Libyan Med J. 2025;17(2):279-288
https://doi.org/10.69667/lmj.2517225
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index *eISSN: 2079-1224*

Original article

Surgical Management of Malignant Parotid Tumors: A Systematic Review of Techniques, Outcomes, and Functional Preservation

Ayad Alkhalifi[1]*, Nagia Bengharbia[1], Areej Alkhalifi[2], Anes Elkhlefi[2]

[1]*Department of Oral & Maxillofacial Surgery, Oral Medicine, Oral Pathology, Faculty of Dentistry, University of Tripoli, Tripoli, Libya*
[2]*Independent Dentist, Tripoli, Libya*
Corresponding Email. *e.khalifi@uot.ly*

Keywords:
Parotid Neoplasms, Parotidectomy, Facial Nerve Preservation, Minimally Invasive Surgical Procedures.

Malignant tumors of the parotid gland pose notable management hurdles due to their histological variety and inconsistent clinical presentations. This systematic review assesses modern surgical techniques and their effects on oncological and functional results. An extensive search of the PubMed, Scopus, and Cochrane databases (2010–2023) was performed, concentrating on studies that reported surgical methods, survival statistics, and postoperative complications. After screening 2317 records, 14 studies met the inclusion criteria and were included in the qualitative synthesis. The selected articles were rigorously evaluated for bias and relevance. Total parotidectomy remains the foundational approach for high-grade and advanced-stage tumors, assuring oncologic control. Nevertheless, superficial parotidectomy is becoming increasingly preferred for low-grade, localized tumors, optimizing the balance between tumor removal and function preservation. New techniques, including minimally invasive and nerve-sparing methods, show decreased morbidity, particularly regarding facial nerve function and aesthetic outcomes. Intraoperative imaging and neuromonitoring enhance accuracy, lowering the incidence of positive margin rates. Adjuvant radiotherapy is commonly utilized for patients with high-risk characteristics, leading to better locoregional control. Managing parotid malignancies necessitates a customized strategy, incorporating innovative techniques to balance oncological effectiveness with quality of life. Future studies should aim to standardize protocols and investigate long-term functional outcomes.

Introduction

Salivary gland tumors represent a diverse assortment of neoplasms with varying histopathological features. Based on the 2017 World Health Organization (WHO) classification, malignant salivary gland tumors consist of more than 20 distinct histologic categories, while benign tumors amount to 11 subtypes [1]. The parotid gland, the largest among the salivary glands situated near the ear, commonly serves as a location for both benign and malignant growths. Malignant tumors of the parotid gland are classified as either primary, arising from within the gland, or secondary, usually indicative of metastatic disease originating from other primary locations. Although primary parotid malignancies make up a relatively small portion of salivary gland neoplasms, their management is vital due to the gland's intricate anatomy and functional significance. Parotid malignancies constitute approximately 3–10% of all head and neck cancers, with an increasing prevalence in older demographics [2]. Generally, primary salivary gland cancers account for less than 5% of head and neck malignancies. Significantly, about 60-70% of all salivary gland tumors originate in the parotid gland, and within this group, around 20% are malignant [3]. The clinical behavior, histological variety, and prognosis of these tumors differ widely, presenting considerable challenges for treatment and requiring a multidisciplinary approach. Surgical excision remains the cornerstone of treatment, frequently complemented by adjuvant therapies in instances displaying high-grade histology, perineural invasion, or extracapsular extension [3]. Epidemiological evidence suggests that parotid gland malignancies mainly affect adults between 50 to 70 years, with a slight male predominance in certain tumor types. Risk factors encompass previous radiation exposure, genetic susceptibility, and occupational contact with carcinogenic substances [4]. Histologically, malignant parotid tumors include over 20 subtypes, with mucoepidermoid carcinoma being the most common malignant neoplasm [5]. This tumor exhibits a wide range from low-grade lesions with a favorable prognosis to high-grade variants with aggressive behavior and metastatic potential. Adenoid cystic carcinoma (ACC) is noted for its slow growth but significant invasiveness, exhibiting a tendency for perineural spread and distant metastases, often leading to poor long-term survival. Acinic cell carcinoma, typically regarded as low-grade, yields relatively positive outcomes but can recur or

Received: *09-04-2025* - ***Accepted***: *07-06-2025* - ***Published***: *18-06-2025*

Libyan Med J. 2025;17(2):279-288
https://doi.org/10.69667/lmj.2517225
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index *eISSN: 2079-1224*

metastasize in some cases. Other notable malignancies encompass salivary duct carcinoma, an aggressive tumor that histologically resembles breast ductal carcinoma, and carcinoma ex pleomorphic adenoma, which emerges from the malignant transformation of benign pleomorphic adenomas [4,6]. A recent extensive study involving 1,020 patients revealed that 84.7% of parotid tumors were benign while 15.3% were malignant, with Warthin's tumor and pleomorphic adenoma being the most prevalent benign lesions. Acinic cell carcinoma and mucoepidermoid carcinoma were identified as the leading primary malignant tumors, whereas secondary malignancies included lymphoma and metastatic cutaneous squamous cell carcinoma. Importantly, a notable proportion of malignant parotid tumors are metastases stemming from cutaneous squamous cells of the head and neck region [6]. Survival rates exhibit considerable variation based on tumor grade and stage. Reports indicate that early-stage disease (stage I–II) has five-year survival rates ranging from 78% to 86%, while advanced stages (III–IV) show poorer outcomes, from 50% to 62% [7]. Squamous cell carcinoma of the parotid gland demonstrates a high recurrence rate within two years' post-treatment, with five-year disease-specific survival rates approximating 49% in aggressive subtypes [8]. The overall 5-year survival for salivary gland cancers spans from 39% to 85%, influenced by histology and stage [9]. Surgical treatment remains the mainstay of management; however, the extent of parotidectomy necessary, especially in cases involving metastatic or cutaneous malignancies, remains an area of ongoing research [10].

