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Original Research Article

Comparison of Antegrade versus Retrograde Facial Nerve Dissection in Cases of Superficial Parotidectomy for Pleomorphic Adenoma of Parotid Gland

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Abstract:

Background: Pleomorphic adenoma is the most common benign salivary gland neoplasm, predominantly affecting the superficial lobe of the parotid gland. The standard treatment is superficial parotidectomy with preservation of the facial nerve. Two primary approaches for facial nerve dissection-antegrade (trunk-first) and retrograde (branch-first)-are practiced, yet their comparative outcomes remain debated. This study aims to evaluate surgical outcomes, complications, and recovery patterns between the two approaches.

Methods: This prospective observational study was conducted in the Department of General Surgery, SCB Medical College, Cuttack, from May 2022 to September 2024, including 61 patients with primary pleomorphic adenoma of the superficial lobe of the parotid. Patients underwent superficial parotidectomy using either antegrade (n=30) or retrograde (n=31) facial nerve dissection. Operative time, duration of hospital stays, pain score, incidence of facial nerve paralysis, and other complications were recorded. Follow-up was done at 1, 3, and 6 months, with a maximum follow-up of 1.5 years. Statistical analysis was performed using SPSS v26.0.

Results: Mean operative time was significantly shorter in the retrograde group (95.6 ± 7.4 min) compared to antegrade (116.2 ± 10.4 min; $p<0.0001$). Transient facial nerve paresis occurred more frequently with antegrade dissection (26.7%) versus retrograde (18.8%), with a significant difference ($p=0.04$). No cases of permanent paralysis, recurrence, or flap necrosis were reported. The incidence of parotid fistula and Frey's syndrome was equal in both groups (3.6–4%). Mean hospital stays (≈9 days) and postoperative pain scores showed no significant difference.

Conclusion: Retrograde facial nerve dissection in superficial parotidectomy is associated with reduced operative time and lower incidence of transient facial nerve paresis compared to the antegrade approach, with comparable complication rates and hospital stay. It is a safe and effective alternative for the management of pleomorphic adenoma.

Keywords: Pleomorphic Adenoma, Superficial Parotidectomy, Facial Nerve Dissection, Antegrade Approach, Retrograde Approach, Surgical Outcomes.

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Introduction

Pleomorphic adenoma is a benign neoplasm of the salivary glands, with the parotid gland being the most commonly affected site, accounting for over 75% of cases. It can also arise from the minor salivary glands in approximately 15% of instances. When it occurs in the parotid gland, the superficial lobe is predominantly involved. The term "pleomorphic adenoma" was introduced by Willis due to its characteristic microscopic architectural pattern composed of both myoepithelial and epithelial cells. This histologic pattern gives rise to the alternative name "benign mixed tumor," which was previously referred to by various terms such as mixed tumor, enclavoma, branchioma, endothelioma, and enchondroma. [1-4]

While pleomorphic adenomas are generally benign, they have the potential for malignant transformation,

with the risk increasing over time. Malignancy occurs in about 1.5% of cases within the first five years, rising to 9.5% after 15 years. Other risk factors for malignant transformation include advanced age, history of radiation therapy, large tumor size, and recurrence. Due to this malignant potential, excision is recommended for all cases.[5]

The standard treatment for pleomorphic adenoma of the superficial parotid lobe is superficial parotidectomy, a procedure that involves removing the tumor while preserving the facial nerve. This surgery is approached through either an antegrade or retrograde dissection technique. Despite advancements in surgical methods, complications remain a concern. These can include nerve paralysis, Frey's syndrome, infection, and tumor recurrence. Utilizing facial nerve monitoring during surgery has led to reduced operative time and decreased incidence of temporary facial nerve paresis, while newer technologies such as laser dissection and ultrasound scalpels have further minimized the risk of nerve injury. [6-8]

Aims and Objectives: The study's primary objective was to compare the incidence of facial nerve paralysis between retrograde and antegrade facial nerve dissection techniques during superficial parotidectomy for pleomorphic adenoma. The secondary objectives include evaluating the differences between the two groups in terms of facial nerve dissection time, total operative time, duration of hospital stay, pain scores, and the occurrence of post-operative complications. By assessing these variables, the study aims to provide a comprehensive comparison of the two surgical approaches, focusing on both clinical outcomes and recovery metrics.

