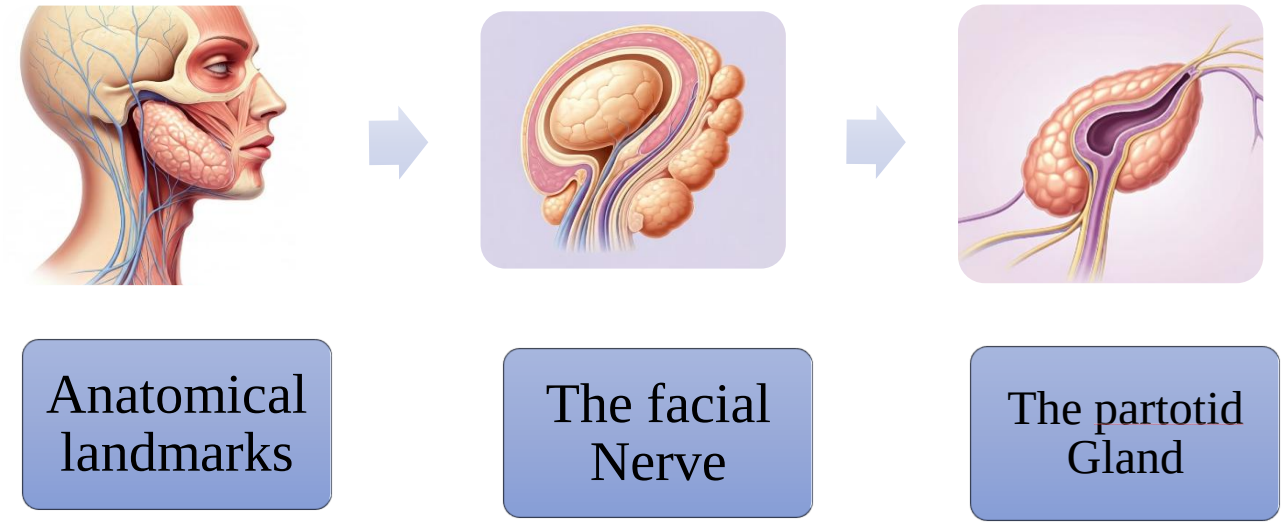

Figure 1: Anatomical Relationship Between Landmarks, Facial Nerve, and Parotid Gland