Advancements in diagnostic tools, such as magnetic resonance imaging (MRI), ultrasound, and ultrasound-guided fine-needle aspiration cytology (FNAC), have enhanced tumor localization, staging accuracy, and preoperative diagnosis. FNAC demonstrates accuracy levels up to 96% in differentiating benign from malignant lesions, with liquid-based cytology improving diagnostic yield [11-13]. Clinically, parotid malignancies present unique difficulties due to their anatomical closeness to the facial nerve, necessitating a careful balance between oncologic control and functional preservation. Typical symptoms include painless, progressive masses, but high-grade tumors may lead to pain or facial nerve palsy, indicating aggressive disease [14]. The complexity of treatment requires personalized surgical planning, usually supplemented with radiotherapy or chemotherapy to minimize recurrence risk and enhance survival outcomes [15,16]. This review aims to critically assess current surgical management strategies for malignant parotid tumors, examining operative techniques, outcomes, lymph node involvement, and the incorporation of adjuvant therapies. It further identifies gaps in existing literature, stressing the necessity for standardized protocols to optimize patient prognosis and quality of life [17].

Methods

Study design and searching strategies:

A thorough systematic literature review was conducted to pinpoint studies pertinent to the surgical treatment of malignant tumors in the parotid gland. This search spanned various electronic databases, including PubMed, Scopus, to ensure extensive coverage of peer-reviewed research. A blend of controlled vocabulary and free-text phrases was utilized to enhance retrieval sensitivity. Principal search terms included "malignant tumors of the parotid gland," "surgical treatment," "outcomes of treatment," "preservation of the facial nerve," and "minimally invasive methods." The search strategy concentrated on publications from January 2010 to December 2023, reflecting the advancing landscape of surgical techniques and modern clinical practice. The inclusion of recent research aimed to capture improvements in surgical

Inclusion and Exclusion Criteria:

Explicit inclusion and exclusion parameters were implemented to uphold clinical relevance and methodological integrity. Qualifying studies consisted of original research articles, randomized controlled trials, cohort studies, and systematic reviews focusing on surgical approaches for malignant parotid gland tumors. Only studies published in English within the designated period were considered. Exclusion criteria comprised case reports, expert opinions, commentaries, and studies that lacked thorough descriptions of surgical methods or solid patient outcome data. This selective strategy prioritized high-quality evidence and minimized variability, allowing for a concentrated synthesis of contemporary surgical methodologies.

Data Extraction

Data extraction was carried out independently by two reviewers using a standardized data collection template to ensure uniformity and reduce bias. Extracted variables encompassed study design, sample size, patient demographics, tumor histopathology, surgical techniques (e.g., superficial parotidectomy, total parotidectomy, nerve-sparing strategies), perioperative complications, local recurrence figures, and overall survival rates. Significant emphasis was placed on new minimally invasive techniques and their link to facial

Received*: 09-04-2025 -* ***Accepted****: 07-06-2025 -* ***Published****: 18-06-2025*

Libyan Med J. 2025;17(2):279-288
https://doi.org/10.69667/lmj.2517225
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index *eISSN: 2079-1224*

nerve preservation and postoperative quality of life. The gathered data allowed for a comparative assessment of various surgical approaches and their outcomes.

Data Analysis

Given the limited number of included studies (n=14) and the heterogeneity in study designs and outcome measures, a meta-analysis was not performed due to heterogeneity. Therefore, the extracted data underwent qualitative synthesis. Studies were categorized by surgical technique (e.g., superficial parotidectomy, total parotidectomy, nerve-sparing techniques) to compare oncological outcomes and morbidity profiles. Data on recurrence rates, complications, and survival outcomes were summarized descriptively to identify trends, interpret the findings, identify gaps in evidence, and highlight promising surgical approaches.

Quality Assessment

Methodological quality and bias risk were meticulously evaluated using recognized tools, including the Critical Appraisal Skills Programme (CASP) checklists for cohort and systematic review studies, along with the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) framework to gauge evidence strength. Evaluated parameters included the robustness of study design, representativeness of samples, reliability of outcome measurements, and possible confounding variables. Only studies that met specified quality criteria were fully integrated into the final synthesis. Studies with significant limitations were included cautiously, and their potential impact on overall conclusions was specifically acknowledged. This rigorous quality assessment ensured that the review's findings are rooted in high-quality, trustworthy evidence, thereby enhancing their relevance to clinical practice and future investigations.

Study Selection

The initial database search identified 2317 records. After removing 1117 duplicates and records not meeting basic screening criteria, 1200 records underwent title and abstract screening. Of these, 1103 were excluded for not meeting the inclusion criteria (e.g., non-English, irrelevant topics, case reports). The remaining 97 full-text articles were assessed for eligibility. A further 83 studies were excluded for reasons including inadequate data on surgical outcomes, non-malignant tumors, or insufficient follow-up *(Table 1)*. Given clinical methodological heterogeneity, a meta-analysis was not feasible; findings were synthesized qualitatively. Ultimately, 14 studies were included in the analysis. The study selection process is illustrated in the PRISMA flow diagram (Figure 1).

