Review Article

Endoscope-assisted hairline approach for head and neck mass

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Review article

Endoscope-assisted hairline approach for head and neck mass: A review

HIGHLIGHTS

- Endoscope-assisted hairline approach is becoming a favored option for many surgical techniques in the head and neck region.
- Endoscope-assisted hairline approach can effectively achieve a better cosmetic outcome.
- Endoscope-assisted hairline approach is a good surgical alternative to traditional transcucaneous approach.
Abstract

Conventional surgery via a transcervical incision is indicated for treating certain tumors in the head and neck. However, it can cause multiple problems, including scars and cosmetic issues. The endoscope-assisted hairline approach, which replaces conventional surgical procedures, is increasing in use due to excellent cosmetic and functional outcomes. However, given its complex anatomical intricacy, the endoscope-assisted hairline technique is not commonly used for head and neck surgery. The hairline surgical approach evolved with changing disease conditions and recent innovations in surgical instruments. This review article discusses endoscope-assisted hairline approaches for resecting head and neck masses as well as the surgical procedure and postoperative clinical outcomes.

**Keywords:** head and neck, endoscope, hairline, scar
Introduction

Endoscopic surgery is popular because it is less invasive and offers cosmetic benefits. Conventional transcutaneous excision is a well-established surgical technique for excising head and neck lesions. However, the external transcervical percutaneous incision inevitably leaves scars. Even if the incision is made on the skin creases and expression line, the scars can become hypertrophic or develop into keloids. Scars resulting from head and neck lesions can result in psychological and social effects on patients, and cosmetic outcomes are an important consideration in surgery.[1-3]

Therefore, many efforts have been made to conceal or minimize the incision scars in head and neck surgery. Since the 1980s, minimally invasive surgery has been popular in all surgical specialties. Endoscopic surgery in thoracic and abdominal surgery replaced conventional surgical methods. In 1996, Gagner first described endoscopic subtotal parathyroidectomy in head and neck lesions with constant gas insufflation for hyperparathyroidism, which leaves a small neck scar.[4-9]

Particularly in the areas of minimally invasive surgery, new surgical techniques are constantly being developed. These techniques exhibit minimal invasiveness and good cosmetic outcomes.[10-12] The hairline approach, in which incisions are not visible, demonstrates a cosmetic advantage due to the elimination of perceptible scars (Figure 1). Despite the similarity in names, the “hairline approach” differs clearly from a retroauricular hairline incision.

Although the hairline approach is usually limited to benign lesions, current efforts are intended to extend the field to malignant head and neck lesions. In terms of cosmetic acceptance, this approach is significantly superior to the percutaneous transcervical approach,
without significantly increasing complications or hospitalization.[13-19] (Figure 2)

However, because of the complexity of head and neck anatomy, such surgical methods are not yet widely used. Therefore, new approaches are being developed to conceal or eliminate incision scars resulting from the resection of head and neck lesions. From 2012 to 2018, we used the hairline approach to perform head and neck mass excision in 65 patients, and we documented their age, sex, tumor size, incision length, pathological findings, complications, and satisfaction scores (Table 1). This review provides an overview of the progress achieved over the years.

1. Submandibular gland

A palpable lesion in the submandibular gland is generally a true salivary gland tumor. Salivary gland neoplasm, chronic sialadenitis with or without sialolithiasis, plunging ranula, tuberculous sialadenitis, and drooling are often indicated for submandibular gland excision. Here, we present the submandibular gland as a successful example of mass removal in this area.[20]

Approximately 7%–11% of all salivary gland tumors originate from the submandibular gland, of which 30%–54% are malignant.[21] They typically present as a swollen mass in submandibular lesions. For benign lesions, the first diagnosis is usually made in patients aged 50 years and for malignant lesions in patients aged 60 years. Most submandibular gland tumors present as a painless, firm mass that is best identified by bimanual palpation.[22]

The only effective treatment for submandibular gland tumors is surgical resection. Many surgical techniques have been introduced to remove submandibular glands, including
intraoral, transoral, and submental resections.[23-25] The conventional technique is well-established and includes the percutaneous transcervical approach through a standard submental incision. This procedure sometimes results in an unsatisfactory visible scar and can also cause neurological damage to the facial, hypoglossal, and lingual nerves.[26, 27]

The hairline approach described here enables surgeons to identify the submandibular ganglion, lingual nerve, hypoglossal nerve, and submandibular gland with ease. This approach may provide a limited operation field. However, a magnified endoscope provides a clear view, allowing for the capsule of a given lesion to be clearly identified and preserved.[13, 28, 29]

Patients who received surgery with the hairline approach reported significantly higher satisfaction than the conventional group. And also there was no significant increases in complications or length of hospital stay.