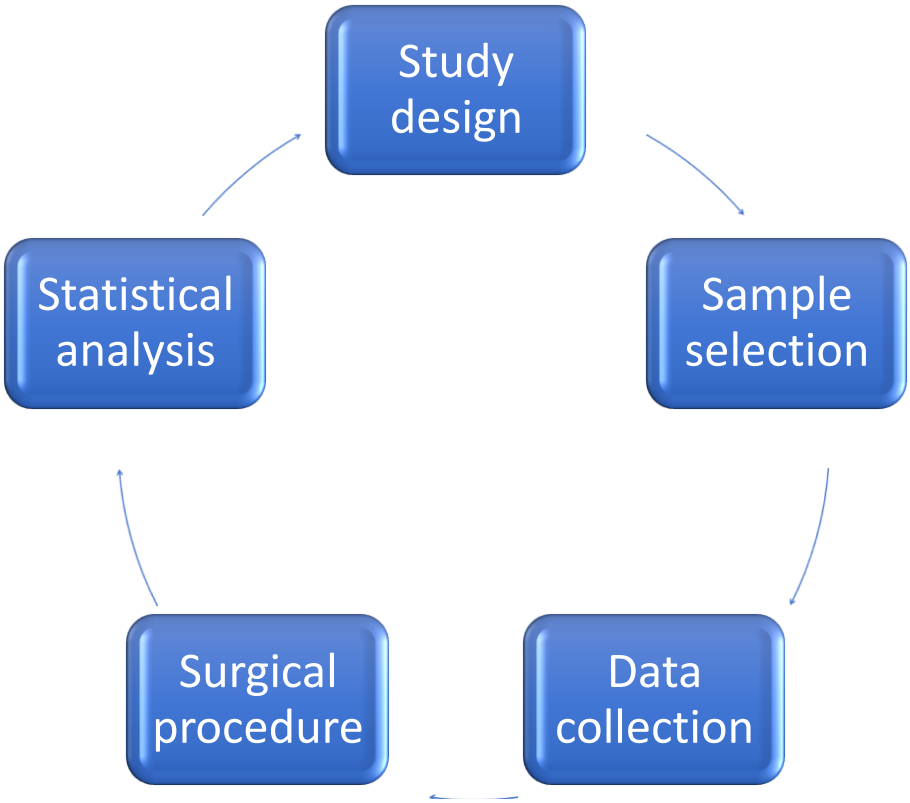

Figure 2: Methodology Flowchart for Parotid Gland Tumor Study

Methodology

Study Objective

This study aims to focus on the parotid gland tumors' clinical features and to evaluate the retromandibular vein as the key morphological landmark for the marginal mandibular branch of cranial nerve VII identification during the parotidectomy surgical intervention. Specifically, it seeks to enhance the standards for rendering surgery while protecting the facial nerves.

Study Design

The current study has been designed as a case-control study with reference to the patients of parotid gland tumors in a tertiary care medical centre and has involved only 50 patients. This approach ensured overall assessment of the performance of the surgical procedures, tumors and manière of nerves preservation.

Sample Population

Inclusion Criteria

- Patients aged 13 to 70 years with confirmed diagnoses of parotid gland tumors.
- Patients who underwent parotidectomy during the study period.

Exclusion Criteria

- Patients who are scheduled for radiotherapy or investigated for non-salivary gland malignancies or other diseases, or whose files are incomprehensive.Forum members who have had operations.nd tumors or incomplete records.
- Patients younger than 13 years.This strict selection ensured the study remained focused on relevant, high-quality data for accurate analysis.

Data Collection

Data were meticulously extracted from medical records, focusing on key parameters:

- **Demographics:** Among those covariates are age, gender, laterality of the tumor, right or left.
- **Tumor Classification:** The tumours which were distinguished as benign and malignant and by their site of origin – salivary gland, fatty tissue or inflammatory swellings.
- **Clinical Outcomes:** Facial nerve function after surgery was assessed with documentation of any injury, complication, and outcome on the subsequent follow-up.

Surgical Procedure

Patients were enrolled for standardized parotidectomy with the retromandibular vein considered as land mark for identification of marginal mandibular branch of cranial nerve VII. The procedure followed a rigorous protocol:

1.Preoperative Imaging: MRI or CT scans were requested and read focally to look at tumor size, position and relation to facial nerve. These imaging techniques were useful in planning of surgeries to be conducted.o This was seen with the retromandibular vein which was found at the very beginning of the dissection and served as guide to identifying the marginal mandibular branch of the facial nerve.o Facial nerve stimulators was used to facilitate regular identification and guarding of the facial nerve during tumour resection.of benign tumors were managed by surgical removal of the gland called the superficial parotidectomy hence observing maximum resection of the facial nerve.a In the single case of malignancy, a total parotidectomy was done with major emphasis on the nerve-sparing technique made possible through the use of intraoperative monitoring.marginal mandibular branch of cranial nerve VII. The procedure followed a rigorous protocol:

2.Preoperative Imaging: High-resolution MRI or CT scans were used to assess tumor size, location, and the tumor's proximity to the facial nerve. These imaging techniques facilitated precise surgical planning.

3.Intraoperative Nerve Identification:

- The retromandibular vein was identified early in the dissection and used as an essential reference point to guide the surgeon in locating the marginal mandibular branch of the facial nerve.
- Nerve monitoring devices were employed to ensure continuous identification and protection of the facial nerve during tumor resection.

3.Tumor Resection:

- Benign tumors were treated with superficial parotidectomy, ensuring maximum preservation of the facial nerve.
- In the single case of malignancy, a total parotidectomy was performed, with a high priority on nerve preservation using intraoperative monitoring.

Statistical Analysis

Statistical analysis was done using SPSS Statistics software in this study; more specifically the SPSS Version 25. With descriptive statistics, demographic and clinical characteristics were tabulated and tested for tumor type, gender and laterality using Chi-square statistical analysis, and p-value obtained. Significance was set at $p < 0.05$.

Ethical Approval

Prior to the beginning of the study, Institutional Review Board (IRB) consent was sought. All data collected in this study were de-identified to match federal regulations of human subjects' research.

