Chapter 13: Tumours of the hypopharynx

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Surgical anatomy

The hypopharynx extends from the lower limit of the oropharynx at the level of the hyoid bone down to the opening of the oesophagus at the lower border of the cricoid cartilage. It is divided into three anatomical sites:

- the pyriform fossa (sinus);
- the postcricoid area;
- the posterior pharyngeal wall.

The definition of these sites is shown in Table 13.1. The larynx projects into the hypopharynx from the front so that grooves, known as the pyriform fossae, are formed on either side. These are shallow above and are separated from the valleculae by the pharyngoepiglottic folds. Lower down, the pyriform fossae become deeper. The upper shallow part of the pyriform fossa is bounded laterally by the thyrohyoid membrane and medially by the aryepiglottic fold. The lower deeper part of the fossa is related laterally to the thyroid cartilage. An important inferior relation is the paraglottic space which is the potential space bounded by the thyroid ala laterally and the conus elasticus and the quadrangular membrane medially: tumours passing through the aryepiglottic fold easily gain entrance to this space and then pass inferiorly lateral to the vocal cord. The pyriform fossae are lined by squamous epithelium, with a rich underlying network of lymphatics. These drain upwards with the superior laryngeal pedicle to the upper deep cervical nodes.

Table 13.1 Definition of the hypopharynx (UICC)

(1) Pharyngo-oesophageal junction (postcricoid area) extends from the level of the arytenoid cartilages and connecting folds to the inferior border of the cricoid cartilage.

(2) Pyriform sinus (fossa) extends from the pharyngo-epiglottic fold to the upper end of the oesophagus. It is bounded laterally by the thyroid cartilage and medially by the surface of the aryepiglottic fold and the arytenoid and cricoid cartilages.

(3) Posterior pharyngeal wall extends from the level of the floor of the vallecula to the level of the cricoarytenoid joints.

The postcricoid are is that segment which extends from the level of the arytenoid cartilages and connecting folds to the inferior border of the cricoid cartilage.

Although the hypopharynx, by definition, ends at the oesophageal opening at the lower border of the cricoid cartilage there is no change in the mucosa at that level and tumours spread readily across the junction. Many carcinomata in this part of the alimentary canal are pharyngo-oesophageal and there would be merit in tumour classifications incorporating the cervical oesophagus into the 'pharyngo-oesophageal region' in the same way that the International Union Against cancer (IUCC) incorporates the posterior third of the tongue into
the 'oropharynx' for oncological classification. The lymphatic drainage of the postcricoid area is less rich than that of the pyriform fossa: it passes to the paratracheal nodes.

The posterior pharyngeal wall is less well defined. It can best be categorized as that part lying between a posterior projection of the vocal cords in the cadaveric position. It ends superiorly at the level of the hyoid bone and inferiorly at the level of the arytenoids. It is separated from the prevertebral muscles by a fascial space.

**Pathology**

As elsewhere tumours may be mesodermal or ectodermal in origin and benign or malignant in behaviour. A résumé of the possibilities and their frequency is shown in *Table 13.2*.

**Table 13.2 Tumours of the hypopharynx**

**Mesodermal**

(1) Benign
- fibrolipoma
- leiomyoma
- haemangioma

(2) Malignant
- leiomyosarcoma
- non-Hodgkin's lymphoma
- malignant synovioma

**Ectodermal**

Malignant
- adenocarcinoma (including salivary carcinomata) 0.25%
- transitional cell carcinoma 0.25%
- undifferentiated carcinoma 0.25%
- oat cell carcinoma 0.25%
- carcinosarcoma 1%
- squamous carcinoma 97.5%

**Benign tumours** are very rare. The commonest of these are the fibrolipoma and the leiomyoma. Both are polypoid tumours which usually present with dysphagia. On barium swallow they present a typical appearance of a smooth constant mass lying in the lumen of the oesophagus. They are treated by surgery: the tumour is removed at its pedicle which is exposed by a lateral pharyngotomy. *Malignant tumours*, as would be expected in an area lined by squamous epithelium, are virtually all squamous carcinomata. Unlike tumours of the oropharynx and nasopharynx, squamous carcinomata of the hypopharynx are usually well differentiated - for example, 85% in Ledermann's (1967) extensive series.
Surgical pathology of squamous carcinoma

Squamous cell carcinomata may be exophytic or ulcerated. An exophytic carcinoma most commonly lies in the upper pyriform fossa and aryepiglottic fold regions, whereas the ulcerated form is typical of the other parts of the hypopharynx. Carcinomata in this region are usually classified under the anatomical site (see Table 13.1) from which they are thought to have arisen.