Materials and Methods

Study Design: This prospective observational study was conducted in the Department of General Surgery, SCB Medical College, Cuttack, and included 61 patients diagnosed with pleomorphic adenoma of the parotid gland. All patients underwent superficial parotidectomy using either the antegrade or retrograde facial nerve dissection technique, based on the surgeon's preference. The study was carried out over a period from May 2022 to September 2024, with follow-up extending until March 2024. The aim was to compare the outcomes between the two surgical approaches, particularly focusing on facial nerve function and other operative parameters.

Inclusion and Exclusion Criteria: The inclusion criteria for this study are patients diagnosed with pleomorphic adenoma, regardless of age, sex, or size of the swelling, who present with involvement limited to the superficial lobe of the parotid gland. The exclusion criteria include patients with recurrent pleomorphic adenoma and those who do not provide consent to participate in the study. These criteria ensure that the study focuses on a homogeneous group of patients with primary pleomorphic adenoma confined to the superficial parotid lobe while excluding those with recurrence or who are unwilling to participate.

Data Collection Procedure: This prospective observational study included 61 patients who underwent superficial parotidectomy for pleomorphic adenoma at SCB Medical College, Cuttack between May 2022 to September 2024 (follow-up until March 2024). Preoperative assessment included detailed history, clinical examination, ultrasonography, CECT of head & neck, FNAC and routine blood tests. Patients were divided into two groups-antegrade and retrograde-based on the surgeon's chosen approach for facial nerve dissection. All surgeries were performed by the same surgeon. Intraoperative data, including time for nerve identification, total operative time and complications, were recorded. Postoperative complications, pain, hospital stay duration and facial nerve function were monitored during hospitalization and follow-ups at 1, 3, and 6 months up to 1.5 years. All treatments, including surgery and medications, were provided free of cost.

Statistical Analysis: Statistical analysis was performed using SPSS software version 26.0. Data were organized and tabulated, and graphical representations were prepared using Microsoft Excel 2010. To compare outcomes between the antegrade and retrograde dissection groups, various statistical tests were applied. The chi-square test was used to assess the correlation between the incidence of facial nerve injury in both groups. Additionally, independent t-tests and Fisher's exact tests were employed to analyze other quantitative and categorical variables. A p-value of less than 0.05 was considered statistically significant.

Results

Table 1: Demographic Distribution (Age and Gender)

Variable	Antegrade Dissection (n=30)	Retrograde Dissection (n=31)	Total (n=61)	P-Value
Mean Age (years)	45.32 ± 4.12	45.70 ± 4.65	45.51 ± 4.39	0.82
Age ≤40	8 (26.7%)	12 (38.7%)	20 (32.8%)	—
Age 41–50	12 (40%)	11 (35.5%)	23 (37.7%)	—
Age 51–60	8 (26.7%)	6 (19.4%)	14 (23%)	—
Age ≥61	2 (6.6%)	2 (6.4%)	4 (6.5%)	—
Male	22 (73.3%)	20 (64.5%)	42 (69%)	0.46
Female	8 (26.7%)	11 (35.5%)	19 (31%)	—

Table 1 shows that both groups had a similar age and gender distribution, with no statistically significant differences. The majority of patients were male (69%) and in the age group of 41–50 years.

Table 2: Comorbidity Profile

Comorbidity	Antegrade (n=30)	Retrograde (n=31)	Total	P-Value	Significance
Diabetes	5 (16.67%)	6 (19.36%)	11	0.90	Not Significant
Hypertension	7 (23.33%)	5 (16.14%)	12	—	—
Both	3 (10%)	4 (12.9%)	7	—	—
None	15 (50%)	16 (51.6%)	31	—	—

Table 2 observes a similar distribution of comorbidities (diabetes, hypertension, or both) in both groups. Half of the patients had no comorbidities. No statistically significant difference was found.

Table 3: Operative Time Analysis

Time Interval	Antegrade (mean ± SD)	Retrograde (mean ± SD)	P-Value	Significance
Time to identify nerve	60.46 ± 7.33 min	46.90 ± 6.18 min	0.0001	**Significant**
Time from nerve identification to resection	42.86 ± 8.60 min	37.03 ± 5.34 min	0.0023	**Significant**
Total operative time	116.16 ± 10.35 min	95.61 ± 7.37 min	0.0001	**Significant**

Table 3 shows a significantly shorter operative time in the retrograde group across all stages of surgery, including identification of the facial nerve and tumor resection. This difference was statistically significant.