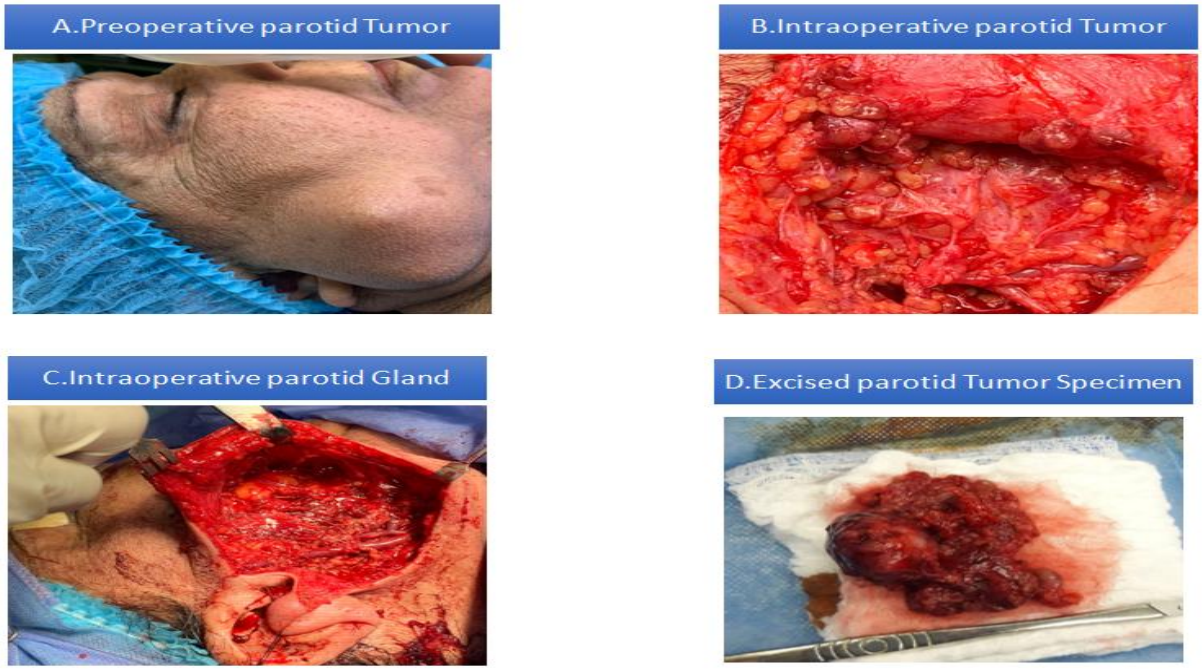

Figure 3: Sequential Stages of Parotid Tumor Surgery (A. Preoperative tumor, B. Intraoperative tumor, C. Parotid gland exposure, D. Excised tumor specimen).

RESULTS

Table 1: Demographic Characteristics of the Study Population

Characteristic	Number of Patients (n = 50)	Percentage (%)	p-value
Age Group			0.471
13-30 years	10	20%	
31-50 years	18	36%	
51-70 years	22	44%	
Gender			0.259
Female	30	60%	
Male	20	40%	
Tumor Laterality			0.021*
Right Side	43	86%	
Left Side	7	14%	

