POSITIVE CONTRAST LARYNGOGRAPHY

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Introduction

A RATIONAL decision on the choice of treatment in each individual case of carcinoma of the larynx or hypopharynx must depend on the fullest assessment of its size and of the extent of any invasion. Such an evaluation has become of even greater importance with the renaissance of conservation surgery. We believe that the radiological evaluation of the lesion, particularly by double contrast laryngography, is a valuable adjunct to clinical and endoscopic examination, but to judge from the literature, this aspect of the preliminary survey has been rather neglected in this country. This paper attempts to emphasize the value of positive contrast techniques in the radiology of this area.

Method

Our routine for the radiological examination of the larynx has been:

1. Plain soft tissue lateral views in inspiration and phonation (high pitched "e").

2. An oblique film of each side of the larynx in turn, the central ray being in line with the cords of that side. The larynx is displaced laterally by the patient's fingers in order to clear it from the spinal shadow.

3. Frontal tomograms during phonation, the sections being at 0·5 cm. intervals, starting 0·5 cm. posterior to the thyroid prominence.

4. Positive contrast laryngograms. The examination is performed under local anaesthesia. Premedication consists of Seconal (gr. $1\frac{1}{2}$) and atropine (gr. 1/60). The importance of reducing mucosal secretions cannot be stressed too greatly. Citanest (prilocaine) has been found to provide satisfactory mucosal anaesthesia. It is sprayed into the mouth and pharynx, then a drop is placed through a curved cannula into each pyriform fossa and finally a small quantity is dropped directly into the larynx. Mild anaesthesia of the trachea and bronchi is helpful in avoiding coughing. Adequate anaesthesia of the pharynx and larynx is vital. Contrast medium (5–10 c.c. of Dionosil Oily) is then applied to the mucosa of the hypopharynx and larynx during gentle respiration. The region is examined fluoroscopically in inspiration, phonation, true and modified Valsalva, and spot films are taken to provide a permanent record of the findings. Occasionally thick cut tomograms are of additional

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value. Demonstration of the laryngeal ventricles may be improved by inspiratory phonation. The post-cricoid region can be further assessed at the end of the examination if necessary. It is important to undertake this examination before biopsy since resultant oedema tends to persist for several days.

Case Reports

Case No. 1.

J.M. This 43-year-old man had been hoarse for 5 weeks. Indirect laryngoscopy revealed a lesion of the free edge of the anterior half of the right vocal cord. The cords were mobile and no nodes were palpable. A laryngogram (Figs. 1, 2 and 3) showed this tumour to be confined to the true cord and subglottic extension was excluded. Radiotherapy was given.

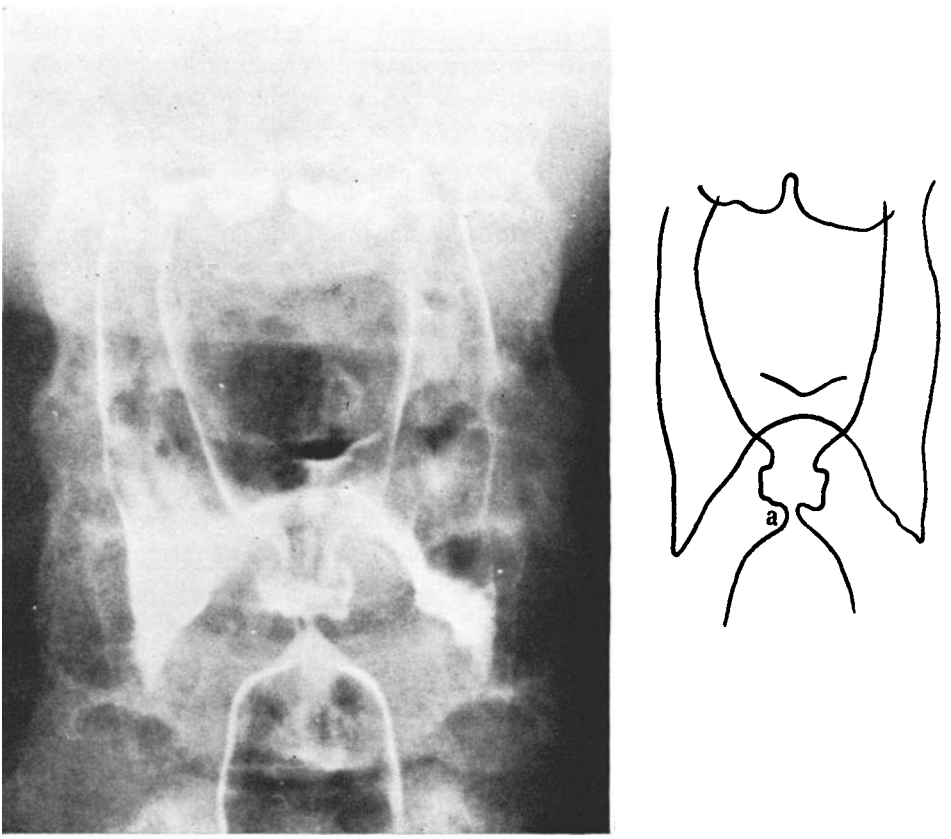


FIG. 1.
Case 1. Carcinoma of the right true cord (*a*), frontal projection, phonation.