Often the tumour is so advanced when first seen that it is difficult to determine its site of origin, and placing it in one of the above categories is rather a matter of guesswork. This may explain the reported variations in frequency of tumours at each site, but there is undoubtedly a wide geographic variation. In the UK, most series of patients show that approximately one-half is considered to arise in the pyriform fossa and the other half from the remaining sites, tumours of the posterior wall being very uncommon. On the other hand, in Canada and the USA the incidence of pyriform fossa tumours is much higher. The differences are well illustrated in the figures of four series of patients from London, Toronto, Houston, USA and Liverpool (Table 13.3).

![Table 13.3 Relative site incidence of hypopharyngeal carcinoma](image)

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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>848</td>
<td>230</td>
<td>245</td>
<td>467</td>
</tr>
<tr>
<td>Pyriform fossa (%)</td>
<td>39</td>
<td>61</td>
<td>75</td>
<td>38</td>
</tr>
<tr>
<td>Postcricoid area (%)</td>
<td>24</td>
<td>24</td>
<td>2</td>
<td>45</td>
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<tr>
<td>Posterior pharyngeal wall (%)</td>
<td></td>
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<td></td>
<td>10</td>
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<tr>
<td>Cervical oesophagus (%)</td>
<td></td>
<td></td>
<td></td>
<td>7</td>
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<tr>
<td>Others (%)</td>
<td>37</td>
<td>15</td>
<td>23</td>
<td>0</td>
</tr>
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1. Royal Marsden Hospital, London (Dalley, 1968).
2. Toronto General Hospital (Bryce, 1967).
3. M. D. Anderson Hospital, Houston, Texas (MacComb and Fletcher).
4. Authors' personal series.

In most series the incidence of carcinoma is much higher in men than in women, but in the postcricoid region the reverse is true.

Tumours of the pyriform fossa can be subdivided into those affecting the lateral and those affecting the medial wall. Tumours arising on the lateral wall extend through the thyrohyoid membrane to invade the carotid sheath and thyroid gland, so that a palpable neck mass in this disease may be direct extension of the tumour and not an enlarged lymph node. This should be confirmed by asking the patient to swallow. Tumours of the medial wall rapidly invade the aryepiglottic fold, a structure rich in lymphatics, and pass through it to enter the paraglottic space. They then pass inferiorly in this space lateral to the vocal cord, but beneath the mucosa. Spread in this space fixes the vocal cord causing hoarseness.

The submucosal spread of the disease is obviously of surgical importance: its average extent is 10 mm in pyriform fossa tumours, and 5 mm in postcricoid tumours (Harrison,
1970). This spread, affecting the oesophageal stump and the thin membranous tracheo-oesophageal wall, is one of the most potent causes of recurrent. In the same report, Harrison showed that deposits in the paratracheal nodes were common. Some surgeons have thus advocated mediastinal dissection but, as enlarged nodes in the tracheo-oesophageal groove can be removed by finger dissection from above, it is probably unnecessary.

Paralysis of a vocal cord may be due to invasion of the recurrent laryngeal nerve or immobility of the cricoarytenoid joint.

Carcinoma of the posterior pharyngeal wall has not been studied in detail. In the authors' series 60% remained localized to the posterior wall, and 40% invaded the pyriform fossa. Fixation to the prevertebral fascia, surprisingly, was rare. One patient in three with this disease has swollen glands in the neck.

Cancer of the hypopharynx has a notorious propensity to metastasize to the lymph nodes of the neck, and indeed an enlarged node may be the presenting symptom. The incidence of lymph node metastases in hypopharyngeal carcinoma (using the authors' series as a guide) is shown in Table 13.4. Although the upper deep cervical nodes are usually invaded first, the lymph may spread up and down so that almost any node in the deep cervical chain may be the first to be enlarged and once one node has been invaded the distribution may be even more eccentric.

<table>
<thead>
<tr>
<th>Table 13.4 Incidence of lymph node metastases (%)</th>
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<tr>
<td></td>
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<tr>
<td>Pyriform fossa</td>
</tr>
<tr>
<td>Postcricoid area</td>
</tr>
<tr>
<td>Posterior pharyngeal wall</td>
</tr>
<tr>
<td>Cervical oesophagus</td>
</tr>
<tr>
<td>Overall</td>
</tr>
</tbody>
</table>

Since the lymphatic network freely crosses the midline, bilateral lymph node metastasis can occur, particularly if the growth itself crosses the midline as in postcricoid carcinoma.