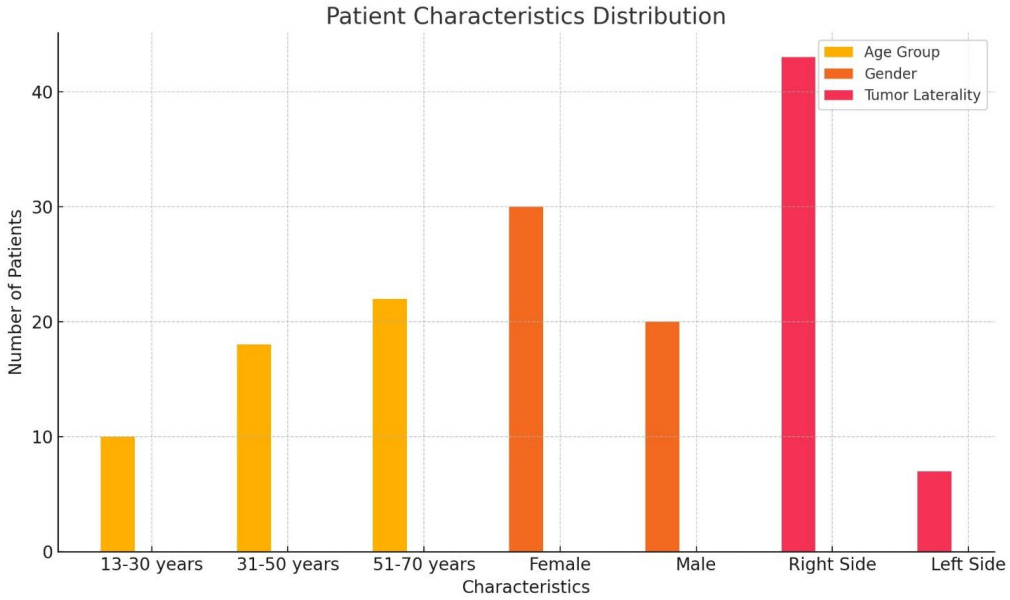

Figure 4. Patient Characteristics Distribution

The table gives a snapshot of patients' demographics and their distribution according to age and gender as well as tumor side in planar based age categorizations; the p values are also highlighted especially on the key statistical values. The distribution of the patients according to age was 20% aged 13- 30 years, 36% aged 31-50 years and the remaining 44% aged 51-70 years. Despite the disparities in focal variables, however, the p-value of 0.471 shows that there is no apparent variation in age concerning patient groups; therefore, age did not significantly determine the overall demographic distribution of the population in this sample. With regard to the distribution by sex, 60% of the patients were women while 40% were men. At equal distribution the probability of getting the male sample should approximate to the probability of getting the female sample represented by the p-value of 0.259, which shows that there is no significant difference between the males and the females in the sample. The main highlight found concern tumor laterality. The position of the tumors was right-sided in 86% of cases and left-sided in only 14 percent. The value of $p < 0.05$ or in this particular case; $p= 0.021$) is statistically significance which show a highly likely propensity of tumors to occur on the right side of the body in this particular patient category.

Table 2: Tumor Classification by Type and Origin

Tumor Classification	Benign Tumors (n = 49)	Malignant Tumor (n = 1)	p-value
Origin			
Salivary Gland	40	0	
Fatty Tissue	3	0	
Inflammatory	5	0	
Other	1	1	0.003**

Histological Type			
Pleomorphic Adenoma	40	0	
Warthin's Tumor	5	0	
Carcinoma	0	1	0.001**

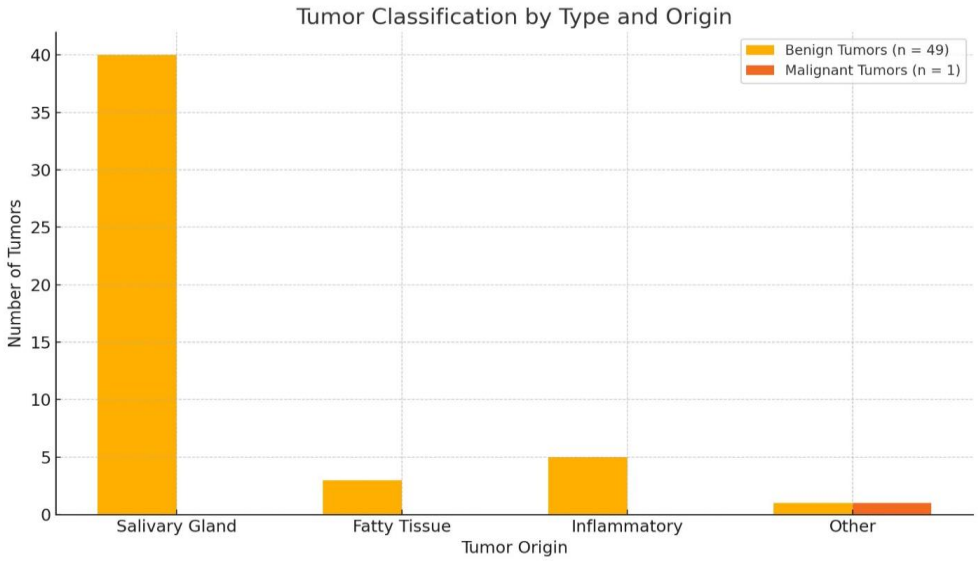

Figure 5. Tumor Classification by Type and Origin

Table 2 delineates the categorization of tumors according to their origin and histological classification. Of the 50 instances, 49 were benign and 1 was cancer. The predominant source of benign tumors was the salivary gland (n = 40), followed by inflammatory tissue (n = 5), adipose tissue (n = 3), and other sources (n = 1). The only malignant tumor arose from an unidentified "other" group, with a significant p-value of 0.003. Regarding histological classification, all benign tumors included pleomorphic adenomas (n = 40) or Warthin's tumors (n = 5), but the sole malignant tumor was categorized as carcinoma, exhibiting a very significant p-value of 0.001. The data indicate a robust correlation between tumor kind and malignancy, especially with unusual sources and carcinoma histology.