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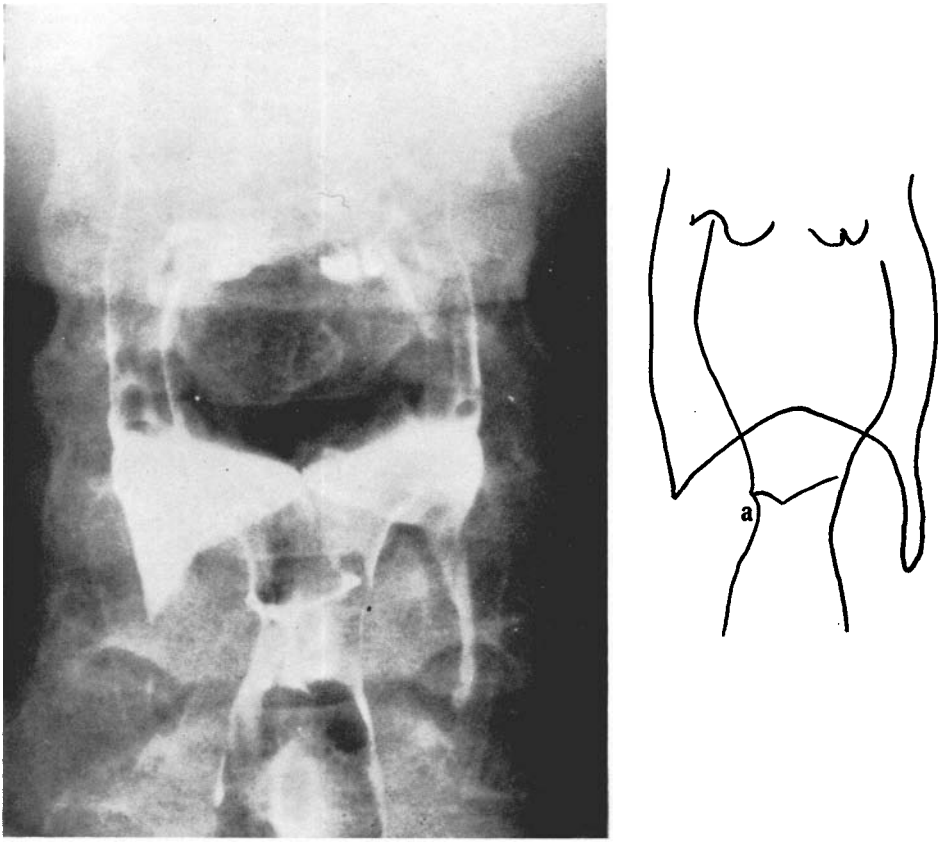


FIG. 2.
Case 1. Inspiration film showing inability of affected cord (*a*) to retract fully.

Case No. 2.

G.J., aged 80, underwent radical radiotherapy in July 1963 for a carcinoma of the right lateral pharyngeal wall. This lesion was controlled, but at routine follow-up, it was noticed that he had developed a lesion of the middle third of the left vocal cord. The cord was mobile and there was no palpable node. A laryngogram (Fig. 4) showed a large lesion almost 1 cm. in diameter. A left hemilaryngectomy was performed and Fig. 5 is a photograph of the specimen.

Case No. 3.

E.P. This lady aged 70, had a short history of dysphagia, throat pain referred to the left ear, and hoarseness. Indirect laryngoscopy revealed oedema of the left arytenoid, fixation of the left vocal cord, and mucosal irregularity of the apex of the left pyriform fossa. Laryngography (Figs. 6, 7 and 8) demonstrated the extent of the mucosal irregularity in the hypopharynx and pyriform

