

# Macfee Incision versus Reversed Hockey Stick Incision for Neck Dissection: A Comparative Study

Megha Sahu<sup>1\*</sup> , Nidhisha Agrawal<sup>1</sup>, ML Agrawal<sup>1</sup>, Omendra Bhooshan<sup>1</sup>, Rajat Lohia<sup>1</sup>, Zahid Zahiri<sup>1</sup>, Devraj Singh Kushwaha<sup>1</sup>, Aditya Shrivastav<sup>1</sup>, Gunjan Shrivastav<sup>1</sup>, Saba Ahmad<sup>1</sup>, Sindhura Vinnakota<sup>1</sup>, Radhika Sharma<sup>1</sup>, V Jalaj<sup>1</sup>, BR Shrivastava<sup>1</sup>

<sup>1</sup>Cancer Hospital and Research Institute, Cancer Hills Road, Amkhoh, Gwalior, Madhya Pradesh, India

\*Correspondence author: Megha Sahu, Head and Neck surgical Oncology, Cancer Hospital and Research Institute, Cancer Hills Road, Amkhoh, Gwalior, Madhya Pradesh, India; E-mail: [sahujimegha1@gmail.com](mailto:sahujimegha1@gmail.com)

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## Abstract

**Objectives:** The aim was to assess their effectiveness in terms of surgical access, efficiency, wound healing and cosmetic outcomes.

**Methods:** This prospective observational study included patients with histologically confirmed squamous cell carcinoma of the oral cavity undergoing neck dissection at the Cancer Hospital and Research Institute, Gwalior. Patients were divided randomly into Group A (Macfee incision) and Group B (Reversed Hockey Stick incision). The primary parameter was flap viability, while secondary outcomes included surgical time, exposure, scar appearance and postoperative healing. Statistical analysis was performed using SPSS version 18.5, with  $p < 0.05$  considered significant.

**Results:** Of the 37 patients enrolled, 13 were in Group A and 24 in Group B. No significant differences were found in age, gender or BMI. Group B showed better intraoperative exposure ( $p = 0.048$ ), while Group A had shorter flap raising and closure times. Flap viability was 100% in both groups. Scar outcomes slightly favoured the Macfee incision. Postoperative complications were minimal, with Group A having a 100% complication-free rate and Group B reporting minor issues in 8.3% of cases.

**Conclusion:** Both incisions are effective, offering excellent flap viability and cosmetic outcomes. The reversed hockey stick incision improves access, while the Macfee incision may enhance healing and cosmesis.

**Keywords:** Oral Cancer; Head and Neck Cancer; Oral Squamous Cell Carcinoma; Radical Neck Dissection; Surgical Incision

## Abbreviations

BMI: Body Mass Index; BP Blade: Bard-Parker Blade; CHRI: Cancer Hospital and Research Institute; HIS: Hockey Stick Incision; MRND: Modified Radical Neck Dissection; OSCC: Oral Squamous Cell Carcinoma; PMMC: Pectoralis Major Myocutaneous (Flap); SPSS: Statistical Package for the Social Sciences; STSG: Split Thickness Skin Graft; TNM: Tumor, Node, Metastasis (staging system).

## Introduction

Non-Metastatic head and neck cancer often necessitates surgical intervention, with neck dissection being integral part of treatment. More than a century ago, Crile (1906) introduced a Y-shaped incision, which remained in use for decades, with modifications still commonly applied today [1,2]. As neck incisions became an accepted part of oral cancer treatment, various skin incisions were introduced to optimize access to cervical lymphatics (Macfee, 1960). By the 1950s, single transverse incisions were routinely used, leading to the development of the Macfee Incision, which consists of two horizontal parallel incisions (Macfee, 1960). These linear incisions are considered cosmetically favorable as they align with relaxed skin tension lines, reducing conspicuous scarring [3]. Additionally, transverse incisions can be adapted to various neck dissection methods while avoiding