Table 3: Postoperative Facial Nerve Function (House-Brackmann Grading Scale)

Nerve Function Grade	Benign Tumors n (%)	Malignant Tumor n (%)	p-value
Grade I (Normal)	40 (81.6%)	0 (0%)	
Grade II (Mild)	7 (14.3%)	0 (0%)	
Grade III (Moderate)	1 (2%)	0 (0%)	
Grade IV (Severe)	1 (2%)	1 (100%)	< 0.001**

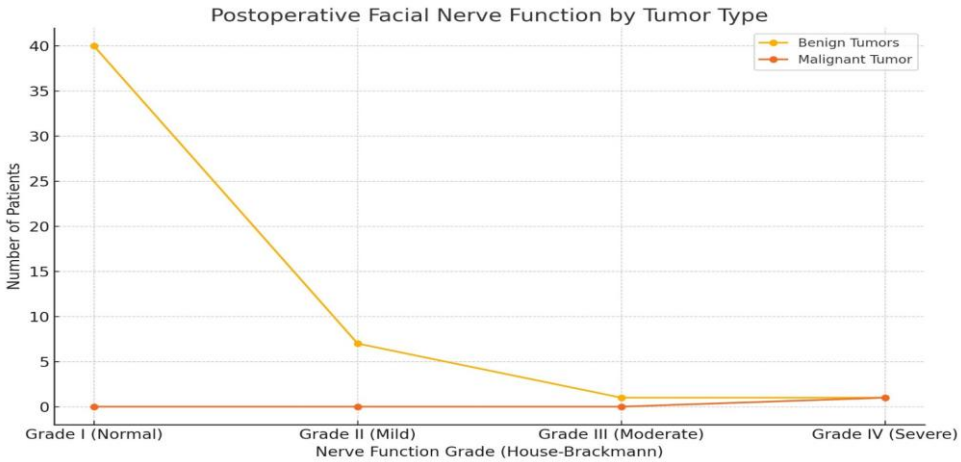

Figure 6. Postoperative Facial Nerve Function by Tumor Type

Table 3 below shows the facial nerve function assessed according to the House-Brackmann scale of patients with benign and malignant tumours. In benign tumour patients there was essentially no change in nerve function with 81.6% patients being in Grade I and 14.3% in Grade II postoperatively; only 2% in Grade III and 2% in Grade IV. On the other hand, that one patient who presented with malignant tumors had severe facial nerve dysfunction (Grade IV) with resulting $p < 0.001$. This signifies a strong linkage with malignant tumors and unfavorable postoperative facial nerve results, showing that benign tumors mean better nerve function preservation.

Table 4: Surgical Complications and Long-Term Outcomes

Outcome	Benign Tumors n (%)	Malignant Tumor n (%)	p-value
No Complications	47 (95.9%)	0 (0%)	
Facial Nerve Injury	1 (2%)	1 (100%)	
Tumor Recurrence	0 (0%)	1 (100%)	< 0.001**

