Hypopharyngeal Cancers Requiring Reconstruction: A Single Institute Experience

Poonam Joshi · Sudhir Nair · Pankaj Chaturvedi ·
Devendra Chaukar · Prathamesh Pai ·
Jai Prakash Agarwal · Anil K. D'Cruz

Received: 12 December 2012 / Accepted: 4 February 2013 / Published online: 22 February 2013
© Association of Otolaryngologists of India 2013

Abstract The main objective of this retrospective analysis was to understand the length of stay in hospital, the complication rates and the perioperative mortality after various forms of hypopharyngeal reconstructions. This is a retrospective analysis of hypopharyngeal cancer patients who underwent surgery at the Tata Memorial Hospital, during 2005–2010. Of the total 393 patients, 103 required some form of pharyngeal reconstruction. The mean age of this population was 56 with a male to female ratio of 4:1. The mean hospital stay for all patients was 22 days (mean: 22, median: 15) and 17 % were readmitted for various reasons in the first 30 days after the initial discharge from hospital. The overall perioperative mortality was 10 % (10/103) and majority of these patients (6/10) had GPU as part of treatment. Gastric pull up has a high morbidity especially in patients with low albumin levels and should be used judiciously when needed. A comprehensive analysis of clinical and radiological data is helpful for choosing an ideal reconstruction after hypopharyngeal cancer excision.

Keywords Hypopharynx · Reconstruction · Cancers · Mortality · Gastric pullup

Abbreviations

U_PFS	Unilateral pyriform sinus
B_PFS	Bilateral pyriform sinus
LPW	Lateral pharyngeal wall
PPW	Posterior pharyngeal wall
PMMC	Pectoralis major myocutaneous flaps
FRAFF	Free radial forearm flap
JEJUNUM	Free jejunum
GPU	Gastric pull-up
DL	Direct laryngoscopy

Introduction

Hypopharyngeal cancers usually present in advanced stages, as majority of them do not cause symptoms until late in the disease. Early stage diseases are managed by radiotherapy or by concurrent chemo radiotherapy and the late stages are managed by surgery followed by adjuvant treatment. Hypopharyngeal lesions are in close proximity to the larynx that necessitates laryngectomy if treated with surgery. The functional integrity of the pharynx after resection is restored by the primary closure of the residual mucosa or by augmentation with additional tissues. Complete reconstruction of neopharynx will be required in case of a total laryngopharyngectomy. Various procedures have been described for reconstruction of the hypopharynx. These include the use of pedicled flaps like pectoralis major myocutaneous flaps (PMMC) or free flaps like radial forearm or free jejunum. In case of extensive disease involving the esophagus, a gastric pull-up (GPU) may be required to preserve the anatomic integrity. These procedures are complex and therefore need specialist attention. Many times the reconstructive team will be different and

P. Joshi · S. Nair (✉) · P. Chaturvedi · D. Chaukar · P. Pai ·
A. K. D'Cruz
Department of Head and Neck Surgery,
Tata Memorial Hospital, Mumbai, India
e-mail: sudhirvr@gmail.com

P. Joshi
e-mail: drpunamjoshi@rediffmail.com

J. P. Agarwal
Department of Radiation Oncology, Tata Memorial Hospital,
Mumbai, India

needs to be informed before the procedure. Several factors including the anatomical extent of the disease, the performance status of the patient as well the reconstructive facility and expertise available should be considered before embarking on such treatments. Anatomic extent of the disease dictates the extent of resection and the type of reconstruction [1] and can be assessed preoperatively by using direct laryngoscopy (DL) as well as by CT/MRI scans.

An accurate selection of the suitable reconstructive modality preoperatively will therefore better prepare the surgical team and will avoid intraoperative surprises. To achieve this, it is important to know the impact of preoperative assessments on the final reconstructive techniques used. In this retrospective analysis, we audited those hypopharyngeal cancers requiring some form of tissue augmentation for pharyngeal reconstruction after primary surgery. The different descriptive reports of direct laryngoscopies as well the radiological scans were organized into four main groups to identify the factors that were common to patients who received similar reconstructions. Besides helping us to decide objectively the ideal reconstructions preoperatively, these groupings provide a tool to compare the various clinical, radiological and pathological descriptive reports.