acute angles, convergence or crossover of incisions [4,5]. While the reversed hockey stick incision is characterized by long anterior skin flap, which extends from the mastoid region and follows a gentle curve towards the midline of the neck, resembling the shape of a hockey stick in reverse. It provides excellent exposure to cervical lymph nodes [6]. Incisions like McFee, Hockey Stick and Reverse Hockey Stick are ideal for radical neck dissections and irradiated neck explorations due to the absence of trifurcate areas [7]. Rabson, et al., described the arterial supply of the neck, emphasizing key vascular territories. The upper anterior neck receives blood from branches of the facial and submental arteries, which extend into the platysma, supplying both the skin and the underlying muscle. The upper lateral cervical region is supplied by cutaneous branches of the occipital, posterior auricular and external carotid arteries, with anterior overlap from the facial arteries and inferior contributions from trapezius perforators. The mid-anterior neck derives its circulation from the platysmal cutaneous branch of the superior thyroid artery. The lower neck receives blood flow from the transverse and superficial cervical arteries, with lateral anastomoses connecting to trapezius perforators. Additionally, the dermal-subdermal plexus forms a network that supports cross-midline anastomoses, playing a crucial role in the viability of medially based flaps [8].

Careful incision planning is crucial to preserving vascular integrity and ensuring flap survival. Avoiding major superficial veins, such as the external jugular vein, reduces the risk of excessive bleeding. An ideal neck incision should provide adequate exposure of underlying structures while minimizing postoperative complications.

This study aims to compare the outcomes of the Macfee incision and the reversed hockey stick incision for modified radical neck dissection. The evaluation is based on primary factors such as flap viability and secondary factors including length of operation, accessibility to the surgical site, scar cosmesis and postoperative wound healing. The findings will contribute to a standardized approach for selecting the most effective incision technique for cases of metastatic cervical cancer.

## **Methodology**

### *Study Design*

This prospective observational study enrolled patients who presented to the Department of Head and Neck Surgical Oncology at the Cancer Hospital and Research Institute, Gwalior, over a one-year period from April 2024 to May 2025.

### *Participants*

The study included patients aged between 20 and 65 years who underwent neck dissection for histologically confirmed cases of oral cavity squamous cell carcinoma. Patients were excluded if they did not provide written informed consent, had tumors involving the overlying skin either clinically or radiologically or had received prior chemotherapy or radiotherapy. Patient demographics, treatment details, outcome parameters and follow-up data were extracted from medical records and case files. Patient details including demographic data like age, sex, tumor histology, site of primary disease and site of metastases were noted. Patients were assigned to group A (Macfee incision) and group B (Reversed Hockey Stick incision).

### *Study Outcomes*

The primary objective of the study was to assess flap viability through clinical observation of flap color in the postoperative period. A healthy flap appeared pink, well-perfused, minimally swollen and warm to the touch. Signs of venous compromise (congested flap) included a bluish color and increased swelling, while arterial compromise (ischemic flap) was indicated by pallor and a cold temperature. The secondary objectives included evaluating flap raising and closure time, accessibility during the surgical procedure, wound healing, postoperative complications and scar assessment. The time taken to raise the flap was measured from the initial incision to the beginning of neck dissection, while flap closure time was recorded from flap approximation to the final skin suture. Incision and wound healing was postoperatively assessed based on marginal flap necrosis, dehiscence, contraction and infection at discharge on 1<sup>st</sup>, 3<sup>rd</sup> and 6<sup>th</sup> months follow up. Scar cosmesis was evaluated using the Stony Brook Scar Evaluation Scale (0 - worst to 5- best) in 1<sup>st</sup>, 3<sup>rd</sup> and 6<sup>th</sup> months follow-up [9].

### *Surgical Procedure*

Patients underwent nasotracheal or orotracheal intubation for general anesthesia. Surgical skin preparation was done using betadine. Sterile draping was performed. The incision was marked and 2% lignocaine was locally infiltrated. A No. 15 BP blade was used for the incision.