Lymph node invasion occurs early in pyriform fossa tumours and there may be a large lymph node in the neck while the primary growth is still small. About two-thirds of patients already have palpable cervical lymph node involvement when they are first seen. Of more importance to the surgeon, however, would be the ability to estimate the likelihood of occult metastases when no nodes are palpable. Ogura and Mallen (1965) showed that 38% had microscopic invasion although clinically no nodes were palpable. They concluded that this figure is high enough to justify an elective neck dissection. Occult lymph node metastases in postcricoid carcinoma are too uncommon to justify elective neck dissection.

Distant metastases to bones and viscera are becoming increasingly recognized, possibly because patients are surviving for longer after their primary lesion.
Other malignant tumours

Malignant tumours of the hypopharynx other than squamous cell carcinomata are shown in Table 13.2. The most important is the carcinosarcoma or pseudosarcoma. This is a polypoid tumour usually arising from the aryepiglottic fold. Its stroma resembles a sarcoma but it is covered by a layer of squamous carcinoma. Despite its bizarre and aggressive appearance the sarcomatous element never metastasizes and the carcinomatous part does so late, to the lymph nodes of the neck. Some pathologists think the 'sarcomatous' element is merely an unusual stromal reaction to squamous carcinoma. Whatever the case, these tumours are not particularly aggressive and localized removal without sacrificing the pharynx and larynx is usually sufficient to control the disease for long periods.

Another interesting rare tumour of very low-grade malignancy, paraganglioma, which arises in the hypopharynx is characterized by pain of neuralgic type which often extends to the ear, mediated via the vagus nerve. In small tumours this can be relieved dramatically by biopsy excision. The pain may be triggered by eating or drinking sharp or bitter substances. Most of these very uncommon tumours have arisen in the arytenoid region, although some have developed on the epiglottis. Macroscopically they usually appear as small reddish or purplish swellings which may be almost pedunculated. Histologically they appear to be paraganglioma. These tumours also tend to metastasize, possibly after several years, to regional lymph nodes and also in a very unusual manner to subcutaneous tissues and subserous layers such as under the peritoneum and pleura. These metastases are also painful and sometimes exquisitely so. They tend to be multiple, and one of Ranger's (1979) patients had 120 metastases removed at one operating session from subcutaneous sites scattered throughout the body. The patient obtained great relief from the procedure. The tumours are not radiosensitive and local excision appears to be the treatment of choice.

Aetiology

Anaemia

In 1919 both Paterson and Brown-Kelly described a syndrome which is now taken to consist of anaemia, glossitis, pharyngeal web, koilonychia and splenomegaly. The association of this disease with postcricoid carcinoma was shown by Ahlbom in 1937. More recently MacNab-Jones (1961) showed that between one- and two-thirds of patients with postcricoid carcinoma have a history of this syndrome. The risk of an individual patient with the Paterson-Brown-Kelly syndrome of developing postcricoid carcinoma is small, of the order of 2%. The anaemia is not necessarily microcytic and may be macrocytic (Jacobs and Kilpatrick, 1964). Of 266 patients with postcricoid carcinoma, 35% had had dysphagia for more than 5 years at the time of diagnosis and a benign stricture of the upper oesophagus had been demonstrated in 9% before the carcinoma developed (Richards, 1970).

The condition is better called sideropenic dysphagia but it is also known as the Paterson-Brown-Kelly syndrome after the two workers who described the condition separately in 1919. In some part of the world it is also called the Plummer-Vinson syndrome.

Sideropenic dysphagia is characterized by thinning of the mucosa of the upper alimentary tract with loss of the rete pegs and a reduction or absence of glycogen in the cells.
This condition is most obvious on the tongue and lips, presenting as superficial glossitis and angular stomatitis with cracking of the mucosa at the corners of the mouth. In the pharyngo-oesophageal region the same histological features are evident and in some patients a mucosal fold develops from the anterior wall of the upper oesophagus referred to as an oesophageal web. In a few patients with long-standing sideropenic dysphagia a dense fibrous stricture may form in the upper oesophagus (Figure 13.4) and histologically there may be necrosis of the muscle as well as fibrosis.

Most patients have a low haemoglobin concentration, mean corpuscular haemoglobin, and serum iron. The iron-binding capacity is raised in about one-half of the patients. In some the serum iron may be low even though the haemoglobin may be within normal limits. In about 20% of patients, vitamin B₁₂ absorption is reduced to within the pernicious anaemia range and in about 5% the level of serum B₁₂ is pathologically low, indicating that the patient has pernicious anaemia in addition to sideropenic anaemia. The word sideropenia reflects the commonest, most striking and most readily demonstrable deficiency (iron), but many patients have other metabolic abnormalities. Approximately one-half of the patients have pyridoxine deficiency as shown by estimations of pyridoxine-dependent transaminases, and have evidence of abnormal tryptophan metabolism as shown by the excretion of excess abnormal metabolites in the urine after oral administration of tryptophan. Riboflavine metabolism remains normal in these patients.