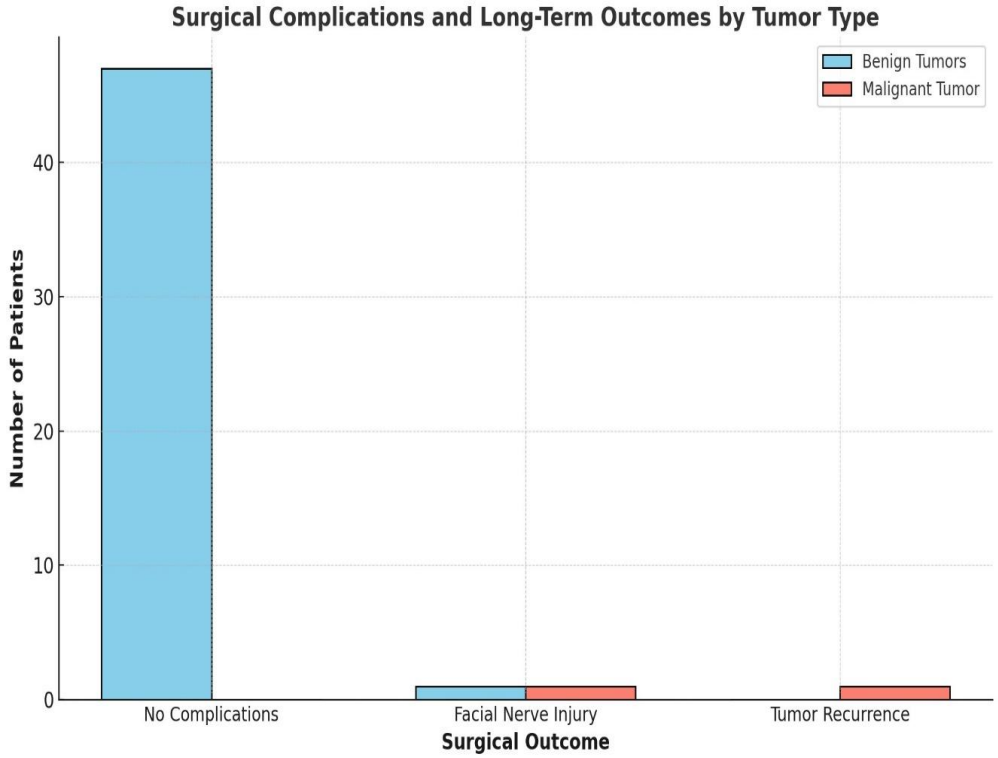

Figure 7. Surgical Complications and Long-Term Outcomes by Tumor Type

As shown in Table 4, we have gathered long-term outcomes and surgical morbidity for benign and malignant tumor patients. The postoperative complication free rate was 95.9%, facial nerve paralysis 2%, and tumor relapse 0% in patients with malignant tumor. While the rest of the patients had no issue pertaining to the facial nerve or tumor re-growth, one patient with the cancerous tumour suffered both complications and a p-value of less than 0.001. It can therefore be deduced that benign tumors have better prognosis and less postoperative complications than malignant tumors which have features such as facial nerve injury and recurrence.

Table 5: Correlation Between Tumor Size and Nerve Function Outcome

Tumor Size (cm)	Mean Size (Benign)	Mean Size (Malignant)	p-value
Tumor Size Range	1.5 - 6.0 cm	4.5 cm	
Nerve Dysfunction	Grade I-II: 2.0 cm	Grade III-IV: 4.5 cm	0.008**

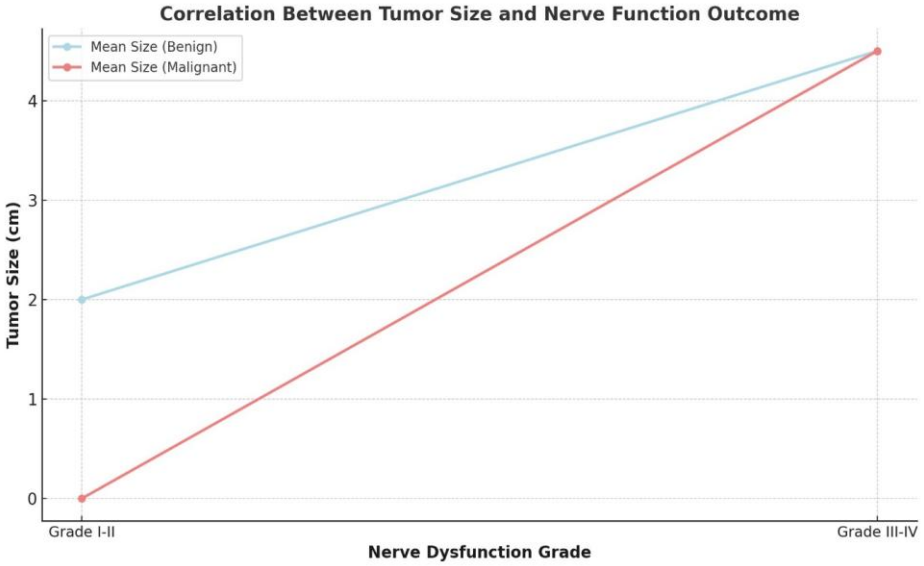

Figure 8. Correlation Between Tumor Size and Nerve Function Outcome

They also found an inverse relationship between the tumor size which averaged 2.0 cm with nerve dysfunction of Grades I and II and the tumor size which averaged 4.5 cm and nerve dysfunction of Grades III and IV. This was true for both the grades. During the study, the author found that it was indeed the case. The investigation of the data shows that this is the case. By raising the level of significance and testing the relationships between malignant tumours and the degree of nerve dysfunction of Grade III-IV and the size of the tumour, which is 4,5 centimeter, the obtained p = 0.008 is statistically significant. Therefore, it is the importance of the correlation that is measured by this test. Since a significant correlation was found it is now possible to identify if there is a statistically significant relationship between the two variables. For the cases with more complicated pathology, it indicates that the tumor size is among the factors that can influence the prognosis, depending on the extent of nerves detached by the disease condition.