**Surgical techniques**

The hair was shaved up to 3 cm above the hairline on the affected side preoperatively. The hairline was indicated with a surgical marking pen to indicate the location of the incision and working space.

The operation team consisted of an operator and an assistant. The assistant held an endoscope to enable the operator to use both hands during the procedure.

The patients, under general anesthesia, were positioned supine, with shoulder rolls under both shoulders. The head was turned to face the side opposite the lesion, and the neck was stretched. The head was fixed to prevent slipping from the surgical bed. Skin preparation and
draping were identical to that used for conventional submandibular gland surgery. An incision of 50–70 mm was made on the scalp, 1 cm behind the hairline. Next, the scalp flaps were elevated using Metzenbaum scissors and 2 prong retractors, with care taken to protect the great auricular nerve and prevent damage to the hair follicles.

Using a monopolar coagulator, the subplatysmal skin flap was lifted just above the sternocleidomastoid (SCM) muscle, with the head tilted toward the anterior and inferior directions. The submandibular gland was partially exposed, and the scalp flap was elevated to establish a working space with sufficient height to enter the surgical field with Sofield retractors. The plane of incision between the submandibular gland capsule and surrounding tissues could be clearly identified.

The operator held DeBakey forceps in the left hand, which was used to hold the mass and adjust its position, and a harmonic scalpel in the right hand, which was used to perform the resection. The facial artery, facial vein, and Wharton’s duct were ligated using the harmonic scalpel. Because of the magnified view through the endoscope, the lingual and hypoglossal nerves were identified easily and preserved (Figure 3).

Next, the submandibular gland, including the intraglandular masses, was removed. After removing the submandibular gland, a Penrose drain was inserted through the hairline incision line, and the incisions were tightly closed using interrupted sutures.[13]

The aforementioned hairline approach was performed in 20 patients, who were compared with 20 patients who underwent conventional transcutaneous surgery. The evaluated parameters include age, tumor size, incision length, amount of drainage, and operation duration. Among these, only operation duration differed between the groups and was longer in the patients undergoing surgery using the hairline approach. One patient (5%) in the hairline approach group experienced temporary facial nerve palsy. However, the patient was
determined to have Bell’s palsy, which affected the entire facial nerve, and recovered after 2 months. Additionally, 2 patients (10%) in the conventional group experienced temporary facial nerve palsy and recovered within 2 months.

2. Parotid gland

The most common salivary gland tumor is the parotid gland tumor, comprising 80% of these identified tumors. Approximately 80% of these tumors arise in the superficial lobe, and the majority of them are in the infra-auricular area.[20, 30] A preauricular location is less common. Parotid tumors are relatively uncommon, with an annual occurrence of 17.6 per million, and 77% are benign. Pleomorphic adenoma is the most common subtype.[31]

The only successful treatment for parotid tumors is parotidectomy, which is a well-established surgical technique. Depending on the extent of the surgery, parotidectomy is divided into extracapsular dissection, partial parotidectomy, superficial parotidectomy, and total parotidectomy.[32-34] To afford better exposure and delicate dissection for avoidance of facial nerve injury, these techniques are performed using a Blair incision or facelift incision. The most common complications following these surgeries are facial nerve paresis and paralysis.[35]

The hairline approach described here enables surgeons to identify the tumors and the branches of the facial nerve with ease. In addition, the incision scars are invisible; even in cases in which a hypertrophic scar develops, it is concealed by the hair.[17, 36]
The advantage of a hairline approach in parotid surgery is the safe dissection of tumors without facial nerve injury, with the help of magnification of the endoscope and a neurological monitoring system.