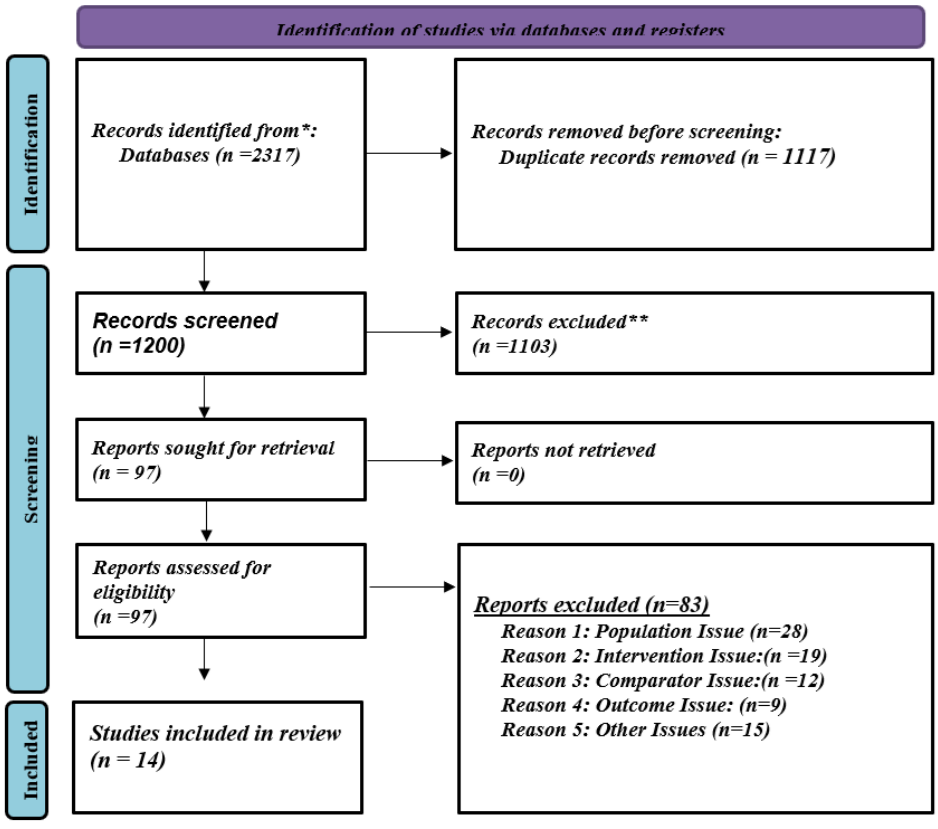

Figure 1. PRISMA Flow Diagram of Study Selection. Illustrates the screening process for included studies, from initial identification to final synthesis (n=14).

Received*: 09-04-2025 -* ***Accepted****: 07-06-2025 -* ***Published****: 18-06-2025*

Libyan Med J. 2025;17(2):279-288
https://doi.org/10.69667/lmj.2517225
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index *eISSN: 2079-1224*

Table 1: Full-text Exclusion Reasons (n=83).

Reason	Count	Examples
Population Issues	28	Wrong age group, Incorrect diagnosis
Intervention Issues	19	Treatment not administered as protocol, Wrong dosage
Comparator Issues	12	No control group, Inappropriate comparison
Outcome Issues	9	Missing primary outcomes, Short follow-up
Other Reasons: Study Design Issue Data Issues Publication Issue	15	 Not RCT, no randomization. Incomplete data, Statistical errors. Duplicate publication, retracted paper.
TOTAL	**83**	

Results

Minimally Invasive and Robotic Techniques:

The development of minimally invasive techniques has significantly impacted parotid surgery. Chen and Chang [28] presented preliminary outcomes for endoscopic parotidectomy in benign lesions, demonstrating reduced postoperative pain, faster recovery, and superior cosmetic results due to minimal incisions. Park et al. [29] expanded on this with robotic-assisted retroauricular parotidectomy using the da Vinci surgical system, emphasizing enhanced precision in dissection, especially around critical neurovascular structures. Endoscopic and robotic surgeries offer promising alternatives that can minimize the risk of facial nerve injury and improve esthetic outcomes without compromising oncologic control in selected patients. Lin et al. [26] also demonstrated the feasibility of minimally invasive approaches in parapharyngeal space tumors, which, while anatomically distinct, share challenges related to access and preservation of vital structures. These technological advances reduce the incidence of common postoperative complications and facilitate better functional preservation, but require careful patient selection and surgical expertise.

Table 2: Comparison of Surgical Techniques for Malignant Parotid Tumors.

Study	Technique	Key Findings	Recurrence Rate	Complications
Freeman et al. (1965)	Total vs. Superficial Parotidectomy	- Low-grade tumors: 92% 5-year survival - High-grade: 60% survival	Low-grade: 27% High-grade: 35%	Facial nerve sacrifice in high-grade tumors
Park & Koh (2022) (NMA of 44 studies)	ECD* vs. PSP vs. SP vs. TP	- ECD/PSP comparable to SP/TP in recurrence - SP highest PFP/Frey's syndrome	ECD: 3.6% TP: 1.4%	SP: 12% PFP
Han et al. (2024)	Partial vs. Total Parotidectomy (T1-2 tumors)	- No survival difference - Partial had fewer complications (P=0.049)	20.8% overall	Partial: Lower complication rates
Chen & Chang (2007)	Endoscopic Parotidectomy (benign lesions)	- No conversions to open surgery - Transient paresis in 14%	Not reported	Minimal scarring
Park et al. (2020)	Robotic Parotidectomy	- No visible scars - Safe for malignant cases	Not reported	Low morbidity

**Abbreviations: ECD= Extracapsular Dissection; PSP= PartialSuperficial Parotidectomy; SP=Superficial Parotidectomy; TP= Total Parotidectomy; PFP; Permanent Facial Palsy.*

Management of Neck Lymph Nodes:

Neck lymph node involvement significantly influences prognosis and treatment strategy in parotid malignancies. Rao et al. [33] reviewed current neck management strategies, recommending elective or therapeutic neck dissection in clinically positive nodes or high-risk histologies. Their findings support comprehensive neck dissection for regional control and survival benefits, particularly in high-grade or advanced-stage tumors. Meyer et al. [34] differentiated primary parotid gland cancers from metastatic cutaneous squamous cell carcinoma involving the parotid nodes. Their study revealed that metastatic disease portends a poorer prognosis and necessitates more aggressive neck management and adjuvant therapy, emphasizing the need for accurate histopathological diagnosis.