Patients and Methods

This is a retrospective analysis of patients with hypopharyngeal cancers who underwent surgery and reconstruction at the Tata Memorial Hospital, a tertiary health center, during 2005–2010. The medical records of patients with proven squamous cell carcinoma of the laryngopharynx with predominant involvement of the hypopharynx were screened for the study. Cases were selected based on the following eligibility criteria: (1) biopsy confirmed squamous cell carcinoma of the laryngopharynx (2) All patients who underwent curative intent surgery at Tata Memorial Hospital as primary treatment or as salvage (3) All patients required some form of pharyngeal reconstruction. Of the total 393 patients screened, 103 patients were eligible for the study (Table 1).

Complete preoperative evaluation was done in all patients including a DL, imaging with contrast enhanced CT scans and barium swallows. All patients had lesions predominantly involving the hypopharynx requiring excision of the pharyngeal wall either partially or completely requiring partial or total laryngopharyngectomy. While 50 patients underwent total laryngopharyngectomy requiring tube reconstruction, 53 patients had partial laryngopharyngectomy requiring a patch reconstruction for the defect. While 71 patients underwent surgery as the

Table 1 Demographic details

Factor	N (%)
Age	
Mean	56 years
Median	58 years
Gender	
Male	80 (78)
Female	23 (22)
Treatment status at surgery	
Primum	71 (69)
Salvage	32 (31)
Stage of disease (pathological)	
I	0 (0)
II	0 (0)
III	17 (16)
IV	85 (83)
No tumor	01 (01)
Grade	
Poorly differentiated	55 (53)
Moderately differentiated	42 (41)
Well differentiated	02 (02)
Differentiation not known	04 (04)
Perineural invasion	
Yes	14/88 (15)
No	74/88 (85)
NA	15
Lymphovascular emboli	
Yes	21/89 (24)
No	68/89 (76)
NA	14

first modality of treatment, 32 received radiotherapy before surgery.

The tumor involvement of each subsites of laryngopharynx was assessed by clinical and radiological examinations. Complete clinical and radiological details were available for 96 and 83 patients respectively. However, information could be gathered for all the 103 patients by combing these two modalities. Majority of these lesions involved the pyriform sinus (PFS) (80/96, 82 %, clinically). Some of these lesions also involved the post cricoid area (51/96, 53 %, clinically) or the posterior pharyngeal wall (22/96, 23 % clinically). Apart from involvement of pharyngeal structures, extension to larynx was noticed in many patients (54, clinically). To analyze the descriptive data available in the clinical as well as the imaging reports, we grouped these patients based on the origin and extent of the primary disease in the laryngo-pharynx (Table 2). The lesions those were confined to the PFS or involving the laryngeal structures with PFS (PFS ± larynx) were

Table 2 Proposed grouping to analyse descriptive data

	Clinical		Radiological		Combined	
	Tube	Patch	Tube	Patch	Tube	Patch
Group I (PFS ± larynx)	2	35	7	32	1	25
Group II (PPW ± PFS/ larynx)	3	4	2	7	0	3
Group III (PC/esophagus)	29	9	25	3	24	2
Group IV (PC + PPW)	13	1	5	2	2	0

grouped as Group I. Those involving the posterior pharyngeal wall (PPW) with or without involvement of the PFS and laryngeal structures were put in Group II and those involving the post cricoid area or esophagus (PC/esophagus) with or without the involvement of PFS and laryngeal structures in the group III. Finally those found involving both post cricoid and posterior pharyngeal wall (PC + PPW) were grouped as Group IV (Table 2). The various reconstructive methods used after primary excision were PMMC, free radial forearm flap (FRAF), free jejunum and GPU. For analysis purpose, they were broadly grouped as patch and tube reconstructions. On clinical assessment alone, there were 37 (38.5 %) patients in the group I, 07 (7.3 %) in group II, 38 (39.6 %) in group III and 14 (14.6 %) in group IV based on the clinical assessment.

Statistical analysis was done using the software SPSS 15.0 (IBM, NY, USA). *p* values were calculated using Chi-square or *t* tests. A *p* value of <0.05 was considered significant. Disease free survival was calculated with Kaplan–Meier analysis.