Table 4: Postoperative Facial Nerve Paresis

Facial Nerve Paresis	Antegrade (n=25)	Retrograde (n=28)	Total	P-Value	Significance
Present	7 (26.67%)	2 (7.14%)	9	0.04	**Significant**
Absent	18 (73.33%)	26 (92.86%)	44	—	—

Table 4 demonstrates a significantly higher incidence of transient facial nerve paresis in the antegrade group. All cases were temporary and resolved over time, but the difference between groups was statistically significant.

Table 5: Post-Operative Complications

Complication	Antegrade	Retrograde	Total	P-Value	Significance
Flap Necrosis	0 (0%)	0 (0%)	0	1.00	Not Significant
Parotid Fistula	1 (4%)	1 (3.6%)	2	1.00	Not Significant
Frey's Syndrome	1 (4%)	1 (3.6%)	2	1.00	Not Significant
Recurrence	0 (0%)	0 (0%)	0	1.00	Not Significant

Table 5 shows a low and comparable rate of postoperative complications between the two groups, including flap necrosis, parotid fistula, Frey's syndrome, and recurrence. None of the differences were statistically significant.

Table 6: Duration of Hospital Stay

Duration (days)	Antegrade	Retrograde	P-Value	Significance
≤7 days	0 (0%)	1 (3.23%)	—	—
8–10 days	28 (93.34%)	28 (90.32%)	—	—
>10 days	2 (6.66%)	2 (6.45%)	—	—
Mean ± SD	9.13 ± 1.22	9.06 ± 1.78	0.8615	Not Significant

Table 6 indicates that the average hospital stay was nearly the same in both groups, with the majority of patients discharged within 8–10 days. The difference in duration of hospital stay was not statistically significant.

Table 7: Post-Operative Pain Score (VAS)

Postoperative Day	Antegrade (Mean VAS)	Retrograde (Mean VAS)	P-Value	Significance
Day 2	7.93	7.48	—	—
Day 4	6.2	5.58	—	—
Day 6	3.83	3.35	—	—
Day 8	1.9	1.64	0.8137	Not Significant
SD	2.6457	2.5527	—	—

Table 7 illustrates a gradual reduction in pain scores postoperatively in both groups. Though pain scores were slightly lower in the retrograde group on all days, the difference was not statistically significant.

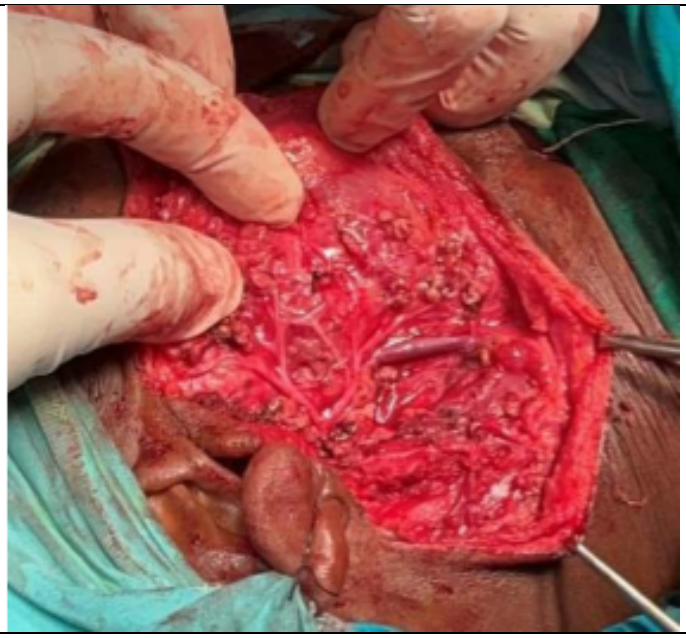

Figure 1: Facial nerve with branches after removal of superficial lobe of parotid gland

Figure 2: CT scan showing isodense parotid tumor

Discussion

The facial nerve is particularly vulnerable to injury during superficial parotidectomy because it lies within the faciovenous plane of the parotid gland. Several factors contribute to the incidence of facial nerve palsy, including the extent of surgery, tumor size and histology, facial nerve dissection technique, duration of the operation, and surgeon's experience.[9] Facial nerve paresis may be transient, typically recovering within six months to a year, or permanent. Transient paresis mainly results from

stretching of the nerve and its branches, neuropraxia, or axonotmesis during surgery.[10] Preventive measures, such as vertical dissection to avoid nerve stretching, can reduce this risk.[11]

