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EDITORIAL

Deep lobe parotidectomy—why, when, and how?

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Abstract This editorial explores the controversies concerning the surgical management of the deep portion of the parotid gland. Specifically, when should the parotid deep lobe be removed if there is metastatic cancer to a superficial parotid node or when a primary aggressive cancer is found in the superficial lobe? The background, indications, rationale, and results of removing the deep lobe nodes are reviewed. Removal of the deep lobe is done to optimize the oncologic outcome for the patient. Deep lobe parotidectomy plays an important role in the treatment of many parotid gland malignancies.

Keywords Parotidectomy · Deep lobe · Parotid metastasis · Parotid cancer

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Introduction

Head and neck oncologic surgery has many unsettled questions regarding optimal surgical management. The rationale, indications, and procedure for deep lobe parotidectomy remain such an area. Management of primary deep lobe tumors, direct extension of tumors into the deep lobe, or management of obvious metastatic deep nodes is not controversial. In these cases, surgery is indicated. Management of the facial nerve, amount of parotid gland removed, and dissection of regional nodes are decided based on histopathologic and clinical findings.

Controversy arises when dealing with metastatic cancer to a superficial intraparotid node from a non-parotid primary or with management of an aggressive primary parotid malignancy. Here, debate occurs as to when to do a neck dissection but especially when to remove the deep parotid lobe for possible metastatic disease.

This paper explores a key question: When should the parotid deep lobe be removed if there is metastatic cancer to a superficial parotid node or when a primary parotid cancer is found in the superficial lobe. Currently, physicians may answer: never, always, only use radiation therapy, or it depends on other factors. If surgery is selected, the technique can also vary greatly.

For patients with a head and neck malignancy, optimal management should follow an individualized approach, based on multiple factors pertinent to the patient, the tumor's behavior, pathologic findings, and the surgeon's training and experience. It is time to examine the question: deep lobe parotidectomy—why, when, and how?

Necessary background

The deep parotid gland is not a true lobe. A better term is the deep portion, as the location of the facial nerve is the artificial separator of the superficial "lobe" from the deep "lobe". This remains an arbitrary separation and not one based on specific embryologic or discrete anatomic structures [1].

The parotid is first noted at the sixth week of embryologic development, arising from oropharyngeal ectoderm. Regional mesoderm enters next and gives rise to the lymphatic system. The parotid gland encapsulates and traps lymph nodes and lymphatic channels within the parotid parenchyma [2]. The facial nerve enters the developing gland at a later embryologic time.

The parotid lymph nodes receive drainage from multiple areas of the head and neck. The surrounding skin of the frontal area and malar area, ear, temporal region, and eyelids is the most frequent cutaneous regions to metastasize to parotid area nodes. Mucosal tumors also can spread to these nodes from the lacrimal gland, the nasal fossa, the oral cavity and oropharynx, Eustachian tube, and middle ear [3–6].

Studies have confirmed the interconnectivity between the superficial and deep nodes in their respective portion of the gland. Since the majority of the gland lies superficial to the facial nerve, superficial parotid nodes, both intraglandular and periglandular, are found in all specimens and range from 3 to 19 in number with a mean of 7 [1, 7–9]. Nodes within the deep lobe are found in approximately 75% of all specimens and range from 0 to 9 in number with a mean of 2 [1, 7–9]. These nodal numbers are actually proportional to the amount of gland found deep and lateral to the facial nerve [10–13].

The deep portion accounts for approximately 20% of parotid glandular substance [1]. Therefore, one should and does find that approximately 20% of parotid tumors, benign and malignant, and parotid lymph nodes are located in the deep portion [7, 8, 11]. The deep portion has areas beneath the nerve and over the masseter muscle and gland under the facial nerve and over the deep parotid musculature, the stylohyoid, stylopharyngeus, and styloglossus muscles. There also are the retromandibular portion and a deep portion by the condyle of the mandible.

Deep lobe removal

Removal of the deep parotid lobe is advocated by most surgeons for the following reasons: malignant tumors located in the deep lobe, palpable or radiographic evidence of metastatic cancer in the deep lobe, or for direct extension of malignancy to the deep lobe from the superficial gland or surrounding structures. Total parotidectomy with facial nerve preservation or radical parotidectomy with facial nerve sacrifice is generally done in these cases. Removal of a portion of the deep lobe may be done for selected low-grade malignancies with rare metastatic potential and for benign tumors.