These biochemical abnormalities found in patients with sideropenic dysphagia do not occur in patients with other strictures of the oesophagus, such as those resulting from ingestion of caustics, and for this reason they appear to be causal and not secondary to the dysphagia as was originally thought by some workers such as Vinson (1922). In addition, patients undergoing gastrectomy develop multiple deficiencies and women in this category develop webs in the upper oesophagus eight times more commonly than a matched group of the population who have not undergone gastrectomy (Jacobs and Kilpatrick, 1964).

The dysphagia in those patients who do not have a fibrous stricture is unexplained. Most of them do not have a demonstrable web on barium swallow and in them it is considered that the dysphagia results from incoordination of muscular contraction due to interference with the sensory side of the reflex arc. The same explanation is probably true of those patients who have a definite web. The web in itself does not explain the dysphagia because it may be just as prominent for a time after the dysphagia has been completely relieved by the administration of iron with vitamin B complex.

Smoking and drinking

Inevitably heavy smoking and drinking have been said to be aetiological factors of pharyngeal cancer. However, this unproven opinion must be interpreted with great caution since the incidence of pharyngeal cancer has not increased during this century, despite the enormous increase in tobacco consumption, and despite the fact that a higher proportion of the population now survive into the cancer age group.
Radiation

In the 1920s and 1930s, there was a vogue, particularly in the North West of England, for treating thyrotoxicosis with small doses of radiotherapy at weekly intervals for several months. This treatment was effective, particularly when one remembers that surgical treatment of thyrotoxicosis at that time was an adventure with a fair mortality. A small proportion of these patients are now developing a pharyngeal carcinoma, with an average latent interval of 25 years.

Clinical features

Symptoms of carcinoma

A carcinoma in the hypopharynx first affects swallowing. Since the pyriform fossae are fairly capacious and since carcinoma is at first painless, symptoms may not arise until the growth is well advanced. The first symptoms may be indefinite but discomfort or pain on swallowing develop, initially for solid food only. The discomfort begins simply as a soreness or slight pricking sensation as solid food is going down, but it gradually progresses to pain, which may be referred to the ear, and to obstruction to all acts of swallowing.

As has already been pointed out, an enlarged lymph node may appear in the neck while the primary tumour is still small and before it has given rise to any throat symptoms.

Carcinomata of the postcricoid area and below cause obstructive symptoms earlier than those at a higher level but discomfort and pain are not so evident. In early cases the patient may say that she feels as though the food is passing over a ledge or ridge while fluids go down without difficulty. In most cases, however, obstructive symptoms are quite severe by the time the patient first seeks advice and loss of weight is usually more marked than in carcinomata arising in the other sites.

In men the tumour is commonest in the sixth to seventh decades but in women postcricoid lesions often appear earlier, and patients in their late twenties and thirties are fairly common.

Clinical examination

The pharynx and the larynx are examined with a laryngeal mirror or a fibreoptic laryngoscope in the usual way.

Tumours of the pyriform fossa are generally easily observed, and some idea of the extent of the tumour can be seen. Fixation of the hemilarynx is an important sign.

In tumours of the postcricoid area the tumour is not often seen unless it extends into the pyriform fossae. Retained secretions may be seen in the pyriform fossa. Immobility of the vocal cord is also important to elicit.

The neck must be examined for lymph node metastases in the usual way. Laryngeal crepitus is lost in postcricoid tumours, and tumours extending out of the thyrohyoid membrane
can also be palpated occasionally. Widening of the laryngeal framework may be felt in advanced postcricoid tumours.

**Investigation**

**Radiology**

Radiological methods of investigation of tumours of the hypopharynx are considered in Chapter 2.

**Endoscopy**

Endoscopy is extremely valuable in the assessment of a hypopharyngeal tumour. It also serves of course to provide a specimen of tumour for biopsy, but this should be the last and, in some ways, the least important part of the endoscopy. The hypopharynx, the larynx, the trachea and the oesophagus are examined using rigid endoscopes.