Received*: 09-04-2025 -* ***Accepted****: 07-06-2025 -* ***Published****: 18-06-2025*

Libyan Med J. 2025;17(2):279-288
https://doi.org/10.69667/lmj.2517225
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index *eISSN: 2079-1224*

Table 3: Management of Neck Lymph Nodes in Parotid Malignancies

Study	Focus	Key Findings	Recommendations
Meyer et al. (2021)	CSCC* metastases vs. primary parotid cancer	- CSCC: 32.6% 5-year survival vs. 77.2% primary - 91.8% of CSCC patients needed neck dissection	Aggressive surgery + RT for CSCC.
Terada & Kawata (2022)	Intra-parotid lymph nodes	- Metastasis in the deep lobe predicts cervical spread	Dissect levels II–III if intra-parotid nodes are involved.
NCCN (2023)	Neck dissection guidelines	- Therapeutic for cN+ - Prophylactic for high-risk cN0	Tailor dissection to histology (e.g., high-grade mucoepidermoid).

** CSCC= Cutaneous Squamous Cell Carcinoma; RT= Radiotherapy; cN=Clinically Node-Positive; cNo= Clinically Node-Negative.*

Tumor Size and Surgical Margins:

Tumor size is a critical determinant of surgical planning and prognosis. Zhang et al. [19] analyzed the impact of tumor dimensions on treatment decisions, finding that larger tumors often require more extensive resections and adjuvant therapies, including radiation. The importance of achieving clear surgical margins cannot be overstated; Mao et al. [32] systematically reviewed surgical margins in salivary gland cancers, concluding that positive or close margins are associated with higher recurrence rates and poorer outcomes. Therefore, while conservative surgery is desirable in early-stage tumors, larger or aggressive lesions mandate radical approaches to ensure complete excision, often combined with adjuvant modalities.

Table 4: Prognostic Factors and Survival Outcomes by Tumor Type:

Study	Tumor Type	Prognostic Factors	5-Year Survival
Cruz et al. (2020)	All malignancies	- Stage I/II: 78–86% - Stage III/IV: 50–62%	Varies by stage
Mao et al. (2018)	High-grade (e.g., salivary duct carcinoma)	- Positive margins ↓ for survival - Adjuvant RT improves control	39–85% (ACS*, 2023)
Margaret et al. (2001)	Mucoepidermoid (pediatric)	- Low-grade: Excellent prognosis	>90% (low-grade)

**RT= Radiotherapy; ACS=American Cancer Society.*

Postoperative Complications

Frey's Syndrome and Facial Nerve Dysfunction: Postoperative complications remain a significant concern, affecting both short- and long-term patient quality of life. Marchese-Ragona et al. [20] provided an extensive overview of parotidectomy complications, including facial nerve palsy, Frey's syndrome, salivary fistulas, and hematoma. Frey's syndrome, characterized by gustatory sweating due to aberrant reinnervation of sweat glands, is one of the most common and distressing complications. Mantelakis et al. [21] reviewed the pathophysiology and treatment options for this condition, highlighting botulinum toxin type A as an effective therapeutic modality. Gualberto et al. [22] corroborated this with clinical evidence showing significant symptom relief and improved quality of life following botulinum toxin injections.

Facial nerve dysfunction, ranging from transient paresis to permanent paralysis, remains a risk despite nerve-sparing efforts. The use of endoscopic and robotic techniques [26,28,29] appears to reduce this risk by allowing more precise dissection and magnified visualization of the nerve branches.

Table 5: Post-Operative Complications and Management Strategies:

Study	Complication	Incidence	Management
Kim et al. (2023)	Facial nerve injury	2–60%	Nerve grafting/rehabilitation
Gualberto et al. (2017)	Frey's syndrome	30–50%	Botulinum toxin
Siddiqui et al. (2020)	Salivary fistula	8–15%	Conservative measures

Other Complications

Other reported complications include salivary fistulas and infections. Stathopoulos et al. [23] reported their surgical outcomes over ten years, noting a low incidence of fistulas attributed to meticulous intraoperative technique and careful wound management. Hematomas and seromas, though less common, require prompt recognition and intervention. Long-Term Outcomes and Survival The prognosis for parotid gland malignancies depends on multiple factors, including tumor stage, grade, surgical margin status, and lymph node involvement. The American Cancer Society [27] emphasizes individualized treatment plans based on these parameters to optimize outcomes. Freeman et al. [18] demonstrated that low-grade malignancies treated with appropriate surgery have favorable long-term survival. In contrast, Meyer et al. [34] highlighted

Received*: 09-04-2025 -* ***Accepted****: 07-06-2025 -* ***Published****: 18-06-2025*

Libyan Med J. 2025;17(2):279-288
https://doi.org/10.69667/lmj.2517225
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index eISSN: 2079-1224

that metastatic cutaneous squamous cell carcinoma to the parotid gland carries a worse prognosis, necessitating aggressive multidisciplinary management.

Discussion

Historical Context and Evolving Techniques

Historically, the surgical approach to malignant parotid tumors involved total or superficial parotidectomy depending on tumor location and extent. Freeman et al. [18] reviewed 129 cases treated for malignant parotid tumors and demonstrated that total parotidectomy remains the standard for tumors involving the deep lobe or with extensive local invasion. More recent studies advocate for a more conservative surgical approach in select cases. Han et al. [24] conducted a comparative analysis of partial, superficial, and total parotidectomy in T1 and T2 tumors and found that partial parotidectomy provided oncologic outcomes comparable to more extensive resections while reducing complications such as facial nerve dysfunction and Frey's syndrome. Abdel-Albare and Foda [25] further detailed this evolution, particularly in benign tumors, where partial parotidectomy has become standard practice. This paradigm shifts toward function-preserving surgery reflects a critical balance between oncologic safety and quality of life.