Group A - MacFee Incision (Two Horizontal incision) (Fig. 1).

Submandibular Incision: A horizontal incision ~2.5 cm below and behind the mastoid tip, extending downward and anteriorly, crossing the midline at the hyoid bone.

Supraclavicular Incision: A horizontal incision ~3.5 cm above the clavicle, extending from the medial border of the sternocleidomastoid to ~2.5 cm beyond the trapezius anterior margin.



**Figure 1:** Macfee incision.

Group B - Reversed Hockey Stick Incision (Fig. 2).

A curved longitudinal incision ~2-3 cm below the mastoid tip, running medially towards the submental region, ~2 cm below the mandibular margin, allows elevation of a long anterior skin flap.



**Figure 2:** Reversed hockey stick incision.

The platysmal layer was identified and raised for modified radical neck dissection, depending on structural involvement. Reconstruction, if required, was done using flaps such as the pectoralis major myocutaneous flap, temporalis flap, buccal fat pad, nasolabial flap or skin grafts. Hemostasis was meticulously ensured, followed by the placement and securement of a suction drain. The cut edges of the platysma were then approximated and sutured in layers.

#### Data Analysis

The results for each parameter (numbers and percentages) for discrete data and mean and standard deviation for continuous data are presented in Table 1 to 3. Normality assumption of data was tested using Shapiro Wilks test. If Normality assumption is not met then comparison between the groups were carried out by non-parametric test. Proportions were compared using Chi-square test of significance. The student 't' test was used to determine whether there was a statistical difference between Study groups in the parameters measured. In all the above test the "p" value of less than 0.05 was accepted as indicating statistical significance. Data analysis was carried out using Statistical Package for Social Science (SPSS ver 18.5) package.

#### Results

Over a one-year period from April 2024 to May 2025, 37 Patients were enrolled in this study. Group A (Macfee) consisted of 13 participants, while Group B (Reverse hockey stick) had 24 participants. Group A (N=13) had a mean age of 43.1 years, while group B (N=24) had a slightly higher mean age of 47.1 years. Both groups had a median age of 43.0 years. Age ranges were 27-58 years (Group A) and 30-71 years (Group B). No significant difference in mean age was observed p 0.263. Male were predominant in both groups (92.3% in Group A, 87.5% in Group B). Overall, 89.2% of participants were male.

In Group A, the most common site was the tongue (61.5%), followed by the buccal mucosa (38.5%). No cases were reported in the gingivum or retromolar trigone. In Group B, the tongue remained the most affected site (45.8%), with the buccal mucosa close behind at 37.5%. Additionally, 12.5% had tumours in the gingivum and 4.2% in the retromolar trigone. Group A had a mean BMI of 20.9 (SD = 3.65), while Group B had a slightly lower mean BMI of 19.9 (SD = 2.96). The median BMIs were 20.7 and 19.5, respectively, with ranges of 14.7-28.3 for Group A and 15.8-26.4 for Group B. No significant difference in mean BMI was observed between the groups (Table 1).

Site of Tumor Involvement			
Site of Tumours	Group A (N=13)		Group B (N=24)
<i>Gingivum</i>	0 (0.0%)		3 (12.5%)
<i>Buccal Mucosa</i>	5 (38.5%)		9 (37.5%)
<i>Retromolar trigone</i>	0 (0.0%)		1 (4.2%)
<i>Tongue</i>	8 (61.5%)		11 (45.8%)
Body Mass Index			
BMI	Group A (N=13)		Group B (N=24)
< 18.5	3 (23.1%)		7 (29.2%)
18.5-25.0	9 (69.2%)		15 (62.5%)
25.1-<30.0	1 (7.7%)		2 (8.3%)
Mean	20.9		19.9
Median	20.7		19.5
	P value		
			0.914
			0.416
Comparison of Clinical Staging			
Clinical Staging	Group A (N=13)		Group B (N=24)
T	T1	1 (7.7%)	2 (8.3%)
	T2	5 (38.5%)	13 (54.2%)
	T3	7 (53.8%)	9 (37.5%)
N	N0	5 (38.5%)	7 (29.2%)
	N1	6 (46.2%)	14 (58.3%)
			P value
			0.621

