A Review of the Management of Benign Parotid Neoplasms

Khalid B. Alghamdi*
Department of Otorhinolaryngology and Head and Neck Surgery, King Abdulaziz University, Saudi Arabia

Abstract
This article provides a quick overview of the different trends in the management of benign parotid neoplasms. A literature review was conducted for the period between 1970 and 2017 using the Medline, PubMed, Cochrane Reviews, and Scopus databases. Key words used for the search were “parotid surgery,” “rhytidectomy and hairline incisions,” “benign parotid neoplasms,” “facial nerve monitoring,” “partial and superficial parotidectomies,” “cytology of parotid mass,” “computed tomography and magnetic resonance imaging of benign parotid neoplasms,” “ultrasonography of a parotid mass,” and “Frey’s syndrome.” Eventually 200 articles were analyzed, after excluding articles written in languages other than English and including only those relevant to benign parotid neoplasms. This article briefly describes the latest classification systems for benign parotid tumors, new advances in the field of cytological genetic markers, and radiologic investigation approaches relevant to parotid surgery that could help surgeons in their decision-making. In addition, the incidence of post-operative complications of parotid surgery is likely to reduce with the implementation of head and neck oncologic surgery, organ preservation approaches, aesthetic incisions and flap elevation, preservation of the major divisions of the great auricular nerve, and facial nerve monitoring. Methods of camouflaging hollow defects with flaps or grafts are also mentioned, as this advancement together with meticulous wound closure will yield superior cosmetic outcomes.

ABBREVIATIONS
CT: Computed Tomography; ECD: Extracapsular Parotidectomy; MRI: Magnetic Resonance Imaging; PSP: Partial Superficial Parotidectomy

INTRODUCTION
Although the incidence of parotid neoplasms is lower than that of other head and neck tumors 1-3 % [1,2], the location of the parotid gland in the face and upper neck as well as the importance of the facial nerve passing through it prior to terminating at the different facial muscles, requires careful attention to limit physical, aesthetic, and psychological side effects. Improved standards of care and quality of life scores demand refinement in the diagnosis, surgical management, postoperative care, and treatment of complications of parotid neoplasms. The literature contains several studies addressing different topics regarding the management of benign parotid neoplasms. This article attempts to summarize all the necessary information and provide a quick review of the latest surgical classification system of benign parotid tumors [1-5], advances in needle aspiration biopsy [6-9], new frontiers in cell markers [10-28] and radiology [29-42], types of surgical interventions [43-66], and finally, the types of plastic reconstructive and aesthetic techniques reported to improve the cosmetic outcome and camouflage obvious defects secondary to tumor resection [67-72].

DISCUSSION
Classification of Tumors
A- Most parotid tumors are located in the superficial lobe of the gland, and relatively few in the deep lobe. In addition to the previously known benign tumor classification [1,2], new attempts have been proposed to re-classify parotid tumors for surgical planning and research application as follows: Based on their location [3] into: 1) Superficial, 2) Deep, or 3) Tail.


The second classification places a greater demand on surgeons to precisely report the location and type of surgery performed on each patient [5], and certain areas within the parotid, such as the prestyloid (parapharyngeal) and temporomandibular

*Corresponding author
Khalid B. Alghamdi, Department of Otorhinolaryngology and Head and Neck Surgery, King Abdulaziz University, P.O. Box 80205, Jeddah 21589, Saudi Arabia, Tel: 966504591481Fax: +966 6408281; Email: kbalghamdy@kau.edu.sa
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juncture regions, are not included in this classification system. Furthermore, the boundaries of a parotid tumor are known to overlap. Further simplification and generalization would be more practical to facilitate inclusion in a tumor registry and comparison of the surgical outcome.

**Fine needle aspiration cytology and fine needle aspiration biopsy**

Despite being utilized in the diagnosis of the nature of parotid masses, these methods could be refined by improving their sensitivity. Their poor sensitivity may be explained by the heterogeneity of parotid tissues, sample size, and the experience of the cytology staff, as well as potentially other unidentified factors. Reports in the literature cite a range of values for sensitivity (85-95%) and specificity (76-98%), with an accuracy of 77% [6-9]. While fine needle aspiration is considered a valuable tool in diagnosis and decision-making, the development of cellular markers and cyto genetics in the field of head and neck neoplasms is promising with the utilization of PCR (polymerase chain reaction), R-PCR (reverse polymerase chain reaction), In Situ Hybridization, Fluorescence In Situ Hybridization (FISH), Tissue Microarray, and RNA sequencing (RNA-seq) [10] and has become applicable to head and neck tumors like thyroid and salivary glands tumors [11-15].