Surgical techniques

The patients were positioned in the supine position with a pillow under the shoulder, with the patients under general anesthesia. Their neck was extended, and their head was rotated to the opposite side of the lesion. Before draping, the location of the mass, the incision line, and the working space were outlined with a marking pen. Next, the same skin preparation and draping procedures used in traditional parotid surgery were employed. An incision was made approximately 50–70 mm over the postero-inferior auricular scalp, 1 cm posterior to the hairline. The scalp flap was elevated using Metzenbaum scissors and right-angle retractors.

The superficial layer of the parotid gland and SCM muscle were exposed by anteriorly dissecting the scalp flap. Additional dissection was performed between the posterior part of the parotid gland and the SCM muscle. During the dissection process, the peripheral branch of the facial nerve was identified using an endoscope and was retracted gently away from the tumor. Because facial nerve damage is the most avoidable adverse effect, we used a meticulous surgical technique. We used the NIM-Response 2.0 nerve-monitoring system (Xomed, Jacksonville, FL, USA) to verify the portions of facial nerve, including peripheral branches. The magnified endoscopic view enabled us to identify the branches of the facial nerve clearly; subsequently, we carefully dissected the tumor to avoid damage to the facial nerve.

The tumor was identified after successful dissection and then extracted through the surgical
wound. Wound irrigation and bleeding control were performed (Figure 4). The incisions were sealed with interrupted sutures after a Hemovac drain was inserted through the hairline incision line.[17]

The described approach was performed in 18 surgeries. The median operation duration was 82.5 ± 18.5 minutes, and the median incision length was 55 ± 0.62 mm. All surgical wounds fully recovered, without any complications such as skin flap necrosis, color change, or hematomas. One patient (6%) had transient facial nerve palsy (House–Brackmann grade II) and recovered within 1 month.

3. Head and neck mass

Head and neck masses are usually detected by physical examination. Because the head and neck area involves complicated anatomical structures and important functions, preserving the morphology and function is necessary to maximize the effectiveness of surgical treatment.[37-39]

The branchial cleft cyst is a unilateral, soft tissue swelling on the lateral part of the neck, anterior to the SCM muscle. Approximately 95% of branchial anomalies are second branchial clefts. The second branchial cleft is associated with the submandibular gland or is found in the anterior triangle of the neck.[40, 41]

Treatment of a branchial cleft cyst requires a profound understanding of the embryogenesis of the branchial cleft cyst. During the first 6–7 weeks of fetal life, the fetal branchial arches form pockets with their ectodermal epithelium due to incomplete closure or obliteration. These pockets are usually filled in during fetal development. However, if the filling effect is
insufficient, they develop into cysts, sinuses, and fistulas.[42]

For benign lesions in the head and neck region, surgical resection is commonly required. One well-established surgical technique is the conventional transcervical approach. However, this procedure results in scarring. Although some scars are well healed along the neck wrinkles, others may develop into hypertrophic scars. The scar of the head and neck region can seriously affect social interactions; therefore, surgeons should consider the postoperative cosmetic outcome when performing operations involving these regions.[40]

**Surgical technique**

After general anesthesia by oral intubation, the patients were laid down in a supine position with the head rotated to the opposite side of lesion. Computed tomography examination assisted the operators in evaluating the lesion in advance. Before draping, a marking pen was used to indicate the mass location, the incision line, and the working space. Skin preparation and draping were identical to those used for transcutaneous neck surgery. While taking care to avoid damaging the hair follicles, 50–70 mm incisions were made over the scalp, approximately 1 cm posterior to the hairline. Next, scalp flaps were elevated carefully to preserve the great auricular nerve, and the flaps were raised to form a tunnel under the skin.

The scalp flaps were retracted using Sofield retractors (Zimmer Biomet). Retraction of the flap allows for a clear view of the operation and decreases bleeding. It also minimizes the possibility of damaging the vessels and nerves. The endoscope entered the operation field after flap elevation. The surgical assistant lifted the scalp flap with one hand to provide sufficient working space for the operation, while the other hand was used to adjust the position of the endoscope such that the operator could obtain an accurate view. This enabled
the operator to use both hands in the procedure.