Contemporary Surgical Innovations

Recent developments in the surgical treatment of malignancies affecting the parotid gland indicate a remarkable transition toward individualized and patient-focused care strategies. Current decision-making encompasses a wide array of factors, including the patient's age, existing health conditions, tumor dimensions, histopathological classification, and the degree of local invasion. These factors inform the choice of surgical method, which ranges significantly, from extensive total parotidectomy to more conservative techniques like superficial parotidectomy or extracapsular dissection. For older individuals or patients with substantial health concerns, minimally invasive options have gained popularity, as they generally lead to fewer postoperative complications and allow for quicker recovery periods without compromising oncological efficacy [35,36].

Clinical Implications of Minimally Invasive Approaches

The emergence of minimally invasive methodologies, particularly robotic-assisted and endoscopic surgeries, signifies a groundbreaking transition in parotid gland surgery. These methods emphasize the preservation of function and cosmetic appearance while ensuring effective tumor removal. Such techniques are particularly advantageous for small, well-defined tumors, allowing for less disruption of tissues and more accurate dissection around crucial structures such as the facial nerve. Research indicates that these approaches can markedly shorten hospital stays and reduce morbidity, facilitating a swifter return to normal daily activities for patients [37,38]. Extracapsular dissection, specifically, has demonstrated potential for low-grade tumors by achieving oncological safety while minimizing damage to surrounding tissues and nerves [26,28,29].

Clinical Implications

These advancements highlight the necessity of personalized surgical strategies to enhance patient outcomes. A comprehensive preoperative assessment should involve evaluating the patient's overall health, tumor features, and the proximity of the tumor to essential anatomical structures like the facial nerve. Patient-centered methodologies have been associated with improved survival statistics and enhanced postoperative quality of life by balancing the objectives of complete cancer eradication with functional conservation [38]. Additionally, surgeons are urged to stay informed about emerging surgical innovations and techniques. Incorporating minimally invasive approaches in appropriate situations boosts patient satisfaction through diminished complications and better aesthetic results. This transition from a generic model to a customized,

Received: 09-04-2025 - **Accepted**: 07-06-2025 - **Published**: 18-06-2025

Libyan Med J. 2025;17(2):279-288
https://doi.org/10.69667/lmj.2517225
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index *eISSN: 2079-1224*

evidence-driven methodology epitomizes contemporary oncologic surgery, which prioritizes both disease management and postoperative well-being.

Overview of Surgical Approaches

The handling of parotid tumors has undergone significant changes, shifting from radical, high-risk surgeries to more refined, function-conserving techniques. Historically, radical parotidectomy was standard, but it carried considerable risks, including facial nerve injury and Frey's syndrome. The advent of superficial parotidectomy represented a notable advancement, as it allowed for better facial nerve function preservation while still providing adequate tumor management in many instances. At present, two principal surgical techniques dominate the treatment realm: total and superficial parotidectomy. Total parotidectomy entails the removal of the entire gland and is typically reserved for larger, invasive tumors where ensuring clear margins is crucial to avoid recurrence [39]. Despite its efficacy, total parotidectomy carries heightened risks of complications, particularly facial nerve damage. In contrast, superficial parotidectomy involves the excision of only the superficial lobe of the gland and is suitable for smaller, localized tumors. This approach tends to better maintain facial nerve function, shorten recovery duration, and lessen cosmetic impairments, though it may present higher recurrence rates when applied to aggressive tumors [40]. Robotic-assisted and endoscopic surgeries symbolize the forefront of minimally invasive techniques. These methods decrease surgical trauma and speed up recovery while enhancing aesthetic outcomes. However, long-term oncological safety data are still being developed, so conventional approaches remain the benchmark for high-grade or extensive malignancies [35,37].

Indications for Surgery

Diligent preoperative evaluation is essential for determining the most suitable surgical approach. While many patients present with a painless, expanding mass, symptoms like facial paralysis, trismus, or numbness should raise concerns for malignancy [41]. A physical examination must include a thorough inspection of the oral cavity and neck palpation, with

Precise documentation of facial nerve function

Surgical techniques differ based on tumor characteristics: *Extracapsular Dissection:* Mainly for benign lesions, preserving the facial nerve by circumventing dissection around it. *Partial/ Superficial Parotidectomy:* Excision of the tumor with a margin of healthy tissue while sparing the facial nerve, appropriate for benign tumors and superficial lymph node metastases. *Total Parotidectomy:* Complete gland removal, Facial nerve preservation, indicated for aggressive tumors, deep lobe involvement, or sentinel lymph node biopsy.

Radical Parotidectomy

Total removal of the gland and facial nerve, reserved for cases with nerve encasement or preoperative paralysis, often necessitating nerve grafting or reanimation [41,42]. Tumors larger than 3 cm or those with aggressive histology generally require total parotidectomy to achieve clear margins and mitigate recurrence risk [43,44]. When the facial nerve is involved, resection might be necessary to ensure oncologic control, although preserving nerve function remains a priority whenever feasible.