Management of the facial nerve can be challenging. When the nerve is working preoperatively and there is no or minimal direct involvement of the facial nerve, one attempts to preserve the nerve. When cancer is found to engulf the nerve or when there is evidence of direct invasion or change in the size and color of the nerve from direct invasion, the nerve generally is removed. Preoperative paralysis or paresis from cancer is an indication that the nerve usually cannot be preserved [14].

A challenging area is trying to determine preoperatively the location of a tumor or nodes based on exam or clinical imaging studies. One can tell whether deep or superficial at the borders of the gland, but as one moves towards the facial nerve, the relationship of the tumor to the nerve branches becomes more difficult to determine. New MRI techniques are able to visualize these branches and may be helpful to determine their relation with the tumor [15]. Ultimately, findings at surgery are the only accurate method. Tumors can displace the nerve in any direction. When the facial nerve has to be taken, performing a radical parotidectomy and completely removing the deep portion are a straightforward operation.

Deep lobe removal?

Management of the deep parotid portion is controversial, mainly as it relates to the presence, behavior, and importance of removing the deep parotid lymph nodes. Metastatic involvement to the deep parotid nodes generally occurs in two situations:

1. metastasis from a node in the superficial portion of the gland;
2. metastasis from a primary parotid cancer.

Deep lobe nodal involvement from an extraparotid primary cancer

In general, this occurs when cancers from the surrounding skin have metastasized to an intraparotid node. These nodes may be detected clinically, radiographically, or as part of a sentinel node removal for aggressive skin cancers. When present, most physicians recommend performing a superficial parotidectomy with removal of all adjacent periparotid nodes. A neck dissection would also be done if palpable or radiographically positive nodes are present. However, even if clinically and radiographically an N0 neck, most surgeons would perform a neck dissection when there is a positive

parotid or periparotid metastasis. With metastasis to the superficial parotid nodes, many surgeons do not remove the deep lobe. Rather, with metastatic cancer to one or more intraparotid nodes, some physicians advocate using postoperative radiation therapy to prevent local and regional recurrence. This is the oncologic treatment of the deep lobe nodes. A study from Australia noted that after superficial parotidectomy alone and neck dissection with the postoperative radiation therapy, there was a 20% recurrence rate, and two-thirds of the recurrences were noted in the parotid area [5]. Other studies have shown recurrences after similar treatment of 11–44% [16–21]. In contrast, a study by Thom et al. noted excellent parotid local control of 93% after superficial parotidectomy, neck dissection with postoperative radiation therapy, and deep lobe removal [22]. Removal of the deep lobe did not negate the role of postoperative radiotherapy, but did seem to improve local tumor control.

Metastatic cutaneous malignancies of the head and neck are aggressive cancers. Their propensity for spreading to parotid area nodes has been well studied [9, 16, 21, 23]. Tumor type can also impact the propensity for metastasis as well as recurrence. The study by Thom et al. showed that with an extraparotid primary with metastasis to a superficial intraparotid lymph node, metastasis to the cervical lymph nodes occurred in 29%, and metastasis to the deep parotid nodes occurred in 22% of cases, almost similar findings of metastatic disease [22]. A study by Wertz et al. found that for stage 3 melanoma with metastasis to the parotid gland, patients who underwent total parotidectomy had less parotid bed recurrence than did those people who had only a superficial parotidectomy [24]. This study confirmed the oncological benefit of deep lobe removal.

Metastatic cancer from a non-parotid primary can involve various combinations of intraparotid, periparotid, and neck nodes. The most critical factor in deciding to remove the deep lobe is the finding of metastasis to an intraparotid node within the superficial gland, the main risk factor for involvement of the deep nodes. Total parotidectomy should be strongly considered in all cases, where there is metastasis from an extra parotid primary cancer to any intraparotid node.