The purpose of the examination of the pharynx is to determine the presence of a tumour and its extent. In a pyriform fossa tumour the main areas of interest are whether both walls of the pyriform fossa are involved, but more particularly the lower limit of the tumour in relation to the postcricoid area and the lateral limit of the tumour in relation to the posterior pharyngeal wall. A tumour which enters the postcricoid area or approaches the midline of the posterior wall of the pharynx cannot be dealt with by partial pharyngectomy and requires total pharyngectomy. The other area of interest in pyriform fossa tumours is to assess whether the tumour spreads superiorly above the pharyngoepiglottic fold to invade the base of the tongue. This spread can often be better felt, using a gloved finger, than seen. A postcricoid carcinoma is assessed for its upper and lower limits measured in relation to the upper incisor teeth. The upper limit is easy to assess, but it is usually very difficult to pass a rigid oesophagoscopy through a postcricoid carcinoma to assess the lower limits. This difficulty can almost always be overcome by passing a filiform bougie through the tumour and then passing a small bronchoscope blind over this. This allows the lower limit of the tumour to be assessed and also permits inspection of the remainder of the oesophagus which, on occasion, harbours a second primary tumour. It is also necessary to note whether the tumour spreads into the pyriform fossa: this information has no relation to prognosis and treatment but it is vital in staging the tumour using the UICC and American Joint Committee (AJC)(1973), classification, despite the fact that the information is completely irrelevant. Lastly, the trachea should be examined for a tracheo-oesophageal fistula, which is rare.

The larynx is examined in patients with tumours of the pyriform fossa to look for extension into the vestibule of the larynx and rigidity of the false cord area. Mobility of the cords cannot of course be reliably assessed under general anaesthesia.

Once the extent of the tumour has been assessed a large specimen of the tumour is taken for histology, preferably using a punch biopsy forceps. Finally, the examiner should put on a rubber glove and examine the inside of the pharynx, assessing mobility of the tumour over the prevertebral fascia, and extension of the tumour over the pharyngoepiglottic ligament into the base of the tongue.
As has been mentioned already in the section on pathology, carcinoma of the hypopharynx tends to spread in submucous tissues well beyond the surface limits of the growth and the extent of this can be difficult to judge. It is never easy to assess possible involvement of deep structures in the neck with any accuracy, although this will be clear if there is a paralysis of the recurrent laryngeal nerve. While involvement of the thyroid gland may be revealed on a thyroid scan there may still be spread into the gland even when the scan is normal.

**Laboratory studies**

These patients require very careful general assessment including routine clinical examination, usually by a physician, to assess their general health. This group of patients also has a very high incidence of blood and electrolyte abnormalities and requires a full routine assessment from this point of view.

**Treatment**

**Untreatable patients**

Probably because of the magnitude of the surgical attack required, there is a higher proportion of untreatable tumours among hypopharyngeal than among other head and neck cancers. Of the authors' series of 500 patients, 31% were untreatable, 10% because of poor general condition, 2% because of metastases, 2% because the patient refused treatment and 17% because of an advanced tumour. Palliative treatment of patients with advanced disease must be governed by the predominant symptom for which relief is necessary and in many of these patients there is little that can be done. A gastrostomy which enables the patient to obtain nourishment but which does nothing to allow the swallowing of saliva or to avoid inhalation pneumonia cannot be regarded as palliation. The treatment of these patients by cytotoxic agents is discussed in Chapter 24.

**Radiotherapy**

The largest series of patients to receive radical radiotherapy alone is that of Ledermann (1967), who showed that patients without enlarged nodes (the minority) stood a 20% chance of surviving 5 years when treated with radiotherapy. However, in the presence of enlarged nodes the cure rate was negligible - less than 5% - which was also the case with anaplastic tumours. Radiotherapy therefore should be reserved for the patient without enlarged nodes, and with a small tumour, that is with a vertical length less than 5 cm and not producing a vocal cord paralysis. Conversely, surgery will be needed as the primary form of treatment for tumours longer than 5 cm, in those patients with enlarged cervical nodes, and for tumours which recur after radiotherapy.

Much is heard at the moment about the possibility of combining radiotherapy or surgery with cytotoxic chemotherapy. Although considerable advances have been, and are still being, made in the field of cytotoxic agents the position at present can be summarized by saying that the stage has not been reached when chemotherapy could be advocated as an adjuvant method of treatment for carcinoma of the hypopharynx: although the administration of chemotherapy before radiotherapy induces response in about 25% of patients, controlled
trials have shown that the ultimate survival is unaltered. Furthermore, the 75% of patients who do not respond to chemotherapy suffer the toxic effects of the drugs (and the State the expense) and their treatment is delayed.

Combined surgery and radiotherapy

About 15 years ago there was a fashion in the treatment of head and neck cancer to administer preoperative irradiation in order to reduce local recurrence by implantation and dissemination by veins and lymphatics. The concept is attractive but there is general disagreement on the dose, different authorities using doses ranging from 1000-5000 cGy. Furthermore, despite the claims of some authors, there is no evidence that combined treatment improves survival rates, and it has become much less popular since Strong et al (1978) showed by a controlled trial that it does not prolong survival.

Surgery

Treatment of the lymph nodes and of the primary site must both be considered.