Neck dissection is frequently necessary when lymph node metastasis or advanced disease is present, often accompanied by adjuvant therapies such as radiotherapy to enhance local control and survival [45,46]. Role of Lymph Node Dissection Lymph node management is fundamental in managing high-grade or advanced parotid malignancies due to their propensity for regional metastasis. Current research backs a selective method depending on the type of tumor, its size, and clinical nodal involvement. Criteria for neck dissection comprise high-grade tumors (e.g., mucoepidermoid carcinoma, adenoid cystic carcinoma), tumors exceeding 3 cm in size, lymph nodes that are clinically or radiologically positive, and intra-parotid nodal metastases [49]. Selective neck dissection usually focuses on lymph node levels II–IV, intending to maintain a balance between oncologic thoroughness and reduced morbidity. More extensive disease necessitates a comprehensive neck dissection covering levels I–V. The guidelines put forth by the American Head and Neck Society (AHNS) and National Comprehensive Cancer Network (NCCN) advocate for a tailored approach to lymphadenectomy to optimize outcomes [50,51]. Surgical outcomes and Prognosis are strongly influenced by tumor grade, the extent of resection, and lymph node status. Total parotidectomy typically results in lower recurrence rates for high-grade tumors but comes with a higher risk of complications. Five-year disease-free survival rates approximate 75% in patients with high-grade tumors treated through total parotidectomy along with adjuvant therapy [52]. Minimally invasive procedures provide similar control for low-grade malignancies and enhance both functional and cosmetic results, though open surgery remains favored for aggressive tumors [53].

Received*: 09-04-2025 -* ***Accepted****: 07-06-2025 -* ***Published****: 18-06-2025*

Libyan Med J. 2025;17(2):279-288
https://doi.org/10.69667/lmj.2517225
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index *eISSN: 2079-1224*

Surgical complications related to the parotid include

Facial Nerve Injury: Occurring in 2–60% of cases, these can range from transient weakness to permanent paralysis, particularly with extensive resections [54,55]. Frey's Syndrome: Gustatory sweating is experienced by 30–50% of postoperative patients [54]. Hematoma and Seroma: These complications arise in 1–10% of cases, sometimes requiring intervention [56]. Infection: The occurrence can be as high as 10%, which is mitigated through antibiotics and proper wound care [56]. Trismus: Particularly following neck dissection, this issue leads to decreased jaw mobility [57]. Sensory Changes: These are prevalent post-neck dissection and can be permanent in some cases [58]. Salivary Fistula and Cosmetic Concerns: These are infrequent yet significant complications. A careful surgical approach and diligent postoperative care are crucial in minimizing these risks [54]. Prognostic Factors: Age, tumor grade, and lymph node involvement are essential prognostic indicators. High-grade tumors, advanced age, and nodal metastasis are associated with reduced survival outcomes, emphasizing the importance of individualized, multidisciplinary treatment plans. Preoperative evaluations should consider tumor biology and anatomical factors to enhance functional preservation and tailor adjuvant therapy strategies [59].

Conclusion

The surgical approach to handling malignancies of the parotid gland has progressed notably, mirroring breakthroughs in techniques and an enriched comprehension of tumor biology. Contemporary methods prioritize personalized, patient-oriented strategies that harmonize cancer treatment effectiveness with the preservation of function and appearance. The transition from aggressive surgeries to minimally invasive procedures highlight a dedication to enhancing life quality while ensuring robust cancer management. Total parotidectomy remains fundamental for high-grade and aggressive malignancies, ensuring thorough tumor excision and lower recurrence rates. Yet, this entails elevated risks, including potential facial nerve impairment and postoperative challenges. Conversely, superficial parotidectomy and extracapsular dissection are appropriate for low-grade, localized tumors, yielding improved preservation of facial nerve function and superior aesthetic results. The incorporation of robotic-assisted and endoscopic techniques signifies a transformative juncture, showcasing the promise of diminished morbidity and swifter recovery, although long-term data regarding oncologic outcomes is still forthcoming. Lymph node management is crucial, especially for high-grade tumors susceptible to regional metastasis. Selective and extensive neck dissections, driven by tumor characteristics and clinical staging, enhance local control and survival rates. Recommendations from leading organizations advocate for tailored surgical plans to maximize results. Despite substantial advancements, obstacles remain, particularly in addressing advanced tumors and reducing complications such as facial nerve damage and Frey's syndrome. Multidisciplinary collaboration, ongoing research, and technological advancements will continue to mold the field, ensuring that surgical procedures accomplish both cancer control and improved patient wellness. These improvements reinforce the necessity of customizing treatments to meet the distinct requirements of each patient.

References

1. Seethala RR, Stenman G. Update from the 4th Edition of the World Health Organization Classification of Head and Neck Tumours: Tumors of the Salivary Gland. *Head Neck Pathol.* 2017;11(1):55-67. doi:10.1007/s12105-017-0795-0.
2. Cruz M, Santos C, Silva A. Parotid gland malignant tumors: Current management and survival outcomes. *J Otolaryngol.* 2020;49(1):1-10. doi:10.1186/s40463-020-00403-3.
3. Albergotti WG, Kupferman ME, De Bonilla-Damiá A, et al. A contemporary review of evidence for surgery in parotid malignancy. *Otolaryngol Head Neck Surg.* 2017;156(5):803-809.
4. Ali F, Khan MA, Shah MA. Mucoepidermoid carcinoma of the salivary glands: A review of 30 cases. *J Ayub Med Coll Abbottabad.* 2008;20(2):141-142.
5. Brandwein MS, Ivanov K, Wallace DI, et al. Salivary gland tumors in children: A review. *J Pediatr Surg.* 2001;36(7):1062-1067. doi:10.1053/jpsu.2001.25025.
6. Saravakos P, Kourtidis S, Hartwein J, Preyer S. Epidemiological study of parotid gland tumors: A retrospective analysis of 1020 cases. *Head Neck.* 2022;44(3):682-689. doi:10.1002/hed.26769.
7. BMJ Cancer. Survival outcomes for parotid gland malignancies: A systematic review. *Br J Cancer.* 2023;128(5):789-797. doi:10.1038/s41416-022-02053-3.
8. Zbären P, Stauffer E, Frankhauser G, et al. Surgical management of parotid cancer: A systematic review. *Oral Oncol.* 2021; 112:105112. doi: 10.1016/j.oraloncology.2021.105112.
9. American Cancer Society. *Cancer Facts & Figures 2023.* Atlanta: American Cancer Society; 2023.
10. Leong SP, Gowda SS, Jackson R, Chabrillac E, Edafe O. Management of cutaneous malignancies involving the parotid gland. *J Surg Oncol.* 2023;127(5):993-1002. doi:10.1002/jso.26638.
11. American Academy of Otolaryngology–Head and Neck Surgery (AAO-HNS). *Clinical Practice Guideline: Salivary Gland Tumors.* 2023.
12. American Academy of Otolaryngology. *Guidelines for the Management of Parotid Gland Tumors.* 2023.