To completely remove the mass, dissection was performed through the avascular plane to separate the surrounding tissue from the mass. To minimize the possibility of mass rupture, the capsule of the lesion must be preserved. The mass was identified and extracted through the surgical wound. Wound irrigation and bleeding control were performed (Figure 5). A silastic drain was inserted through the wound, and the incisions were tightly closed using interrupted sutures[18] (Figure 6).

We employed this technique in 27 procedures and compared various parameters, including age, tumor size, incision length, amount of drainage, and operation duration, with 28 patients who underwent traditional transcutaneous surgery. Operation duration was the only difference between the two groups and was longer in patients undergoing surgery using the hairline approach. There was temporary nerve damage in the great auricular nerve in one patient in each group, both of whom recovered within 2 months. One patient who underwent transcutaneous surgery experienced facial nerve palsy involving the buccal branch; however, the symptoms disappeared within 3 months.

Discussion

The surgical technique described here is the latest method for excising a head and neck mass via the hairline approach, and many studies on this topic are in progress.[43] The hairline approach is associated with many benefits. The top benefit is the better cosmetic outcomes. When planning surgery, postoperative scars are an important consideration. In head and neck
surgery, scars are inevitably located on the neck, which is essential to social interactions. The hairline approach has been shown to provide significantly higher levels of satisfaction than the transcutaneous approach. The best advantage of the hairline approach is that the cosmetic outcomes are excellent, resulting in patients’ emotional satisfaction.[44]

Minimally invasive surgical techniques in the head and neck region have advanced steadily. Various methods of thyroidectomy have been attempted, including the use of transaxillary, transoral, submental, and retroauricular approaches, all of which are known to produce good cosmetic outcomes. However, for other head and neck masses, except for retroauricular approach, other methods are rarely used because the incision and the mass are too far apart. Both the retroauricular hairline incision and the hairline approach produce good cosmetic outcomes, but the hairline approach has other advantages: The magnified and clear view provided by the endoscope allows precise dissection and preservation of delicate structures, including specific nerves, and with an endoscope, the working space can be smaller, which is advantageous for postoperative healing.

In particular, traditional parotidectomy is usually performed using an incision with a length of approximately 10 cm. This incision line results in a serious effect on postoperative esthetics, especially for scar constitution patients. Thus, many attempts have been made to conceal the incision scar. Various types of incision have been used, such as preauricular and postauricular incisions. Similarly, the endoscope-assisted hairline approach can hide the incision scar beneath the regrown hair, leading to better cosmetic outcomes.

The hairline approach for the submandibular gland allows the surgeon to easily identify the submandibular ganglion, lingual nerve, hypoglossal nerve, and submandibular gland. The marginal mandibular nerve can be preserved safely by direct identification of the nerve by upward retraction after ligation of the facial vein. In addition, the harmonic scalpel generates
heat using vibration instead of electricity. Thus, using a harmonic scalpel is less damaging to the nerve.[45]

The most anticipated complication during parotidectomy is facial nerve paresis or paralysis. However, endoscope-assisted parotidectomy exhibits a benefit in this area by using nerve-monitoring and endoscope systems. The amplification of the endoscope allows for the clear identification of the branches of the facial nerve, and the nerve-monitoring system makes it possible to distinguish the facial nerve branches. After detecting the facial nerve, the surgeon merely has to retract gently away from the tumor.[14]

Satisfactory results after the hairline approach are also greater than with conventional techniques. The satisfaction score, which represents the subjective satisfaction with the patient's postoperative wound, was measured high in each hairline incision group and showed a statistically significant difference compared to the conventional group. This indicates that patients who received the hairline approach were significantly satisfied for their hidden scar. [13, 17, 18]

The main disadvantage of endoscopic excision is the longer operation duration. The hairline approach is more time-consuming than the percutaneous transcervical approach owing to the time spent elevating the scalp flap and creating the working space required for the endoscope-assisted approach. However, all surgeries using the hairline approach were completed within 120 minutes. Although the increased operation duration is an disadvantage, it could be acceptable considering the cosmetic outcomes.