For the patient with secondarily involved lymph nodes the operation of radical neck dissection has stood the test of time. More recently many surgeons have advocated prophylactic neck dissection, that is radical neck dissection in the absence of palpable lymph nodes, on the grounds that, although impalpable, some may be histologically involved.

Pathological studies have shown a high incidence of impalpable but invaded neck nodes in pyriform fossa tumours and it is probably advisable therefore to carry out prophylactic neck dissection for these patients.

There is no evidence, from carefully controlled trials, that prophylactic neck dissection improves the chances of survival in postcricoid carcinoma. Since it can cause a stiff shoulder and at worst may kill the patient, the operation is not justifiable. In the authors' series only 5% of patients undergoing pharyngolaryngectomy later developed an enlarged lymph node and they are the only patients who therefore stand to benefit from the operation. As a postcricoid carcinoma lies in the midline a neck dissection of both sides is logically needed, but this would increase the mortality by roughly the same order as the theoretical gain and the overall benefit would be negligible.

Antibiotic chemoprophylaxis

Resection of a hypopharyngeal tumour exposes the wound to the existing oral/pharyngeal microflora and any potential pathogens. The wound is therefore at risk of becoming infected and fistulae or massive breakdown may complicate healing. The incidence of wound infection after major head and neck operations in which the mouth/pharynx is opened is often substantial, ranging from 14 to 87% (Swift, Bartzokas and Corkill, 1984). In spite of this, prophylactic antibiotics are used to cover such surgery routinely by only about one-half of the otorhinolaryngologists in the UK (Raine and Swift, 1984). Before the introduction of antibiotic prophylaxis on the authors' unit, 22 of 32 patients developed a wound infection after major oncological surgery (Bartzokas et al, 1984). Cultures of the saliva and throat before surgery were of limited value in predicting sepsis. After surgery, all of the
wound infections were polymicrobial, and consisted of Gram-negative aerobic bacilli (34.4%), Staphylococcus aureus (21.3%), anaerobes (13.6%), pneumococci and Haemophilus influenzae (10%). A subsequent controlled trial with an antibiotic suitable for covering these organisms (Augmentin: amoxycillin and clavulanic acid), substantially reduced the incidence of wound infection and antibiotics have since been used routinely (Raine et al, 1984).

Of the microorganisms grown from infected wound, intestinal aerobic Gram-negative bacteria are commonly found. The source of these bacilli was originally thought to be exogenous contamination after surgery but they have since been shown to originate from the stomach, and their subsequent ascent is facilitated by the nasogastric feeding tube (Swift, Bartzokas and Corkill, 1984). An attempt to interrupt this gastro-oral pathway by regular instillation of 40% ethyl alcohol into the stomach after surgery has since been undertaken, but was unsuccessful. These intestinal bacteria are isolated from the mouth and pharynx in most patients after surgery in spite of broad-spectrum antibiotic prophylaxis, and yet the number of wound infections remains low. This is probably because they are not present during surgery, but colonize the pharynx after surgery, when the wound has been closed. Their importance in the aetiology of wound infections is therefore not as great as once thought, although they are still likely to contribute to existing infections. Anaerobes are generally the commonest group of commensal bacteria in the oropharyngeal flora, and although they are not prevalent pathogens on the authors’ unit, they are considered to be important nevertheless.

The choice of the prophylactic antibiotic regimen is determined from the potential pathogens present at the time of surgery when the wound is exposed. Providing an adequate regimen is given perioperatively, the intricacies of the choice are probably not crucial.

The chosen regimen should therefore cover at least the oral anaerobes, streptococci and staphylococci, and combinations of metronidazole and cephalosporin or one of the penicillin group of agents are eminently suitable. On the authors’ unit, four doses of erythromycin 1 g intravenously 6-hourly, starting during the early stages of surgery are given. Erythromycin is active against the likely pathogens, especially the oral anaerobes, although it does not cover intestinal aerobic Gram-negative bacteria. However, as stated previously, these microorganisms are rarely present at the time of surgery, unless a tracheostomy or nasogastric tube has been previously inserted, in which case broader spectrum cover is necessary. The advantage of this regimen are that effective prophylaxis is obtained using a single agent for a short period; the induction of bacterial resistance will be unlikely; the oral flora will not be grossly disturbed and thus resistant pathogens will be prevented from proliferating freely.

The regimen is also employed when free small bowel loops are used to replace the pharynx after total pharyngolaryngectomy. Cultures from the bowel have all been sterile, so there has been no need to expand the spectrum of chemoprophylaxis.