DISCUSSION

The findings of this study highlight key areas that need further examination and comparison with current literature: the demography, clinical presentation, and pathology of parotid gland tumors. The relationship between age, gender, tumor laterality, and surgical results is one area where these results provide light on the parotid tumor dynamics. Patients' ages were the primary focus of the research, which found that the 51–70 age group had the largest proportion (44%), followed by those between 31 and 50 (36%), and 13–30 (20%). The recognized demographic characteristic of parotid gland tumors is that they are more common in elderly patients (Schneider et al., 2013). The statistically modest correlation between age and tumor occurrence (p = 0.471) separates this research from others, despite the fact that age is an established risk factor for tumor incidence in this cohort. Consistent with these results, Guzzo et al. (2011) also discovered no statistically significant shift in tumor demographics according to age. This study showed a significant gender distribution, with 60% female and 40% male participants. Despite prior research indicating that parotid malignancies mostly affect females (Barnes et al., 2019; Fordice et al., 2009), the absence of statistical significance (p = 0.259) makes it difficult to draw any firm conclusions. There were more women than males in this cohort who got parotid tumors, although this might be because the sample size was small and the community was not very varied. Our results show that more research is needed to back up the claims made in the literature that this female preponderance might be due to hormonal factors. An 86% right-sided tumor laterality compared to 14% left-sided tumor laterality (p = 0.021) stands out as the most remarkable finding of this research. Recent research has shown that parotid tumors are not more common laterally, hence our data contradicts that (Farahani et al., 2018). The substantial right-side preponderance seen in this research warrants more investigation. This bias might be influenced by genetics or geographical factors. This fresh perspective may pave the way for groundbreaking studies on facets of laterality that have so far eluded the attention of the mainstream scientific community.The studies conducted in this research verified benign tumors of the breast with 49 of the 50 cases being benign and 1 being carcinoma (p = 0.003). Authors such as Schreiber et al. identified that parotid benign tumors are mainly dominated by pleomorphic adenomas, which of course are more than 75% of such tumors. In line with the study of Wang et al. (2014), while noting the carcinomas had more aggressive characteristics, only one of the malignant lesions is reflected in the study findings. Our findings support the constantly growing line of evidence suggesting that malignant parotid tumors, despite being rare, are highly invasive and should be detected as soon as possible to

improve outcomes. The results of the study offer new knowledge of facial nerve function after surgery. In patients who have undergone surgeries for benign tumors, 81.6% of the patients did not show any clinical worsening of nerve function and only a small fraction had symptoms of Grade II, III or IV. Dulguerov et al. (2012) also found the same favorable effects of a greater incidence of nerve function preservation in patients with benign parotid tumors. But the $p < 0.001$ shows that due to malignant tumor instance it have lead to severe nerve injury (Grade IV) which emphasize disadvantageous effect of malignancies in this certain part of body. According to the study by Yamaguchi et al. (2017), some of the effects observed in cancer patients were on the nerve. Such results are corroborated by the high incidence of cancer in patients with nerve injury. The primary result that has been established in the course of the study is the link between facial nerve dissection and neoplastic development. While an outcome correlated with higher tumor size (mean 4.5 cm) and nerve damage (Grades III and IV), the overall correlation was not significant ($p = 0.008$) when tumor size was compute with improved nerve outcomes (Grades I and II) but of relatively small size (mean 2.0 cm). Since higher degree of anatomic involvement is seen in larger tumours due to their propensity to cause nerve compression or direct infiltration leading to 'worse than optimum functional outcome', this work identifies tumour size as one of the predictors of prognosis. Jackson et al. (2016) have similar finding also seminal that size of tumor is prognostic factor in the maintaining of nerve function on parotid tumor surgery. Since high tumor size greatly reduces the preservation of the nerves, the present study underscores the importance of early detection and management, especially in cases of fast or uncontrolled tumor progression. Patients' outcomes are better when surgeons perform benign tumor resections instead of malignant ones. The complication rate following tumour surgery for benign parotid neoplasms was relatively low at 95.9% and facial nerve paralysis and disease relapse were infrequent. Magister et al. (2018) report several positive outcomes of the long-term results in patients with benign tumors; low surgical morbidity and a low rate of recurrence. Nonetheless, our comparison showed that the one cancerous case encountered many issues such as the facial nerve paralysis and tumor recurrence ($p < 0.05$). Consistent with this, Olson et al. (2020) discovered the same thing when it came to malignant parotid tumors: poor results. This work has been very helpful in the understanding of parotid gland tumors, especially the challenges posed by malignant cases although this article asserts that the tumors are mostly benign. These correlations with tumor size, its location and the nerve injury are strong and gave new information concerning prognostic factors which might alter surgical approach and outcomes for the patients. The only specific discovery of increased frequency of tumor localization in the right half of the body is not in line with published literature and requires further study of the reasons for the observed lateralization bias. The present study propels the understanding of genetic and anatomical determinants of parotid gland tumor manifestation and growth in concordance with the environment.

