

Reconstructive Options in Head-and-Neck Cancer Surgeries

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Abstract

Introduction: Surgery is the standard treatment to achieve cancer control, but due to socioeconomic and other factors, most patients present with a locally advanced tumor leading to extensive resection of mucosa, muscle, bone, and skin. Reconstruction of these defects is essential not only in ensuring function and cosmesis but also in enabling the start and completion of adjuvant therapy on time.

Aim: The study aims to analyze the various reconstruction methods used in the head-and-neck cancer surgery.

Materials and Methods: Various cancers of the head and neck using various reconstruction options such as primary closure, local flaps, and regional flaps. Pre-operative radiotherapy, extent of defect, the type of reconstruction used, post-operative complications, and the functional outcome in the immediate post-operative period, 1 month after surgery, and at 6 months were recorded.

Results: Of the 180 surgeries for head-and-neck cancers, primary closure was done in 79 cases. Other reconstruction options used were pedicled regional flaps – 75, local flaps – 11, and split skin grafting – 15. Of the 79 primary closures, 2 cases of infection, 2 cases of partial necrosis (neck skin and tongue), 8 cases of minor wound dehiscence, and 2 cases of fistulae of which one was chylous were noted. Of the 50 pectoralis major myocutaneous (PMMC) flaps, 29 were for lining the oral/oropharyngeal cavities, 6 were for cover the skin defects, and 15 were for both lining and cover.

Conclusion: PMMC is the choice flap in high-volume centers with resource and time constraints where microsurgical expertise is not available. They have proved effective in the absence of microvascular free flaps. Further improvement in our results can be achieved if free flaps could be used in a choice few cases and effective mandibular reconstructions are to be used.

Key words: Head-and-neck cancer, Microvascular free flaps, Reconstruction

INTRODUCTION

Head-and-neck cancer represents the sixth most frequent malignancies. Worldwide, more than 500,000 new cases are diagnosed annually, along with 300,000 deaths. Head-and-neck cancer predominantly affects men, with a male:female ratio of up to 10:1. There is also an increased risk of developing this type of cancer.^[1,2]

Head-and-neck cancer surgery entails a range of surgery from simple primary closure to complex reconstruction

requiring free flaps. Several flaps, including the anterolateral thigh, fibula osteocutaneous, and suprafascial radial forearm fasciocutaneous free flaps, have emerged as workhorse flaps for reconstructing a wide variety of defects. As the anatomy of these flaps has become more familiar, their reliability and versatility have increased. Reliable wound closure without exposure to vital structures is no longer the only priority.^[3,4] It is prudent to follow an order of reconstruction using the simplest that suits the requirement. Excision of head-and-neck tumors may result in the exposure of vital structures such as the brain, eye, aerodigestive tract, or major neurovascular structures. If inadequately reconstructed, such defects may result in significant complications and/or impairment in the performance of routine daily functions, such as speech and swallowing. In addition, esthetic disfigurement may be very significant to the patient's self-image and social adaptability. Adequate reconstruction after tumor excision is, therefore, the first step to rehabilitating the head-

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Month of Submission : 05-2019
Month of Peer Review : 06-2019
Month of Acceptance : 07-2019
Month of Publishing : 07-2019

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and-neck cancer patient, aiming to preserve and restore pre-operative activity and quality of life.^[5]

Aim

The study aims to analyze the various reconstruction methods used in the head-and-neck cancer surgery.

MATERIALS AND METHODS

A total of 180 surgeries were done for various cancers of the head and neck using various reconstruction options such as primary closure, local flaps, and regional flaps in the Department of Surgical Oncology at Tirunelveli Medical College Hospital from January 2016 to June 2019. Some patients had more than one type of reconstruction in the same or subsequent surgery. A common pro forma incorporating the details such as name, age, sex, diagnosis, comorbid conditions, pre-operative radiotherapy (RT), extent of defect, the type of reconstruction used, post-operative complications, and the functional outcome in the immediate post-operative period, 1 month after surgery, and at 6 months was noted in all cases involving major oral cavity resections as applicable. The surgeries were analyzed as to the outcome of each method.