Metastasis from a primary parotid malignancy

A primary parotid cancer clearly has the chance for metastasis to the intraparotid nodes and spreading to regional nodes and distant sites. The risk of lymphatic metastasis depends on knowledge of the tumor's behavior and pathology. The risk of metastasis to the deep nodes is greatest in the following scenarios: a high-grade cancer located anywhere in the parotid gland with known risk of lymphatic metastasis, a primary malignancy that has metastasized to an intraparotid node or that has metastasized to a cervical node. The highest risk of deep node metastasis is in cases of metastatic involvement of multiple superficial parotid nodes.

Multiple patient cases have clearly demonstrated that a primary high-grade parotid cancer in the superficial lobe can metastasize to any node(s) located in the superficial portion and/or deep portion and/or neck nodes [25, 26].

Pathology

Pathologic information at the time of surgery can provide important input to plan surgical management optimally. The parotid surgeon needs an experienced head and neck pathologist able on frozen section to identify the various forms of parotid cancer and nodal metastasis. When sending tissue to the pathologist, the surgeon should separate superficial glandular tissue from deep gland tissue and ask for identification of parotid and neck nodes and information as to their exact location. The surgeon needs to know if any nodes are positive. This should not be a difficult task with frozen section except for cases of micrometastasis or with melanoma.

It is helpful if the pathologist reports whether any positive nodes are in the gland or outside of the gland and their specific location. Knowing the presence of positive superficial intraparotid nodes is critical information to determine the need for a deep lobe parotidectomy. When the pathologist can tell if a primary parotid tumor is a high-grade carcinoma and reports the status of the superficial nodes, operative decision making can proceed regarding performing a neck dissection and deep lobe removal [27].

When frozen section is not available, the surgeon must rely on permanent studies. This may result in performing a delayed second surgical procedure. In these cases, a good rule is to perform the operation the surgeon would have done if the information on permanent pathology was available at the time of the original surgery. It is helpful to perform an eventual reoperation within 2 weeks to decrease the risk of severe fibrosis formation around the dissected facial nerve. Some surgeons may be reluctant to reoperate on a recent parotid case due to concern of facial nerve damage or increased difficulty operating in scar tissue. In this case, they may recommend proceeding with just radiation therapy.

Preoperative discussion

The surgeon should have a complete discussion with the patient as to the risks and benefits of any parotid procedure, including what will occur if a high-grade cancer is found in the gland or if metastatic cancer is found in a parotid lymph node. If the patient is found to have metastatic cancer to an intraparotid node or if the parotid mass

proves to be a high-grade cancer with potential lymphatic metastasis, options do exist.

Regarding the need for deep lobe removal when clinically and radiographically negative, some would not recommend a deep lobe parotidectomy for the following reasons:

- The surgeon may feel that there are few or no nodes in the deep lobe, and therefore, they do not warrant removal (small and non-palpable nodes will not be identified).
- If necessary, the surgeon may feel that the deep lobe can be managed with just postoperative radiation therapy (there are no randomized studies directly comparing adjuvant radiotherapy versus deep lobe removal or with deep lobe removal plus radiotherapy).
- Removal of the deep lobe could increase the surgical risk to the facial nerve with paresis and paralysis (with an en bloc deep lobe removal, the facial nerve is mobilized and there is more short-term facial weakness).
- There is more tissue loss with a deeper postoperative depression and greater cosmetic deformity (a definite occurrence that can be mitigated by various reconstructive options).
- A surgeon may not be trained in removal of the deep lobe as an en bloc operation (a competent head and neck surgeon should be able to do a piecemeal or partial deep lobe removal. As there is no way to identify the exact location of the deep nodes, the more complete removal, the higher chance of oncologic success).

Some surgeons recommend removing the deep lobe any time the parotid area nodes are involved with metastatic cancer [3, 28, 29]. However, this may ignore other important information necessary for optimal decision making. Metastasis to a tail of a parotid node without other positive nodes likely has a low risk of metastasis to the deep lobe. In addition, the patient may have health issues that demand a quick operation, where the risk of a longer operation outweighs the risk of leaving the deep nodes in place.