For benign parotid tumors Pleomorphic Adenoma (PA) was studied in great details and this can be explained on the high incidence of this tumor among all others. It has been shown that 70% of all PA display karyotype anomalies in the form of; 1. Rearrangement in 8q12 chromosome which is linked to 5’ non coding region of zinc finger gene PLAG-1 (pleomorphic adenoma gene-1) [15-17] and identification of this protein by Immunohistochemistry Technique (IHC) may be promising in diagnosing PA with FNAC [18]. 2. Rearrangement of 12q 13-15 in 8% of cases. 3. Sporadic clonal changes in 23%of cases [17]. 4. Normal karyotyping in 30 % of cases [17].

Several other biomarkers have been described and this include: a. beta- catenin (essential for cell-cell adhesion, proliferation and apoptosis) has shown high expression in carcinoma expleomorphic adenoma as compared to PA [19], not only that but the expression of WISP-1 (Wnt-1 induced secreted protein which is also regulated by beta-catenin) is high in most malignant salivary gland tumors than benign [19].

Cyclooxygenase enzymes (cox-1,cox-2) posses carcinogenic activities by promoting angiogenesis and inhibiting apoptosis [20], cox-1 is not expressed in benign tumors while cox-2 is highly expressed in malignant and to a lesser extent in benign tumors [19,21]. The expression of XIAP (a member of the inhibitor apoptotic protein IAP family) and Ki-67 (nuclear protein associated with cell proliferation) have been linked to malignant transformation of PA and other malignant tumors [22,23]. D.SOX10 protein has been shown to be highly expressed in tumors of acinar and intercalated ducts like PA and carcinoma expleomorphic, acinic cell, adenoid cystic, and myoepithelial carcinoma but not with mucoepidermoid carcinoma, warthrin tumor, onc cytoma, or oncocystic carcinoma [24].

Warthrin tumor; showed minimal chromosomal changes so far and lack biomarkers display [17],while basal cell adenoma shows trisomy 8 and 7:13 chromosomal translocation [17] and the high expression of Ki-67 protein is seen in the adenocarcinoma variety than in benign basal cell adenoma [22].

Finally the application of the FISH, PCR and other techniques has been applied to human saliva in an effort to diagnose a spectrum of diseases including benign and malignant tumors in addition to inflammation, autoimmune, and potential for more disease and health issue [25-28].

**INVESTIGATIONS & SURGICAL TECHNIQUES**

**Radiological Investigations**

Ultrasoundography is a convenient, simple, cheap, and radiation-free method of investigating the parotid. For more than three decades, ultrasoundography has been used as a supplementary tool to define parotid masses, with a sensitivity of more than 85% [29-30]. Ill-defined borders, increased tumor vascularity, the presence of enlarged lymph nodes, and heterogeneous echogenicity are considered the main criteria for differentiating malignant lesions from benign masses [31]. The recently described technique of Minimum Fascia-Tumor Distance (MFTD) which measures the distance between the tumor under investigation and the parotidomassentric fascia (sensitivity of 85%, specificity is 91%) is promising in identifying deep lobe tumors [32]. Low-grade malignant tumors, tumor subtypes, and the position of the facial nerve are considered limiting factors in the application of ultrasoundography. For this reason, the addition of fine needle aspiration cytology can increase the sensitivity and specificity to 85% and 90%, respectively [31,33]. Promising results with advances in software technology [34,35] and contrast materials [35] could help in further identification and sub typing of parotid neoplasms.

Positron emission tomography does not yield superior image quality and is in fact more expensive than standard imaging examinations [36]. Computed tomography (CT), apart from aiding in the delineation of tumor size, extension into surrounding tissue, and lymph node involvement, has not been successful in differentiating between subtypes of benign parotid neoplasms. There is hope that this will improve either through the combination of CT and fluorodeoxy glucose/positron emission tomography, which indicate the metabolic activities of tumors, or through CT perfusion utilizing a tissue-time density curve. Further controlled studies are required, however, to validate the efficacy of these methods [37,38].

Texture analysis and diffusion-weighted magnetic resonance imaging (MRI) have the potential to discriminate between different types of parotid neoplasms on the basis of their apparent diffusion coefficient scores, with sensitivity close to 89% and specificity of nearly 100% [39]. Tumor behavior can be differentiated on the basis of their MRI signals (T1, T2), contrast enhancement pattern, and shape [40]. The definition of the facial nerve branches and their spatial relation to the tumor achieved using CT and MRI is considered poor by some investigators [41], while others report promising results with new software and their MRI applicable versions [42].

**SURGICAL TECHNIQUES**

The preauricular or modified Blair incision technique has
gained widespread acceptance for parotid tumor excision; however, the facelift (rhytidectomy) incision with its modification can be utilized for better cosmetic outcomes, and has been implemented for more than three decades [43,44]. This topic has been reviewed by Grover and D’Souza in a recently published article [45].