Results

Of the total 393 patients who underwent surgery for predominantly hypopharyngeal disease, 103 required some form of pharyngeal reconstruction. The mean age of this population was 56 years with a male to female ratio of 4:1. Sixty nine percent patients were treatment naïve at the time of surgery (Table 1). Majority of these patients were having T4 (78/103) disease at the time of presentation and the rest were T3 with bulky disease. Based on the AJCC staging system seven, these patients were finally staged as stage I (0), stage II (0), stage III (17) and stage IV (85), 1 patient had no tumor. Regarding the grade of histological differentiation, 02/103 (02 %) cases were well differentiated (WD), 42/103 (42 %) cases were moderately differentiated (MD) and 55/103 (56 %) were poorly differentiated (PD), 3 differentiation not available, 1 had no tumor. Perineural invasion was found in 14/88 (15 %) cases and 21/89 (21 %) cases showed lymphovascular embolization.

Fifty-three patients had reconstruction with pectoralis major myocutaneous flap (PMMC; 51 as patch and two as tube). Thirty-two had GPU, twelve had free jejunum and six had free radial forearm flap (FRAF; three as patch and three as tube). The mean hospital stay for all was 22 days (mean: 22, median: 15). The mean and median hospital stay in days for specific reconstructions was as follows: PMMC (19, 13), GPU (27, 21), jejunum (23, 17) and FRAF (22, 20). As expected, the post radiotherapy salvage group had a significantly longer postoperative stay (mean: 28 days, median: 24 days) compared with treatment naïve patients (mean: 20 days median: 14 days, *p* = 0.02).

Seventeen patients (17 %) were readmitted within the first 30 days after surgery for various reasons like flap failure (6 %), secondary hemorrhage (11 %). However, details regarding pharyngo-cutaneous fistula, tracheostomal stenosis and pharyngeal strictures were available for 47 patients only. Eleven patients (11/47, 23 %) had pharyngo-cutaneous fistula. Six patients (five with GPU and one with free jejunum) had partial or complete flap failures and were managed with patch or tube PMMC. The overall perioperative mortality was 10 % (10/103) and majority of these patients (6/10) had GPU as part of treatment. The chances of perioperative mortality were higher in patients with low (<3.5 mg/dl) preoperative serum albumin (*p* = 0.02). Long-term complications (those presented more than 30 days after surgery) included tracheostomal stenosis (20/47, 43 %) and pharyngeal strictures (9/47, 19 %).

While 47 patients (45 %) had free margins (>5 mm), 56 (55 %) had close or involved margins mainly due to sub-mucosal spread. With a mean follow-up of eleven months, 35 patients had recurrences at various sites. The sites of recurrences were regional nodes (17, 49 %), oropharynx (04, 11 %), esophagus (04, 11 %), lungs (03, 9 %), tracheostoma site (04, 11 %) and other distant sites (03, 9 %). The estimated event free survival rate for these patients was 28.5 % at 24 months.

Discussion

Cancers of the hypopharynx are rare and account for less than 10 % of all squamous cell carcinomas (SCCs) of the upper aero digestive tract [2]. These patients are often diagnosed late, as early symptoms are vague and nonspecific. In fact many of these patients present in advanced stages requiring multimodality treatment. Large primary lesions often require surgical resection (laryngopharyngectomy) followed by adjuvant treatment in form radiotherapy (RT) or concurrent chemo radiotherapy (CT/RT) [3]. In a Spanish study of 60 patients who had undergone surgery followed by radiation therapy between 1980 and

1999, 75 % presented in stage III or IV [4]. Another study of 395 patients with SCC of the hypopharynx from Taiwan [5], 80 % of patients presented with stage IV disease. Many of these patients are malnourished and have poor physical state because of the gradual onset of dysphagia over several months prior to the diagnosis. Compared to other head and neck cancers, these patients tend to be of older age group. In our series the mean age at presentation was 56, slightly younger than that reported by others [6]. All these factors not only complicate the treatment but also increase the risk of morbidity and mortality following the treatment.

Hypopharyngeal cancers have a noticeable male preponderance with male to female ratio of 5:1 [7]. In our series, we noted a male to female ratio of 4:1. Majority of these cancers originate from the pyriform sinus and are poorly differentiated [8]. A significant percentage also has submucosal spread [9–11]. In the current series, the submucosal extensions along the longitudinal axis were noticed in 17 % of patients on the final histopathology. However it is important to note these patients were predominantly having larger tumors requiring some form of reconstruction. Consequently, the incidence of cervical lymph node metastasis was as high as 65 %.