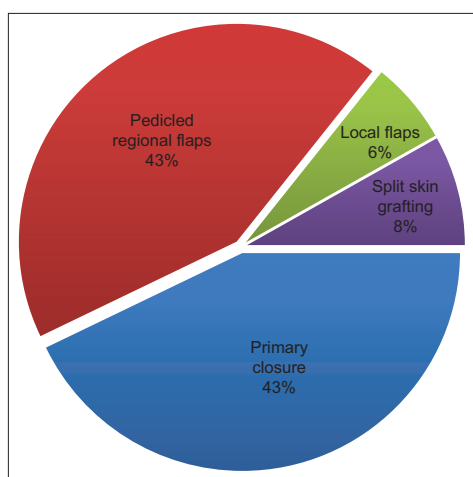


Figure 1: Types of reconstructions used

Royapettah Scoring System

A scoring system devised by our parent institute at Government Royapettah Hospital, Chennai, to assess the post-operative outcome of our major oral resections incorporating both functional (chewing, speech, and swallowing) and cosmetic aspects has been applied to all cases, and the outcome was assessed. A score of 17 or more was considered satisfactory.

RESULTS

Of the 180 surgeries for head-and-neck cancers, primary closure was done in 79 cases [Figure 1].

Split Skin Graft (SSG)

Fifteen skin/mucosal defects were closed with SSG. Small mucosal defects after resection of buccal, tongue, and floor of the mouth (FOM) cancers can be reconstructed with SSG. Three cases had partial necrosis and three cases had complete necrosis.

Local Flaps

Among the four nasolabial flaps, all were for skin cancers. Two tongue flaps were used, one each for defects of FOM and lower alveolus defects. Both were posteriorly based and healed without any significant morbidity. Five local rotation flaps were used for skin cancer and parotid defects. One patient had partial necrosis salvaged by SSG.

Forehead Flap

The forehead flap has been routinely used for closing full-thickness cheek defects of eight cases, two had partial necrosis, and one had fistula.

Deltpectoral (DP) Flap

DP flaps were used in eight cases mostly to provide skin cover in two cases, and DP was used in conjunction with pectoralis major myocutaneous (PMMC). In two cases, DP was used for parotid region 1 case each for skin defects in the neck following submandibular tumor resection and flap necrosis complicating chyloous fistula.

Table 1: Significant post-operative complications

Reconstruction	Gross infection	Partial necrosis	Complete necrosis	Dehiscence	Sinus fistula
Pectoralis major myocutaneous	7	17	-	17	17
Forehead	1	2	-	-	1
Nasolabial	-	-	-	-	-
Latissimus dorsi	-	1	1	1	1
Deltpectoral	-	-	-	-	-
Pericranial	-	-	-	-	-
Local	-	-	1	-	-
Stomach	-	-	-	1	1
Split skin graft	-	3	3	-	-
Primary closure	2	2	-	8	1

No post-operative complications were encountered in any of the flaps.

PMMC Flap

Of the 50 flaps, 29 were for lining the oral/oropharyngeal cavities, 6 were for cover the skin defects, and 15 were for both lining and cover by bipaddling the flap. There were 7 cases of gross infection, 17 – partial necrosis, 17 – dehiscence, and 17 – fistula. Four cases of secondary hemorrhage due to carotid blowout occurred leading to a major complication of 31% and overall complication rate of 52%; two cases required major surgical intervention such as latissimus dorsi (LD) flap. Others were managed conservatively [Tables 1 and 2].

LD Flap

Of the four cases reconstructed, two had no complications. one patient had to be taken up for LD flap as PMMC flap

Table 2: Various factors in pectoralis major myocutaneous

Necrosis	Yes	No	P value
Age >60 years	6	7	0.375
Male	14	26	0.768
Diabetes mellitus	6	8	0.528
Radiotherapy	12	20	0.768
Palato-alveolar resection	3	4	0.683
Bipaddled	8	5	0.025

raising had to be abandoned midway because of inanition and poor pectoralis major muscle bulk. This flap was partially necrosed and fistula formed. One patient had partial necrosis of previous PMMC, and LD was applied. This patient had recurrent cancer buccal mucosa where both DP and forehead flaps had already been used and so LD was chosen. LD flap necrosed completely on the 2nd post-operative day. The patient was discharged for microvascular repair elsewhere.