The standard technique is the cold dissection method, but numerous reports have described parotid tumor excision using an endoscopic approach, and this technique seems to be more accepted in the Far East than in the rest of the world [46-47]. Other methods of dissection include harmonic scalpels [48] and water-jet excision [49]. Robotic surgery is well established in head and neck surgery, and may soon be implemented in parotid surgery.

Regardless of the instrument used for dissection, the degree of tumor excision that has been described includes enucleation, superficial parotidectomy, subtotal parotidectomy, partial superficial parotidectomy (PSP), and extracapsular parotidectomy (ECD). Typically, superficial parotidectomy has been the procedure of choice for all benign tumors [50]. Enucleation has almost been abandoned owing to the high recurrence rate in pleomorphic adenomas, which constitute the bulk of benign parotid tumors. Enucleation may be used if preoperative assessment has shown that the mass is a Warthin's tumor or an isolated lymph node [50-52].

Organ preservation is not a new concept in the field of head and neck oncology. Different surgical techniques, including subtotal parotidectomy [53], PSP [54,55], and ECD [56,57], have been advocated for organ preservation to maintain salivary function; tumor excision with a cuff of healthy tissue; and minimization of postoperative complications such as hypoesthesia, facial paralysis, hematoma or fistula, sialocele, and contour deformities. Subtotal parotidectomy is similar to a partial superficial parotidectomy, where parts of the superficial lobe or the tumor with a cuff of healthy tissue is resected, and only parts of the tumor in close proximity to the facial nerve are dissected [53]. In ECD, dissection and exposure of the main trunk of the facial nerve are not often performed, but achieve the same treatment outcomes with minimal morbidities [57-61]. The literature indicates that the facial nerve is exposed (at least partially) in both techniques (PSP and ECD), and these surgical terms should be reconsidered. Meta-analyses have demonstrated that ECD is superior to superficial parotidectomy in terms of efficiency, safety, and achievement of complete surgical resection with minimal complications [60-62], while other studies have yielded conflicting results [63]. Despite their acceptance, both ECD and PSP would benefit from controlled multicenter clinical trials.

Both anterograde and retrograde dissection of the facial nerve have similar outcomes [64], but it is interesting that none of the articles discussing facial nerve dissection for either ECD or PSP precisely describes how the facial nerve dissection was performed. Although facial nerve monitoring during dissection is a safe approach, this does not eliminate the need for a good understanding of the anatomy and different techniques for facial nerve dissection. Apart from revision surgery or those involving large tumors, the operative duration and incidence of facial nerve injuries (temporary 40%, permanent 2%) did not significantly change with the use of different monitoring devices [65,66].

Small tumor wounds can be closed without the need for intervening skin flaps. Tumors that leave a hollow defect may be covered by a superficial musculoaponeurotic system flap [67], free fat graft [68], and sternocleidomastoideus muscle flap [69], a cellular dermis sewn across the cut ends of the remaining parotid tissues [70], or temporoparietal fascia [71].

The complications associated with conservative parotidectomy have been addressed with a choice of incisions, techniques, and closure methods. The scar can be camouflaged with a good cosmetic face-lift or trichophyte post-auricular incisions. Sensation is preserved by preserving the posterior, lobular, and possibly some of the anterior divisions of the great auricular nerve. The risk for Frey's syndrome is minimized by creating a moderately thick dermal flap together with other reconstructive techniques at the end of the procedure. If Frey's syndrome becomes evident in the post-operative period, botulinum toxin injection is currently considered the treatment of choice [72]. A salivary fistula may be prevented by limited dissection, minimal ligation of the parotid duct, and interposition flaps at the end of the surgery. Facial nerve injuries may be kept to a minimum by selection of a conservative surgical approach, use of facial nerve monitoring, and minimal use of bipolar cautery for hemostasis. Postoperative hollow defects are treated with one of the reconstructive methods mentioned above.

CONCLUSION

There are many articles to date that discuss specific issues regarding surgery for benign parotid tumors; however, some of these articles are collections of case series and lack an empirical analysis. In terms of aiding surgeons in decision-making, many new technologies have been developed in the field of genetic markers; moreover, radiologic investigation is an advancing option. To obtain better treatment outcomes, cosmetic incisions and flap elevations should be implemented and the major divisions of the great auricular nerve should be conserved. These steps, together with an organ preservation approach and facial nerve monitoring, should limit the rate of postoperative complications. Camouflaging hollow defects with flaps or grafts and meticulous wound closure is another aspect that should be properly considered by any surgeon who deals with these tumors.

REFERENCES

5. Wierzbitcka M, Płowowarczyk K, Nogala H, Błaszczynska M.


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