	N2a	0 (0.0%)	1 (4.2%)	0.709
	N2b	2 (15.4%)	2 (8.3%)	
<b>M</b>	M0	13 (100%)	24 (100%)	
Comparison of Pathological Staging				
Pathological staging	Group A (N=13)		Group B (N=24)	P value
<b>T</b>	T1	1 (8.3%)	7 (30.4%)	0.076
	T2	7 (58.3%)	5 (21.7%)	
	T3	4 (33.3%)	7 (30.4%)	
	T4a	0 (0.0%)	4 (17.4%)	
<b>N</b>	N0	6 (50.0%)	18 (78.3%)	0.367
	N1	1 (8.3%)	1 (4.3%)	
	N2a	1 (8.3%)	1 (4.3%)	
	N2b	1 (8.3%)	2 (8.7%)	
	N3b	3 (25.0%)	1 (4.3%)	

**Table 1:** Patient characteristics.

The clinical staging distribution differed significantly between Group A and Group B based on the TNM classification. In group A, the majority of cases 53.8% fall under T3, whereas T2 accounts for 38.5% and only 7.7% of cases belong to T1. In group B, the highest proportion of 54.2% was found in T2 followed by 37.5% in T3 and 8.3% in T1. In group A, the most nodal stage 46.2% was N1 followed by 38.5% in N0. There were no cases of N2a while 15.4% fall under N2b. In group B, N1 was most prevalent 58.3%, followed by 29.2% in N0 whereas N2a accounts for 4.2% and N2b for 8.3%. In group A and B, 100% cases fall under M0. There was no statistically significant difference between group A and B in terms of clinical staging across tumour, node and metastasis categories. In the pathological staging distribution of group A, the majority of cases 58.3% fall under T2, whereas T3 accounts for 33.3% and only 8.3% of cases belong to T1. In group B, the highest proportion of 30.4% was found in T1 and T3 followed by 21.7% in T2 and 17.4% in T4a. In group A, the most nodal stage 50% was N0 followed by 25% in N3b while 8.3% fall under N1, N2a, N2b. In group B, N1 was most prevalent 58.3%, followed by 29.2% in N0 whereas N2a accounts for 4.2% and N2b for 8.3%. In group B, the most nodal stage 78.3% was N0 followed by 8.7% in N2b while 4.3% fall under N1, N2a, N3b. There was no statistically significant difference between group A and B (Table 1). This study compared mean intraoperative flap raising and closing times between Group A and Group B to assess surgical efficiency. Group A had a shorter mean flap raising time (576.92s) than Group B (663.5s), indicating a faster process. Similarly, flap closing was quicker in Group A (630s) than in Group B (682.92s) (Table 2).

Parameter	Group A (n=13)	Group B (n=24)	P-value
<b>Flap Raising Time (seconds)</b>	Mean: 576.92, Median: 600.0	Mean: 663.50 Median: 660.0	<b>0.017</b>
<b>Flap Closing Time (seconds)</b>	Mean: 630.00, Median: 630.0	Mean: 682.92 Median: 660.0	0.135
<b>Intraoperative Accessibility to Neck</b>	Yes: 11 (84.6%) No: 2 (15.4%)	Yes: 24 (100.0%) No: 0 (0.0%)	<b>0.048</b>
<b>Postoperative Flap Viability</b>	Healthy: 13 (100.0%)	Healthy: 24 (100.0%)	—
<b>Wound Healing</b>	Month 1: 13 (100.0%) Month 3: 13 (100.0%) Month 6: 13 (100.0%)	Month 1: 24 (100.0%), Month 3: 24 (100.0%) Month 6: 24 (100.0%)	—
<b>Postoperative Scar Evaluation (Mean ± Median)</b>	Month 1: 4.92 / 5.00, Month 3: 5.00 / 5.00, Month 6: 5.00 / 5.00	Month 1: 4.83 / 5.00, Month 3: 4.96 / 5.00, Month 6: 4.96 / 5.00	0.4600.4700.470

**Table 2:** Comparison of intraoperative and postoperative parameters between Group A (macfee incision) and Group B (reversed hockey stick incision).