**Resection of the primary tumour**

The operation advised obviously depends on the site of the primary tumour. Patients with a tumour on the posterior pharyngeal wall are often advised to have a total pharyngolaryngectomy; but Ogura, Watson and Jurema (1960) showed that it is usually unnecessary to sacrifice the larynx. Such tumours can be removed by a lateral pharyngotomy; the resultant deficit is covered by a split skin graft stitched over the prevertebral fascia.
Preliminary results indicate that this operation is satisfactory, and has the enormous advantage of preserving the voice.

Operations for tumours of the pyriform fossa vary from partial laryngectomy and partial pharyngectomy to total pharyngolaryngectomy. Ogura, Saltzsrein and Spjut (1961) attempted to apply supraglottic laryngectomy, removing the affected part of the pharynx and the suprastructure of the larynx, but preserving the patient's vocal cords and hence his voice. However, pathological studies have repeatedly shown that most of these tumours invade the larynx, notably the paraglottic space, making the operation highly dangerous. A total laryngectomy is therefore always needed but it is not necessary always to perform a total pharyngectomy. Indeed, in the authors' series, it was possible to preserve enough pharyngeal mucosa in 67% of patients for closure of the defect, in the same manner as after total laryngectomy for laryngeal carcinoma. The operation is thus very similar to that of total laryngectomy (see Chapter 11) including a hemithyroidectomy. The patient is thus spared the problem of a pharyngeal reconstruction. When this is not possible (usually because the tumour has invaded the postcrioid area) a total pharyngolaryngectomy with a pharyngeal reconstruction is necessary.

There is no dubiety about the treatment of postcrioid carcinoma - a total pharyngolaryngectomy is needed, with resection of part of the oesophagus, or all of it, if the tumour extends into the cervical oesophagus, which it often does.

**Restoration of continuity of the alimentary tract after laryngopharyngectomy**

The oesophagus has a segmental blood supply and, despite a few reported successes, it is not usually possible to mobilize the oesophagus sufficiently to allow it to be brought up for anastomosis to the pharynx. The methods which are currently in use to restore continuity can be classified as follows:

1. plastic strips;
2. skin flaps;
3. visceral repair:
   - pedicled;
   - free.

These will now be considered in more detail.

**Repair with a plastic tube**

Silicone rubber tubes are advocated by Stuart (1979) and they have the advantage of simplicity and the fact that the lower end can be inserted into the oesophageal lumen without sutures being required and so a considerable length of oesophagus can be resected without opening the chest. Difficulties arise in obtaining a water-tight seal between the pharynx and the upper end of the tube.
Repair using skin

While split skin grafts wrapped around a moulded tube have been used, they are liable to give rise to fistulae and to stenosis and cannot be used after radiotherapy.

The most suitable skin flap is the pectoralis major musculocutaneous flap. At the end of excision of the pharynx and larynx, the flap is raised and passed upwards between the skin of the upper chest and lower neck. The skin island is made into a tube, with the skin surface inwards. The upper and lower ends of the tube are then anastomosed to the pharynx and oesophagus respectively. This method has the advantage that an abdominal operation is not required but the disadvantage that only a limited length of oesophagus can be resected and reconstituted without opening the chest. Also, fistulae and stenosis are common. The deltopectoral flap has already passed into history, and repair with this flap probably will be abandoned soon.

Visceral repair

Visceral transposition has the great advantage that it effects an immediate repair of the pharynx and oesophagus and the whole length of the gullet can be removed so that there is no lower limit to the level of resection. Swallowing is restored within a few days and most patients are eating almost a normal diet within a week or two. Also, the repair can be regarded as durable in the sense that swallowing tends to be maintained even when recurrent growth develops in the neck. Fistulae are uncommon and stenosis is unknown when stomach is used and is seldom seen when colon is transposed. However, the procedure does impose a major operation on the patient and it requires the cooperation of an experienced surgeon who is well versed in the techniques of handling abdominal viscera.

Both stomach and colon have their own advantages and disadvantages which may determine the choice in a particular patient but, in many, the decision may merely reflect the particular experience and preference of the surgeon concerned.

Two particular advantages of transposing the stomach are that it has an excellent blood supply and when it is used only one anastomosis, in the neck, is required. On the other hand, mobilization of the stomach requires extensive and meticulous dissection and in a few patients there is some tendency to reflux and to dumping. On balance, stomach is the viscus of choice and the colon has now been abandoned by all but a few.

Repair procedures of this type should not be undertaken by the 'occasional' surgeon in the field of laryngopharyngectomy and it is necessary to discuss only the general principles of the operations rather than the minute details which are, nevertheless, critical to the success of the procedure.