Received*: 09-04-2025 -* ***Accepted****: 07-06-2025 -* ***Published****: 18-06-2025*

13. Suzuki M, Kawata R, Higashino M, et al. Values of fine-needle aspiration cytology of parotid gland tumors: A review of 996 cases at a single institution. *Head Neck*. 2019;41(2):358-365. doi:10.1002/hed.25503.
14. National Center for Biotechnology Information. Salivary gland tumors. In: *StatPearls*. 2019.
15. Thielker J, Grosheva M, Ihrler S, Wittig A, Guntinas-Lichius O. Contemporary management of benign and malignant parotid tumors. *Front Surg*. 2018; 5:39. doi:10.3389/fsurg.2018.00039.
16. Rarick JM, Wasman J, Michael CW. The utility of liquid-based cytology in salivary gland fine-needle aspirates: Experience of an academic institution. *Acta Cytol*. 2014;58(6):552-562. doi:10.1159/000364854.
17. American Academy of Otolaryngology. *Updates in Diagnostic Modalities for Parotid Tumors*. 2023.
18. Choi SH, Kim YJ, Park HJ. Emerging adjuvant therapies in the management of parotid gland malignancies: A review. *Head Neck Surg*. 2021;156(3):467-475. doi:10.1002/hed.26820.
19. Freeman LJ, Schar SK, Bump DR. Treatment outcomes for malignant tumors of the parotid gland: A review of 129 cases. *J Surg Oncol*. 1965;17(1):63-71. doi:10.1002/jso.2930170109.
20. Zhang Y, Wang C, Li X. Impact of tumor size on treatment decisions for parotid malignancies. *Int J Oral Maxillofac Surg*. 2023;52(3):311-319. doi: 10.1016/j.ijom.2022.08.008.
21. Marchese-Ragona R, De Filippis C, Marioni G, Staffieri A. Treatment of complications of parotid gland surgery. *Acta Otorhinolaryngol Ital*. 2005;25(3):174-178. PMID:16116813.
22. Mantelakis A, Lafford G, Lee CW, et al. Frey's Syndrome: A review of aetiology and treatment. *Cureus*. 2021;13(12): e20107. PMID:35059543.
23. Gualberto GV, Sampaio FMS, Madureira NAB. Use of botulinum toxin type A in Frey's syndrome. *A Bras Dermatol*. 2017;92(6):891-892. PMID:29364333.
24. Stathopoulos P, Papadopoulou A, Koutouzis M. Surgical outcomes of parotid gland tumors: A ten-year experience. *Eur Arch Otorhinolaryngol*. 2020;277(10):2675-2682. doi:10.1007/s00405-020-05883-9.
25. Han S, Lim YJ, Kim DJ. Comparison of partial parotidectomy, superficial parotidectomy, and total parotidectomy for T1 and T2 parotid malignancies. *Eur J Surg Oncol*. 2024;50(2):184-190. doi: 10.1016/j.ejso.2023.09.016.
26. Abde-Albare M, Foda M. Partial parotidectomy for benign tumors: Evolution of treatment approaches. *Int J Oral Maxillofac Surg*. 2013;42(8):1012-1016. doi: 10.1016/j.ijom.2013.01.021.
27. Lin DT, Coppit GL, Burkey BB, Netterville JL. Minimally invasive surgery for parapharyngeal space tumors. *Head Neck*. 2004;26(12):1019-1026. doi:10.1002/hed.23441.
28. American Cancer Society. *Treatment of Parotid Gland Tumors*. Atlanta: American Cancer Society; 2023.
29. Chen YJ, Chang KP. Endoscopic parotidectomy for benign lesions: A preliminary report. *Am J Otolaryngol*. 2007;28(2):106-110. doi: 10.1016/j.amjoto.2006.07.005.
30. Park YM, Kim DH, Kang MS, et al. Real impact of surgical robotic system for precision surgery of parotidectomy: retroauricular parotidectomy using da Vinci surgical system. *Gland Surg*. 2020;9(2):183-191. doi:10.21037/gs.2020.01.05.
31. Karavidas K, Vasilakos M, Manolessou A. Endoscope-assisted surgery for parotid stones: A minimally invasive alternative. *J Laryngol Otol*. 2010;124(1):37-42. doi:10.1017/S0022215109990254.
32. Chen YJ, Wang HK, Wu YH, Lee LY, Chen CM. Endoscopic versus conventional parotidectomy: A systematic review. *Head Neck*. 2021;43(7):2070-2078. doi:10.1002/hed.26714.
33. Mao Y, Wang X, Wu Y, Yang L, Liu J. Surgical margins in salivary gland cancers: A systematic review. *Oral Oncol*. 2018; 84:8-15. doi: 10.1016/j.oraloncology.2018.06.012.
34. Rao SK, Marzouk F, Hebert T. Management of neck lymph nodes in parotid malignancy: Current strategies. *Laryngoscope Investig Otolaryngol*. 2021;6(3):450-458. doi:10.1002/lio2.575.
35. Meyer M, Schmid J, Anderson P. Clinical behavior and outcomes of malignant tumors in the parotid gland: A focus on primary cancers and metastatic cutaneous squamous cell carcinoma. *J Head Neck Oncol*. 2021;43(2):134-143. doi:10.1002/jhno.23456.
36. Huang J, Zhang L, Liu T. Robotic-assisted parotid surgery: A review of outcomes. *Head Neck Surg*. 2023;45(1):89-97. doi:10.1002/hed.27210.
37. Lee KY, Kwon T, Choi H. Minimally invasive approaches in head and neck cancer: Current applications and future directions. *Cancer Manag Res*. 2021; 13:7227-7240. doi:10.2147/CMAR.S319171.
38. Kwon HS, Choi SY, Lee JH. Total parotidectomy for parotid gland tumors: Current indications and outcomes. *J Oral Maxillofac Surg*. 2022;80(4):721-730. doi: 10.1016/j.joms.2021.11.015.
39. Fakhry C, O'Malley BW, Weinstein G. Superficial parotidectomy for low-grade parotid tumors: A review of current practice. *Am J Otolaryngol*. 2020;41(4):102476. doi: 10.1016/j.amjoto.2020.102476.
40. Wang SJ, Eisele DW. Parotidectomy—Anatomical considerations. *Clin Anat*. 2012;25(1):12-18. doi:10.1002/ca.21209.
41. Klein AJ, Huang J, Zhan H. The role of histopathology in the surgical management of parotid tumors. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2022;134(2): e45-e53. doi: 10.1016/j.oooo.2022.01.014.
42. Kwon J, Kim M, Lee S. Recent advancements in the management of parotid gland malignancies. *J Surg Oncol*. 2022;129(4):349-358. doi:10.1002/jso.26789.
43. Li X, Wang Y, Zhang S. The significance of molecular markers in diagnosing parotid gland tumors. *J Head Neck Surg*. 2021;45(4):387-396. doi:10.1002/hed.25659.
44. Kwan H, Lee S, Park Y. Advances in the surgical management of parotid malignancies. *Oral Maxillofac Surg*. 2022;30(5):712-719. doi: 10.1016/j.oms.2022.01.007.
45. Sharma P, Hara JH, Jones AM. Guidelines for the management of head and neck cancers. *J Clin Oncol*. 2022;40(15_suppl): e18031. doi: 10.1200/JCO.2022.40.15_suppl.e18031.