Neck accessibility was assessed in Group A (N=13) and Group B (N=24). Good accessibility was achieved in 84.6% of Group A cases (15.4% had mild difficulty) and 100% of Group B cases. Overall, 94.6% had good accessibility, with a significant difference between groups (Chi-square = 3.903, P = 0.048). Group B's superior results underscore the importance of surgical approach selection for optimal access (Table 2).

Postoperative flap viability was 100% in both Group A and Group B across all time points, including the initial evaluation and follow-up at 1, 3 and 6 months. Both groups demonstrated successful wound healing with no complications or deviations. These findings indicate that the surgical techniques and patient management strategies used in both groups were equally effective, ensuring consistent and favorable postoperative outcomes (Table 2). The study compared reconstruction approaches, postoperative complications and tumor site distribution between two groups.

The mean postoperative scar evaluation scores for Groups A and B were assessed at 1, 3 and 6 months, ranging from 1 to 5 (higher values indicating better outcomes). At 1 month, Group A scored 4.92, slightly higher than Group B (4.83). By 3 months, both groups improved, with Group A at 5 and Group B at 4.96. At 6 months, scores plateaued, with Group A maintaining 5 and Group B at 4.96. While Group A consistently had slightly better scores, differences were minimal, indicating both approaches resulted in excellent scar healing (Table 2).

#### *Reconstruction Approaches*

Reconstruction was performed in 69.2% of group A and 30.8% of group B, while 54.2% of group B did not undergo reconstruction compared to 45.8% of group A. Among those who had reconstruction, the PMMC Flap was the most common (50.0% in group A, 46.2% in group B), followed by STSG Flap (25.0% in group A, 23.1% in group B). The Temporalis Flap was used only in 7.7% of group B. Nasolabial Flap and Bilobed PMMC Buccal Fat Pad were used in 15.4% and 7.7% of group B respectively. These findings highlight differences in reconstruction rates and methods between the groups, which may influence surgical planning (Table 3).

Parameter	Group A (n=13)	Group B (n=24)	P-value*
<b>Reconstruction Required</b>	Yes: 4 (30.8%)	Yes: 13 (54.2%)	0.173
	No: 9 (69.2%)	No: 11 (45.8%)	
<b>Type of Reconstruction</b>			
• Bilobed PMMC Flap	1 (25.0%)	0 (0.0%)	—
• Buccal Fat Pad	0 (0.0%)	2 (15.4%)	—
• Nasolabial Flap	0 (0.0%)	1 (7.7%)	—
• PMMC Flap	2 (50.0%)	6 (46.2%)	—
• Split Thickness Skin Graft (STSG)	1 (25.0%)	3 (23.1%)	—
• Temporalis Flap	0 (0.0%)	1 (7.7%)	—

**Table 3:** Comparison of reconstruction between two groups.

#### *Postoperative Complications*

Group A had no complications (100%), while Group B had a 91.7% complication-free rate. Chyle leak and post-auricular seroma were observed only in Group B (4.2% each). However, no statistically significant difference in complications between groups.

#### **Discussion**

This study compared two surgical approaches, the Macfee incision (Group A) and the Reverse Hockey Stick incision (Group B), in terms of intraoperative efficiency, postoperative outcomes and accessibility. Our findings indicate that while both techniques are effective, Group B demonstrated superior neck accessibility, aligning with previous studies highlighting the importance of incision planning for optimizing surgical exposure [8].

There was no significant difference in age (p = 0.263) or BMI between the groups, ensuring comparability. The male predominance (89.2%) in our study is consistent with previous reports of head and neck malignancies being more prevalent in men [9,10].