Gastric Transposition

All the four cases were for pharyngo-laryngo-esophagectomy. One case developed wound dehiscence and fistula. One case developed secondary hemorrhage and expired in the post-operative period.

Pericranial Flaps

There were two anterior craniofacial resections – recurrent cancer of the right eyelid involving the skull base and another case of post-RT residual nasal cavity transitional cell carcinoma. Both patients had the closure of the anterior skull base by the use of dural and pericranial flaps; both healed well without complication [Figure 2].

Royapettah Scoring System

A total of 36 patients had satisfactory Royapettah scale score. Fourteen patients had a score of <17. Only

Table 3: Royapettah scoring system

Pain	Nil (5)	Rare (3)	Modest (1)	Severe (0)
Mouth opening	Normal	Trismus+	++	+++
Oral closure	Blows	Holds food	Rare spill	Drools saliva
Occlusion	Hard bite	Chews solids	Soft boiled	Liquids
Phonation	Normal	Few syllable difficult	Audible	Not audible
Swallowing	Normal	Avoids certain food	Rare regurgitation	Aspirates
Cosmetic/social acceptance	Resumes work enthusiastic	Adapts work satisfied	Socializes accepts	Confined dislikes

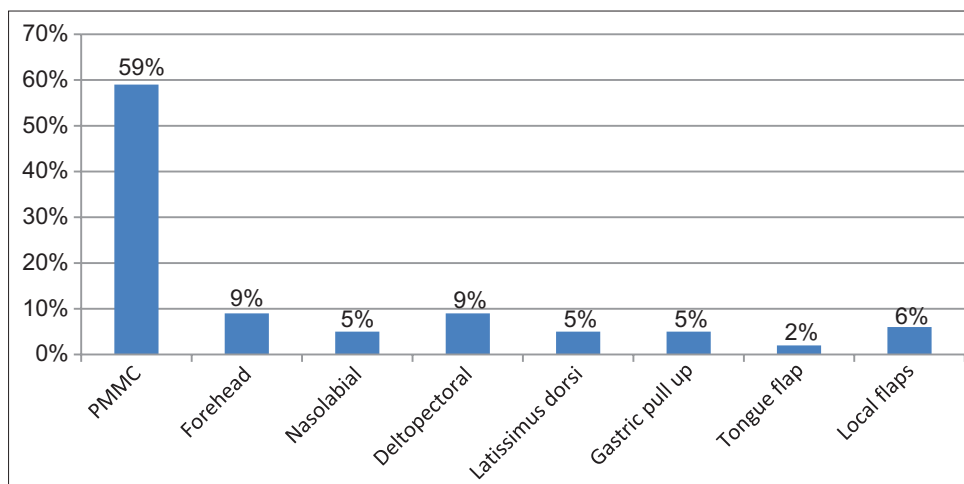


Figure 2: Various flaps used

diabetes mellitus was associated with the outcome measure in a statistically significant manner ($P = 0.004$) [Tables 3 and 4].

DISCUSSION

For head-and-neck reconstruction, the skin between the nipple and midline based on the pectoralis major muscle is used, depending on the distance between the pivot point of the flap (the midclavicular point) and the recipient site. The thoracoacromial artery descends from its origin from the subclavian artery at the level of the midclavicular point in an inferomedial direction and anastomoses within the muscle with the direct branches of the internal mammary artery and anterior intercostal branches of the internal mammary artery. The branches to the skin are spread in the fourth, fifth, and sixth intercostal spaces. When the flap is raised on the thoracoacromial artery, the skin paddle receives blood from the direct musculocutaneous branches of the thoracoacromial artery as well as from the musculocutaneous branches of the intercostal artery via the rich anastomotic network within the muscle with the thoracoacromial artery. In elevating over 300 PMMC flaps, the authors noticed that the perforating branches to the skin paddle area used for head-and-neck reconstruction are located in three distinct places (designated P1, P2, and P3) – P1: Along the medial edge of the muscle, direct musculocutaneous branches from the internal mammary artery (similar to the DP flap perforators); P2: 2–4 cm medial to the nipple, coming from the anterior intercostal branch of the internal mammary artery, as elaborately described