At operation the two surgical teams should start their procedures synchronously, but if a bilateral radical neck dissection is included the abdominal surgeon will complete the mobilization before the neck dissection is finished. This has advantages in that the viscus can remain in its natural environment for a while after mobilization before being moved to the neck. The main steps of the procedure are as follows. The pharynx and larynx are mobilized from the carotid sheath on each side as described for total laryngectomy (see Chapter 11), the
superior and inferior thyroid pedicles being divided. Both lobes of the thyroid gland are also mobilized. The trachea can be divided at this stage, and the tracheostome is created. The upper thoracic oesophagus is mobilized by blunt finger dissection, and the paratracheal lymph nodes are also mobilized en bloc with the oesophagus. Simultaneously, the abdominal team opens the abdomen through an upper paramedian incision. The abdominal oesophagus is freed, followed by mobilization of both curvatures of the stomach, dividing the left gastric artery but preserving the right gastro-epiploic artery. Finally the first two parts of the duodenum are freed, and a pyloromyotomy is performed. The thoracic oesophagus is now mobilized by blunt finger dissection from above and below. Once it is free the stomach is pulled into the neck. The pharynx is divided above the level of the hyoid, the oesophagus is divided from the stomach and this hole is oversewn. A fresh opening is made in the fundus of the stomach which is anastomosed to the base of the tongue.

At the end of the operation and before the patient leaves the theatre a radiograph of the chest must be taken, and if pneumothorax is present, this must be treated appropriately by aspiration or insertion of an intercostal drain attached to an underwater seal unless the pneumothorax is very small. In any event the radiograph must be repeated after a few hours.

In recent years great strides have been made in microvascular surgery and it is now possible to restore continuity between the pharynx and the oesophagus by the use of revascularized segments of intestine, with success in about 95% of patients. At the end of the excisional phase a loop of ileum is taken by a second team taking care to preserve an artery and vein in its entirety. A suitable adjacent artery and vein of the same calibre as the ileal vessels are freed in the neck - the facial artery and vein are often suitable. The ileal loop is then freed, and the artery and vein reanastomosed in the neck. Finally the ileum itself is anastomosed, the upper anastomosis to the oropharynx often being end-to-side. Small fistulae can occur but the method is remarkably free of complications and is the treatment of choice where the tumour is confined to the neck. Larger tumours require visceral repairs which are in effect limited to transposition into the neck of either the stomach or the colon. Both procedures have had considerable success and many surgeons regard them as providing the most satisfactory method of restoring swallowing and speech after laryngopharyngectomy.

**Postoperative care**

*Speech therapy*

Only a tiny minority of patients develop 'oesophageal' speech after pharyngolaryngectomy. The best hope is one of the vibrating machines, but the results are generally poor.

*Thyroid and parathyroid replacement*

As the patient must undergo total thyroidectomy (and therefore parathyroidectomy) he must take thyroxine for life (usually 0.2 mg/day), and the serum calcium must be maintained within the normal limits by supplements of calcium and calciferol.
Diagnosis of recurrence

As has been discussed, both radiotherapy and surgery are used in the treatment of carcinoma of the hypopharynx and upper oesophagus and they are not mutually exclusive. Accordingly, after either form of treatment it is necessary to try to detect the presence of any residual or recurrent disease at the earliest possible moment while alternative treatment is still possible. Unfortunately there are difficulties in detecting further growth before it has reached an advanced stage and this is well illustrated by the very large number of patients reported in numerous series who succumb to their disease after being treated by only one method. Although there may be differences of opinion about the relative merits of each form of treatment used as a primary measure or as a salvage procedure, there is ample evidence to support the use of a second form of treatment if the first fails and, if this is not employed, it is usually because recurrent disease has advanced to the stage of being untreatable before being positively identified.

Treatment of any type alters the tissues and subsequent examination is a matter of determining whether the abnormalities are those which would be expected or whether they indicate that active tumour is still present. While positive biopsies confirm the presence of growth (unless taken within a few weeks of the completion of a course of radiotherapy) negative biopsy findings in no way exclude the possibility. After both radiotherapy and surgical excision there may well be healing of the surface while there is still active growth in the deeper tissue.

Mortality after pharyngolaryngectomy

Pharyngolaryngectomy is the most major head and neck procedure, and it has the highest mortality. Unlike survival, which is quoted at 5 years to ensure that the figure is representative, mortality rates are quoted on a very vague basis. The mortality ranges from 0.5% to 25% depending on the criteria chosen, from a death during operation at one extreme, to counting any patient who does not go home alive and swallowing at the other. There is an urgent need to standardize reporting so that different methods of treatment can be compared. Death within one week is probably a reasonable period to encompass those causes immediately connected with the operation. The mortality by this definition should be 0.5-1.0% for skin flaps and revascularized loops, and 10-15% for gastric transposition.