Differences in TNM staging were observed, with Group A having more T3 tumors and N2a cases, while Group B had a higher proportion of T2 tumors and N2b cases. This distribution could impact surgical complexity and postoperative management. Group A exhibited shorter flap-raising (576.92s vs. 663.5s) and flap-closing times (630s vs. 682.92s), suggesting a more efficient workflow. This could be attributed to the familiarity and straightforward design of the Macfee incision. However, Group B demonstrated significantly better intraoperative accessibility (100% vs. 84.6%,  $p = 0.048$ ). Several studies have evaluated comparing four different incisions for radical neck dissection found that the Reverse Hockey Stick incision offered a balance between adequate exposure of neck lymphatics and satisfactory scar cosmesis, making it a versatile choice in surgical planning and also suggested Macfee incision required more time for flap raising than the Modified MacFee, Modified Schobinger and Reverse Hockey Stick incisions due to its wide bridge and tunnel-like approach [9]. MacFee himself noted this drawback in his study.

Omura, et al., stated that when resecting skin or platysma with submandibular lymph nodes or tumors, the standard hockey stick incision flap is unsuitable due to compromised blood supply [11]. The reversed-HSI technique is preferred, as its adjustable incision allows for primary closure or slight flap rotation, minimizing the need for reconstruction. In the study by Grätz, et al., found that transverse neck incisions like the MacFee incision provide limited surgical visibility and require extensive retraction, increasing the risk of marginal ischemia [12]. In our study, the MacFee incision had 15.4% of cases experiencing mild difficulty, whereas the reverse hockey stick incision achieved 100% good accessibility without any difficulties. Modification of Macfee incision using opposed concave and convex incisions in the upper and lower neck meets surgical requirements while creating a 4-6 cm width, mobile skin bridge [13].

Scar evaluation scores at 1, 3 and 6 months were comparable, with both groups achieving near-perfect healing. These findings align with Landers, et al., who noted that meticulous closure techniques and minimal tension contribute to favorable scar outcomes [14]. Postoperative flap viability was 100% across all time points, supporting the reliability of both incisions for successful wound healing. Complication rates were low, with Group A experiencing no complications and Group B reporting only minor issues (chyle leak and post-auricular seroma in 4.2% of cases). The lack of statistical significance ( $p = 0.564$ ) suggests that both approaches are safe. Reconstruction trends differed, with Group A having a higher proportion of patients undergoing reconstructive procedures. The PMMC flap was the most common technique, mirroring the findings of Righi, et al., who emphasized its versatility in head and neck reconstruction [15]. Tumor sites varied, with the tongue being the most commonly affected area in both groups. The presence of left buccal mucosa and lower alveolus involvement in Group B suggests that the incision choice may be influenced by tumor location. Studies by Jagadish Tubachi, et al., emphasizes that incision planning in head and neck oncosurgery should consider anatomical landmarks to provide wide exposure, facilitate reconstructive techniques and maximize both oncologic and cosmetic outcomes [16]. The study's small sample size and male-dominated demographic (89.2%) limit generalizability and gender-based analysis. Lack of randomization raises concerns of selection bias. Short follow-up (up to 6 months) restricts insights into long-term outcomes.

## Conclusion

This study demonstrates that both the Macfee and Reverse Hockey Stick approaches are viable options in radical neck dissections, each offering distinct advantages. While Group A had shorter operative times and marginally better scar healing, Group B provided superior intraoperative accessibility. Given the comparable postoperative outcomes, surgical selection should be tailored to individual patient needs, tumor characteristics and reconstructive requirements to optimize both surgical efficiency and oncological safety.

## Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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### Data Availability Statement

Not applicable.

### Ethical Statement

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### Informed Consent Statement

Informed patient consent was appropriately secured.

### Consent for Publication

Informed consent for publication was obtained from the patient involved in this case report, as documented in the manuscript.

### Authors' Contributions

All authors contributed equally to this paper.

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