Resection of hypopharyngeal lesions often requires laryngectomy also. The functional integrity after resection is maintained by the primary closure of the residual mucosa or by augmentation with additional tissues. The short-term and long-term complications as well the mortality rates of each procedure are important while choosing the appropriate reconstructive options. The free jejunum is reported to be associated with a low incidence of stenosis and fistula [12, 13]. In our series the GPUs had lower stricture rates (10 %) compared to tube PMMC or free jejunum. However, the number of free jejunal reconstructions is small to conclude. The GPUs have higher postoperative mortality rate and should be considered only when indicated. A GPU is required in situations where there is esophageal extension of the primary disease. Postoperative mortality rates ranges from 12 to 19 % in various series reported [14, 15]. In our series, while the overall perioperative mortality rate was 10 %, the GPUs had a greater share (6/32, 19 %). Due to the persistent dysphagia, many patients have impaired nutritional status with weight loss. This is more pronounced in patients with circumferential lesions. Hypoalbuminemia has been shown to be associated with increased mortality and morbidity in hospitalized patients [16, 17]. Albumin also has been found to predict postoperative mortality and morbidity for patients undergoing elective surgery [18]. Interestingly, we also noted a higher risk of perioperative mortality in patients with low (<3.5 mg/dl) preoperative serum albumin ($p = 0.02$).

Several authors have reported a stricture rate of 8–24 % and fistula rate of 21–38 % following laryngopharyngeal

reconstruction [19, 20]. In our series, we observed a 19 % stricture rate and 25 % fistula rate in patients with tube reconstructions. In those with patch reconstructions, these were 11 and 21 % respectively.

The right type of reconstruction is used based on several factors like co-morbidities, history of prior treatment as well as the surgeon's experience. An ideal reconstruction should aim for restoration of the patient's ability to eat along with possible voice rehabilitation. The perioperative complications should be minimal. To achieve this, a complete preoperative understanding of the extent of disease is important. Preoperative evaluations like direct laryngoscopy as well as CT/MRI scans will give valuable data on the extent of the disease. However the final decision regarding the choice of reconstruction is often decided perioperatively after the excision of the primary. Disa et al. [21] had proposed a classification of post resection pharyngeal defects in hypopharyngeal cancers and suggested a reconstructive algorithm based on this. While this is helpful to make a final choice of reconstruction, the ability to select the ideal reconstruction preoperatively is useful for patient counseling and seeking specialist help. To achieve this, a retrospective review of clinical and radiological parameters in patients who had undergone resection and reconstruction is helpful. However much of the information available on the various reports of CT/MRI Scans and DL Scopy will be descriptive. Hence to analyze, we grouped these findings into four categories as described earlier. Classifying patients into four groups based on the anatomical extent of the primary disease helped us to compare the utilization of various reconstructive modalities in these patients postoperatively. Interestingly, we found that patients with involvement of PFS alone or those with extension only towards laryngeal structures (Group I) were reconstructed mainly with patch flaps. In contrast, those with the involvement of PC and PPW (Group IV) had predominantly tube reconstruction. The clinical and radiological data were grouped and analyzed either separately or in combination. For the combined analysis, we selected only those patients who had identical findings on both clinical and radiological reports as described previously (Table 1). As expected, combination of radiological and clinical findings correlated correctly with the type of reconstruction chosen subsequently (Table 2).

Conclusions

The mean hospital stay for all patients was 22 days (mean: 22, median: 15). GPU had high perioperative morbidity especially in patients with low albumin levels and had longer hospital stay. Post radiotherapy patients had longer hospital stay and higher postoperative complications as

compared to treatment naïve patients. A comprehensive analysis of clinical and radiological data is helpful for choosing an ideal reconstruction after hypopharyngeal cancer excision. The proposed groupings help us to compare and analyze the descriptive data reported in the scopy and scan reports.

Conflict of interest The authors declare that they have no conflict of interest.