by Kiyokawa *et al.* and P3: Fine branches are reaching the skin by curving around the lateral border of the muscle. In addition, some branches of the lateral thoracic artery are found in the skin lateral to the nipple at the level of the fourth rib. Because of the rich anastomotic network within the muscle, the blood supply from the acromiothoracic artery safely reaches the skin even after ligation of the branches of the internal mammary artery and the lateral thoracic artery.^[6-8]

The most dreaded complication of the PMMC flap is the loss of the flap. This unfortunate event is often a consequence of a technical mistake in either the harvesting of the flap or on the inset. When harvesting the flap, care must be taken to avoid the shearing forces on the skin paddle from the underlying muscle. The placement of significant forces will cause disruption of the perforating vessels to the overlying skin and potentially lead to the loss of the skin paddle. Another reason for the eventual loss of the skin paddle due to a technical mistake during harvest is the undermining of the skin leading to a larger skin island over a small base of fat connecting to the muscle. In these cases, the lateral edges of the unsupported skin may not be perfused and could potentially become ischemic later. Technical mistakes can also be made at the time of the inset, which can lead to the loss of the flap. In this scenario, the most common culprit is the closure of the flap under significant tension. In cases where there is tension on closure, the shoulder roll should be taken out allowing the shoulder to drop, and at the same time, the neck should be flexed to further diminish the distance from the donor site and the reach of the flap. Once this is done, the tension should be relieved, and the closure should be performed in a safer manner. Complications can also occur at the donor site. The most commonly seen complications in this region are: formation of a hematoma, dehiscence of the wound closure, loss of alignment of the breast as it relates to the contralateral breast, ischemia of the skin, and the formation of a seroma [Table 5].^[9,10]

Table 4: Royapettah scoring system

Ramsay sedation scale score >17	Yes	No	P value
Age >60 years	8	5	0.328
Male	28	12	0.528
Diabetes mellitus	6	8	0.004
Radiotherapy	21	11	0.18
Palato-alveolar resection	6	1	0.383
Bipaddled	10	1	0.645

Table 5: Comparison study results with literature

Study	Type of flap	Number of cases	Major complication	Overall complication
Ahmad <i>et al.</i> , Tata Memorial Hospital, Mumbai ^[6]	PMMC	47	2.1% complete loss	30%
Wadwongtham <i>et al.</i> , Bangkok. ^[11]	PMMC	93	17.70%	54.20%
Milenović <i>et al.</i> ^[12]	PMMC	506	17%	33%
Koh <i>et al.</i> , Seoul ^[13]	PMMC	34	6%	Not mentioned
Feng <i>et al.</i> , Taiwan ^[14]	DP	34	Nil	7%
Our study	PMMC	50	31%	52%
Our study	DP	8	Nil	Nil

PMMC: Pectoralis major myocutaneous, DP: Deltopectoral

CONCLUSION

Head-and-neck cancer surgeries require various reconstruction methods ranging from the simplest to the complex. Reconstruction is to be tailored according to the needs of the individual case. Pedicled regional flaps, especially PMMC, have been the workhorse in our hospital. Most of the complex oral and oropharyngeal resections can be effectively managed with PMMC without any expert plastic surgical help. They can be monitored easily postoperatively without any need for sophisticated methods for free flaps. PMMC is the choice flap in high-volume centers with resource and time constraints where microsurgical expertise is not available. They have proved effective in the absence of microvascular free flaps. Further improvement in our results can be achieved if free flaps could be used in a choice few cases and effective mandibular reconstructions are to be used.

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How to cite this article: Shanmugasundaram S, Shunmugam D, Gandhi A. Reconstructive Options in Head-and-Neck Cancer Surgeries. *Int J Sci Stud* 2019;7(4):70-74.

Source of Support: Nil, **Conflict of Interest:** None declared.