Various studies have reported differing incidences of facial nerve paresis based on the surgical approach. Khazaeni et al. [12] reported temporary facial nerve paresis rates of 8.3% and 8% in antegrade and retrograde approaches, respectively. Other studies by Mahfouz et al. [13] and Stankovic et al. [14] found higher incidences of temporary paresis, with 33% and 34.4% in the antegrade group and 27% and 18.2% in the retrograde group, respectively. For permanent paralysis, reported rates were 11% and 2.4% in the antegrade group and 0.8% in the retrograde group. [13,14]

Our study demonstrated a statistically significant difference (p=0.04) in the incidence of transient facial nerve paresis, with the antegrade facial nerve dissection group showing a higher rate compared to the retrograde group. This finding aligns with Bhattacharya et al. [15] who concluded that retrograde superficial parotidectomy is more efficient, sparing normal parotid tissue without compromising surgical margins.[15]

Operative time comparisons between the two techniques have been inconsistent in the literature. Studies by Bhattacharya et al. [15] Chow et al. [16] and Mahfouz et al. [13] reported shorter operative times with the retrograde approach. Conversely, Elwahab et al. [17] found no significant difference. Khazaeni et al. [12] noted a shorter time to identify the nerve trunk or branch with the retrograde method, though this was not statistically significant (p=0.227). Our study found a significantly shorter operative time with the retrograde approach (p=0.0001), consistent with previous studies. [13,16] The time from skin incision to identification of the nerve branch was also significantly less than identification of the nerve trunk (p=0.0001).

Regarding postoperative hospital stay, Khazaeni et al. [12] observed a longer stay in the retrograde group (2.28 ± 0.5 days) compared to the antegrade group (2.04 ± 0.2 days), with statistical significance (p=0.048). However, our study found no significant difference in hospital stay between the antegrade (9.14 days) and retrograde (9.06 days) groups (p=0.86).

Other postoperative complications such as parotid fistula, sialocele, and recurrence have generally been reported as statistically insignificant between the two approaches.[7] The incidence of Frey's syndrome was higher in the retrograde group (30.7%) than the antegrade group (10.5%) in some studies,[18] though this was not statistically significant. Gurung et al. [19] reported no cases of Frey's syndrome following the retrograde approach. Khazaeni et al. [12] reported a low and statistically insignificant incidence of Frey's syndrome in both groups (4% in retrograde and 4.2% in antegrade). Our study observed two cases of parotid fistula and two cases of Frey's syndrome, with no recurrence reported so far; these findings were statistically insignificant.

Statistical analyses of age and gender distributions between the two approaches in our study were comparable (p=0.82 for age and p=0.45 for gender), indicating no demographic bias. Similarly, the presence of comorbidities such as type 2 diabetes mellitus and hypertension was evenly distributed, with no significant difference in outcomes between the two groups (p=0.90).

Patients with diabetes mellitus are generally more susceptible to nerve degeneration compared to non-diabetics [20.21] as both Schwann cells and the myelin sheath are at increased risk of damage.[22] Yuan et al. [23] reported diabetes as a significant risk factor for transient facial palsy (p=0.022). However, in our study, diabetes was not associated with an increased risk of transient facial nerve palsy (p=0.71).

Limitations: This study has several limitations, including a small sample size, a relatively brief follow-up period, and the lack of randomization, which may affect the generalizability and strength of the conclusions.

Conclusion

Our study concluded that the retrograde approach for superficial parotidectomy in cases of pleomorphic adenoma is technically easier and allows surgeons to limit dissection to one or two facial nerve branches when necessary. This targeted dissection helps avoid injury to the main trunk or other branches of the facial nerve, focusing on removing only the tumor-bearing parotid tissue. Injury to a single branch in the retrograde approach results in localized facial paralysis, unlike the antegrade approach, where damage to the trunk can cause paralysis of an entire side of the face. Additionally, the zygomatic branch of the facial nerve serves as a reliable landmark for retrograde parotidectomy, with complication rates comparable to those of the antegrade approach.

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