An individualized approach is always the best. The surgeon should look at all factors important in deciding to remove the deep lobe: what is the patient's overall health? How likely are they to return if additional treatment is needed? What are their ages, their immunologic status, their comorbidities, and their wishes? Tumor factors become equally important—how is the tumor behaving in the patient? What is its rate of growth? What are the clinical findings regarding palpable disease, metastasis, fixation, facial nerve involvement, etc? Pathologic factors include the grade and histologic type and knowledge of risk of metastasis. Some cancers, such as salivary duct cancers and poorly differentiated cancers, will often metastasize to many nodal areas. Finally, there are physician factors, including the surgeon's level of knowledge, experience, training, and skill in removing the deep parotid lobe.

Surgical removal of the deep parotid lobe can be done with preservation of the facial nerve and with an en bloc excision of the deep lobe tissue. This is done by isolating and including the major vessels in the resection, coupled with a keen awareness of regional anatomy. The description and illustrated steps to an en bloc removal with facial nerve preservation have been well illustrated in prior publications [26, 30, 31].

Reconstruction of the soft-tissue defect can be done if desired, and in general, a dermal fat graft taken from the abdomen gives the best results. Facial nerve weakness after deep lobectomy is greater than after superficial parotidectomy, but is usually dependent on the patient's age and surgeon's experience. Results from a prior publication were quite acceptable [22]. Some cases are best managed without reconstruction to aid in the early discovery of possible local recurrence, especially for a very aggressive parotid malignancy. If a surgeon is not comfortable removing the deep lobe, another surgeon should be doing the surgery.

Oncologic results

Definitive benefit to removal of the deep parotid lobe for possible lymph node involvement is hard to document. Often, pathology reports do not separate superficial and deep lobe nodal involvement when a total parotidectomy was performed with facial nerve preservation. Total case numbers are low compared to many malignancies when one studies the benefit of deep nodal removal. A randomized series of deep lobe removal plus radiation therapy versus no deep lobe removal and radiation therapy after superficial parotidectomy and neck dissection would require a large number of cases given the variable pathology and low number of nodes in the deep portion.

Yet, as shown earlier, deep node involvement does occur at a rate nearly equal to cervical metastasis for metastasis to the parotid gland [22, 28]. Removal of the deep lobe seems to reduce local recurrence risk compared to no deep lobe removal and radiation therapy [22, 24]. Local recurrence is a serious finding with skull base pain, masses, 7th nerve paralysis, and risk of additional spread, etc. For primary parotid cancers, utilizing the approach outlined above for managing local and regional lymphatic nodal spread has shown favorable oncologic outcomes for many parotid cancers [28, 32–34]. The indications for deep lobe parotidectomy follow the rationale for removal of superficial and neck nodes when considering the interconnectivity between the parotid lymphatic system.

Summary

Back to the original question: why remove the deep lobe? Obviously, if it is involved by cancer or at high risk of malignancy, either primary or metastatic. The deep portion should not be viewed as unique or different from the superficial portion, only that it is smaller with fewer nodes present. Removal of the deep lobe is done to optimize the oncologic results for the patient. When should it be removed? In all cases of direct extension of a primary cancer to the deep lobe or with a primary deep lobe parotid cancer. Strong consideration should be given to prophylactically remove the deep lobe if the patient's health warrants and the patient has metastatic cancer to a superficial intraparotid node, or the patient has a primary parotid cancer that has metastasized to an intraparotid node or cervical node, and finally remove the deep portion for all high-grade primary parotid cancers. An individualized approach to decision making should always be done. Finally, how does one do a deep lobe removal? It can be done piecemeal or partial, but this will leave some gland behind. In our opinion, the performance of an en bloc deep lobe removal is an operation that can best remove potential metastasis to the deep parotid nodes. This surgical procedure requires knowledge of embryology, anatomy, and parotid lymphatic connections and tumor behavior. The technique of a complete deep lobe removal with facial nerve preservation is a well-described procedure. The patient should be given the best chance for oncologic success. Deep lobe parotidectomy plays an important role in the successful management of many parotid gland malignancies. Avoidance of locoregional recurrence is what truly matters, as there is no quality of life without life.

Compliance with ethical standards

Conflict of interest Kerry D. Olsen declares that he has no conflict of interest. Miquel Quer declares that he has no conflict of interest. Remco de Bree declares that he has no conflict of interest. Vincent Vander Poorten declares that he has no conflict of interest. Alessandra Rinaldo declares that she has no conflict of interest. Alfio Ferlito declares that he has no conflict of interest.

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Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

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