In patients with short hair, any remaining scars are hidden inside the hairline and thus difficult to see. Temporary numbness in the ear lobe after procedures with the hairline approach could result from damage to the great auricular nerve caused by traction. Of the 65
patients, 4 had temporary ear lobe numbness, which disappeared within 3 months.

Compared with traditional open surgery, endoscopic surgery may exhibit a smaller workspace. Next, conventional open surgery can expose the entire surgical field well and provide a wide operation view. However, endoscopic surgery exhibits an advantage in that the magnified endoscope provides a clear view, resulting in a more accurate surgery.

Continual advances in surgical techniques emphasize the importance of minimally invasive techniques. Since the first endoscopic subtotal parathyroidectomy was implemented by Gagnar in 1997, various remote access techniques have been used in head and neck surgery. Among these, the hairline approach has been actively studied using the latest technology. Although the access is technically challenging, the hairline approach has better cosmetic outcomes without significant complications.

Innovations and enhancements are continually being made in endoscope-assisted hairline approaches. There are several opportunities for improvement in many areas, including the skill level of the operator; however, there may be collaboration with the minimally invasive surgery area in the future. In the field of minimally invasive surgery, various techniques are being developed, including the implementation of the Da Vinci robotic system. Robotic surgical systems provide the surgeon with a magnified, three-dimensional view of the operating field from various perspectives. Better outcomes will be achieved by combining these endoscope-assisted hairline approaches with the finesse of robotic surgery.
Conclusion

This review presents the endoscope-assisted hairline approach of head and neck masses. This technique is a highly recommended alternative surgical option for surgeries involving the head and neck, and it is expected to eventually replace conventional skin incisions.
Figure Legends

Figure 1. A 2 × 2-cm submandibular mass was excised via the hairline approach. (A) Preoperative marking was done before surgery. (B) A 50-mm incision was made on the scalp, 1 cm behind the hairline. (C) The scalp flap was elevated to establish a sufficient height to enter the surgical field with Sofield retractors.

Figure 2. The hairline approach exhibits an advantage in cosmetics by eliminating perceptible scars. (A) The operation wound was located at the end of the hairline. (B) Three months after surgery. The scar was covered by the growing hair. (C) A male patient 3 months after surgery. Even in patients with short hair, scars were rarely observed because they were located along the hairline.

Figure 3. Endoscopic view of the submandibular gland (SMG) mass excision via hairline incision. (A) The subplatysmal skin flap was elevated to create a sufficient working space. (B) Endoscopic guidance can identify mass-like lesions. (C, D) After careful dissection in the anterior and inferior direction, the SMG was identified. (E) The facial artery was identified easily using the endoscope and preserved. (F) The SMG was resected and then extracted through the surgical wound.

Figure 4. A parotid mass was excised via the hairline approach. (A) The scalp flap was elevated after anterior dissection. (B, C) Anterior dissection to expose the sternocleidomastoid (SCM) muscle and superficial parotid. (D, E) The parotid gland was
excised and extracted through the operation wound.

Figure 5. A neck mass was excised via the hairline approach. (A) An incision was made over the scalp, approximately 1 cm posterior to the hairline. (B) The scalp flap was elevated and extracted. (C, D) Careful dissection was performed, and the lesion was exposed. (E, F) A mass was excised and extracted through the operation wound. The mass was diagnosed as a branchial cleft cyst after histopathologic examination.

Figure 6. A cystic mass located in lateral neck was excised. (A, B) An incision was made through the hairline, and the flap was elevated. (C, D) Endoscopic view of the surgery. The mass was identified with a magnified view and clearly resected. (E) After tumor removal, the great auricular nerve (arrow) was preserved. (F) At 1 week after the operation: the scar is on the hairline and cannot be seen after the hair grows.

References


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Table 1. Demographics, tumor characteristics and details of the Submandibular gland, Parotid gland, and Lateral neck mass group. Patient satisfaction parameters were assigned scores ranging from 0 to 10, with a score of 0 indicating extremely unsatisfied and a score of 10 indicating extremely satisfied.
Figure 4-E
Figure 5-A