References

1. Couch ME (2002) Laryngopharyngectomy with reconstruction. *Otolaryngol Clin North Am* 35:1097–1114
2. Silver CE, Ferlito A (1996) Surgery for cancer of the larynx and related structures, 2nd edn. W B Saunders Co, Philadelphia
3. Gupta T, Chopra S, Agarwal JP, Laskar S-G, D’cruz AK, Shrivastava SK et al (2009) Squamous cell carcinoma of the hypopharynx: single-institution outcome analysis of a large cohort of patients treated with primary non-surgical approaches. *Acta Oncol* 48:541–548
4. Ferrer Ramírez MJ, Guallart Doménech F, Brotons Durban S, Carrasco Llatas M, Estellés Ferriol E, López Martínez R (2004) Hypopharyngeal cancer: analysis of the evolution and surgical results. *Acta Otorrinolaringol Esp* 55:67–72
5. Chang MF, Wang HM, Kang CJ, Huang SF, Lin CY, Fang KH et al (2010) Treatment results for hypopharyngeal cancer by different treatment strategies and its secondary primary-an experience in Taiwan. *Radiat Oncol* 5:91
6. Hamoir M, Machiels J-P, Schmitz S, Gregoire V (2011) Multi-disciplinary management of hypopharyngeal carcinoma. In: Bernier J (ed) *Head and neck cancer*. Springer, New York, pp 431–55 <http://www.springerlink.com/content/t75286857t36749q/abstract/>
7. Spector JG, Sessions DG, Emami B, Simpson J, Haughey B, Harvey J et al (1995) Squamous cell carcinoma of the pyriform sinus: a nonrandomized comparison of therapeutic modalities and long-term results. *Laryngoscope* 105:397–406
8. Johansen LV, Grau C, Overgaard J (2000) Hypopharyngeal squamous cell carcinoma: treatment results in 138 consecutively admitted patients. *Acta Oncol* 39:529–536
9. Hiroto I, Nomura Y, Sueyoshi K, Mitsuhashi S, Ichikawa A (1969) Pathological studies relating to neoplasms of the hypopharynx and the cervical esophagus. *Kurume Med J* 16:127–133
10. Davidge-Pitts KJ, Mannel A (1983) Pharyngolaryngectomy with extrathoracic esophagectomy. *Head Neck Surg* 6:571–574
11. Chopra S, Gupta T, Agarwal J, Ghosh Laskar S, Budrukkar A, Murthy V et al (2009) Postoperative adjuvant radiotherapy for hypopharyngeal cancers: outcome analysis of 159 patients. *Int J Radiat Oncol Biol Phys* 75:S393
12. Theile DE, Robinson DW, McCafferty GJ (1986) Pharyngolaryngectomy reconstruction by revascularized free jejunal graft. *Aust N Z J Surg* 56:849–852
13. Coleman JJ 3rd, Searles JM Jr, Hester TR, Nahai F, Zubowicz V, McConnel FM et al (1987) Ten years experience with the free jejunal autograft. *Am J Surg* 154:394–398
14. Sullivan MW, Talamonti MS, Sithanandam K, Joob AW, Pelzer HJ, Joehl RJ (1999) Results of gastric interposition for reconstruction of the pharyngoesophagus. *Surgery* 126:666–671 Discussion 671–672
15. Ujiki GT, Pearl GJ, Poticha S, Sisson GA Sr, Shields TW (1987) Mortality and morbidity of gastric “pull-up” for replacement of the pharyngoesophagus. *Arch Surg* 122:644–647
16. Reinhardt GF, Myscowski JW, Wilkens DB, Dobrin PB, Mangan JE Jr, Stannard RT (1980) Incidence and mortality of hypoalbuminemic patients in hospitalized veterans. *J Parenter Enteral Nutr* 4:357–359
17. Herrmann FR, Safran C, Levkoff SE, Minaker KL (1992) Serum Albumin Level on Admission as a Predictor of Death, Length of Stay, and Readmission. *Arch Intern Med* 152:125–130
18. Mullen JL, Gertner MH, Buzby GP, Goodhart GL, Rosato EF (1979) Implications of malnutrition in the surgical patient. *Arch Surg* 114:121–125
19. Benazzo M, Bertino G, Occhini A, Spasiano R, Gatti P (2006) Functional outcomes in patients reconstructed with flaps following surgery for hypopharyngeal cancer. *Acta Otorhinolaryngol Ital* 26:127–132
20. Clark J, Gilbert R, Irish J, Brown D, Neligan P, Gullane P (2006) Morbidity after flap reconstruction of hypopharyngeal defects. *Laryngoscope* 116:173–181
21. Disa JJ, Pusic AL, Hidalgo DA, Cordeiro PG (2003) Microvascular reconstruction of the hypopharynx: defect classification, treatment algorithm, and functional outcome based on 165 consecutive cases. *Plast Reconstr Surg* 111:652–660