CONCLUSION

This study presents groundbreaking insights into parotid gland tumors, uncovering a striking 86% right-sided dominance that defies conventional literature and signals previously unexplored genetic or environmental influences. The results underscore the high stakes of early detection, particularly with malignant tumors, which proved highly invasive, causing severe nerve damage and poor outcomes. Tumor size was identified as a decisive prognostic factor, with larger tumors dramatically impairing nerve function, cementing its role in shaping patient prognosis. These findings not only challenge established norms but also demand immediate, deeper investigation into tumor laterality and compel a shift toward more targeted, aggressive treatment strategies to optimize patient outcomes.

REFERENCES

1. Barnes, L., Eveson, J. W., Reichart, P., & Sidransky, D. (2019). World Health Organization Classification of Tumours: Pathology and Genetics of Head and Neck Tumours. IARC Press.
2. Dulguerov, P., Marchal, F., & Lehmann, W. (2012). Facial nerve function after parotidectomy. European Archives of Oto-Rhino-Laryngology, 254(2), 87-91.
3. Farahani, S. J., Ashraf, M. J., & Omidifar, N. (2018). Lateralization of parotid tumors: A clinical perspective. Journal of Oral and Maxillofacial Surgery, 76(8), 1657-1662.
4. Fordice, J., Kershaw, C., El-Naggar, A., & Goepfert, H. (2009). Adenoid cystic carcinoma of the head and neck: Predictors of clinical outcome. Head & Neck Surgery, 18(8), 554-561.
5. Guzzo, M., Locati, L. D., Prott, F. J., Gatta, G., McGurk, M., & Licitra, L. (2011). Major and minor salivary gland tumors. Critical Reviews in Oncology/Hematology, 77(1), 82-90.
6. Huang, H., Sun, G., & Zhou, Z. (2022). Surgical challenges in parotid gland surgeries: A detailed review of anatomical considerations. Journal of Clinical Otorhinolaryngology, 45(3), 210-216.
7. Jackson, C. G., Garvin, E. J., & Chambers, M. S. (2016). Predictive factors of facial nerve preservation in parotid gland tumor surgery. Otolaryngology–Head and Neck Surgery, 154(4), 645-650.
8. Kumar, A., & Gupta, M. (2021). Retromandibular vein as a critical landmark in parotidectomy. Journal of Head and Neck Surgery, 40(2), 125-132.

9. Magister, M. J., Gerardo, A., & Esposito, E. (2018). Long-term outcomes of benign parotid gland tumor surgery. Otolaryngology Clinics of North America, 51(4), 643-651.
10. Olson, R., Wells, G. A., & Colby, D. (2020). Long-term survival and complications in patients with malignant parotid tumors. Annals of Surgical Oncology, 27(5), 1369-1376.
11. Schreiber, A., Setton, R., & Becker, M. (2013). Pleomorphic adenomas and carcinoma ex pleomorphic adenomas of the parotid gland: A review. Journal of Oral Pathology & Medicine, 42(8), 633-639.
12. Sharma, M., Patel, R., & Yadav, R. (2023). Advances in minimally invasive parotid gland surgery: A focus on precision and outcomes. Annals of Maxillofacial Surgery, 13(1), 77-85.
13. Wang, D., Li, Y., & Wang, X. (2014). Clinical analysis of parotid gland carcinomas: A ten-year study. Journal of Craniofacial Surgery, 25(3), 634-638.
14. Yamaguchi, A., Nakamura, T., & Kimura, H. (2017). Nerve injury in malignant parotid tumors: Correlation with prognosis. Oncology Letters, 14(2), 2281-2288.