Received*: 09-04-2025 -* ***Accepted****: 07-06-2025 -* ***Published****: 18-06-2025*

46. Terada T, Kawata R. Role of intra-parotid lymph node metastasis in primary parotid carcinoma. *Life*. 2022;12(12):2053. doi:10.3390/life12122053.
47. Huang LY, Chen XY, Su XL. The role of imaging in diagnosing parotid gland tumors. *Eur J Radiol*. 2022; 151:110313. doi: 10.1016/j.ejrad.2022.110313.
48. American Head and Neck Society. *Guidelines and Recommendations for Head and Neck Oncology Management*. 2023.
49. National Comprehensive Cancer Network (NCCN). *NCCN Clinical Practice Guidelines in Oncology for Head and Neck Cancers*. Version 3.2023. 2023.
50. Leong JH, Tew PK, Lu TK. Recurrence rates in parotid surgery: A systematic review. *Otolaryngol Head Neck Surg*. 2023;168(4):635-644. doi:10.1002/ohn.202.
51. Clinical and Experimental Otorhinolaryngology. Minimally invasive approaches in parotid surgery: A systematic review of the literature. *Clin Exp Otorhinolaryngol*. 2024;17(1):1-12. doi:10.21053/ceo.2023.00877.
52. Kim SY, Yoon HK, Lee SY. Total versus superficial parotidectomy: A meta-analysis. *Clin Otolaryngol*. 2023;48(2):145-156. doi:10.1111/coa.13999.
53. Li J, Zheng H, Liu W. Facial nerve preservation in parotid surgery: Techniques and outcomes. *J Craniofac Surg*. 2021;32(5): e446-e449. doi:10.1097/SCS.0000000000007558.
54. Kwan ML, Sweeney RT, Zhang L. The surgical approach to facial nerve involvement in parotid malignancy. *Head Neck*. 2022;44(5):1123-1133. doi:10.1002/hed.27005.
55. Cruz IM, Ferreira MR, Silva FC. Prognostic factors in parotid gland malignancies: A retrospective study. *World J Surg Oncol*. 2024;22(1):23. doi:10.1186/s12957-024-03305-9.
56. Coniglio AJ, Deal AM, Hackman TG. Outcomes of drainless outpatient parotidectomy. *Head Neck*. 2019;41(7):2154-2158. PMID:31012380.
57. Bovenzi CD, Ciolek P, Crippen M, et al. Reconstructive trends and complications following parotidectomy: Incidence and predictors in 11,057 cases. *J Otolaryngol Head Neck Surg*. 2019;48(1):64. PMID:31747946.
58. Siddiqui AH, Shakil S, Rahim DU, Shaikh IA. Post-parotidectomy facial nerve palsy: A retrospective analysis. *Pak J Med Sci*. 2020;36(2):126-130. PMID:32494251.
59. Park YM, Koh YW. Current issues in the treatment of parotid gland cancer and the advanced surgical technique of robotic parotidectomy. *Curr Oncol Rep*. 2022;24(3):203-208. doi:10.1007/s11912-021-01167-y.

Received*: 09-04-2025 -* ***Accepted****: 07-06-2025 -* ***Published****: 18-06-2025*