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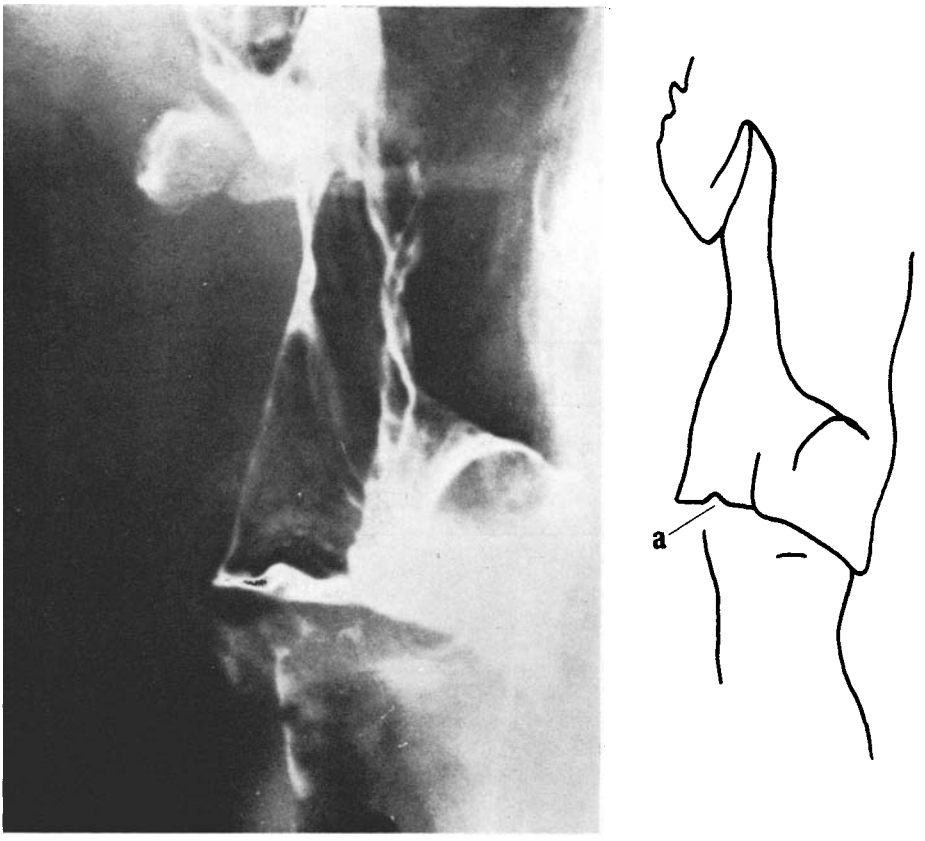


FIG. 3.
Case 1. Lateral projection demonstrating site of carcinoma (*a*).

fossa and the oedema of the left larynx. These findings were confirmed by direct laryngoscopy and biopsy showed squamous cell carcinoma. A photograph of the excised specimen (Fig. 9) is shown.

Case No. 4.

G.L., aged 60, presented with an 8 months' history of sore throat, pain on swallowing and pain referred to the right ear. Indirect examination of the larynx and pharynx demonstrated no abnormality, although the epiglottis was curled forward on itself and it was impossible to see its lingual surface. There were no palpable nodes in the neck. While a barium swallow revealed no abnormality, laryngography demonstrated a constant filling defect of the lingual surface of the epiglottis on the right side (Fig. 10). A biopsy on this area was reported as squamous cell carcinoma. A supraglottic laryngectomy and prophylactic right neck dissection were carried out. Fig. 11 shows a photograph of the excised specimen.

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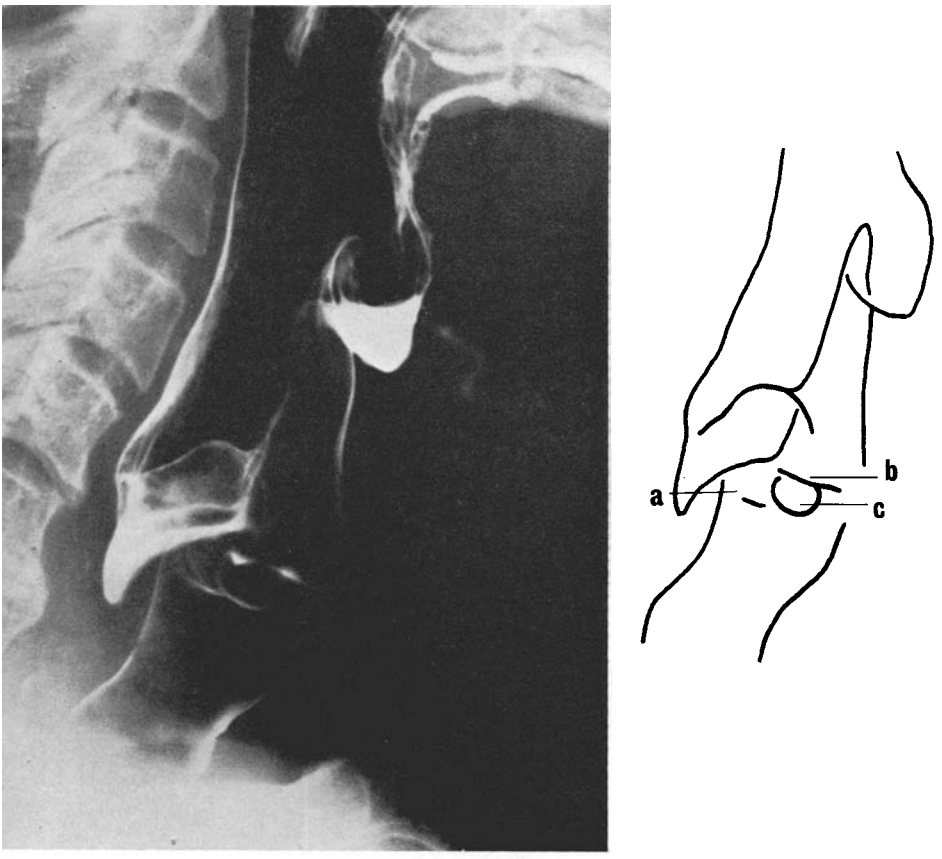


FIG. 4.
Case 2. Lateral view, outlining true cord (*a*), ventricle (*b*) and tumour (*c*).

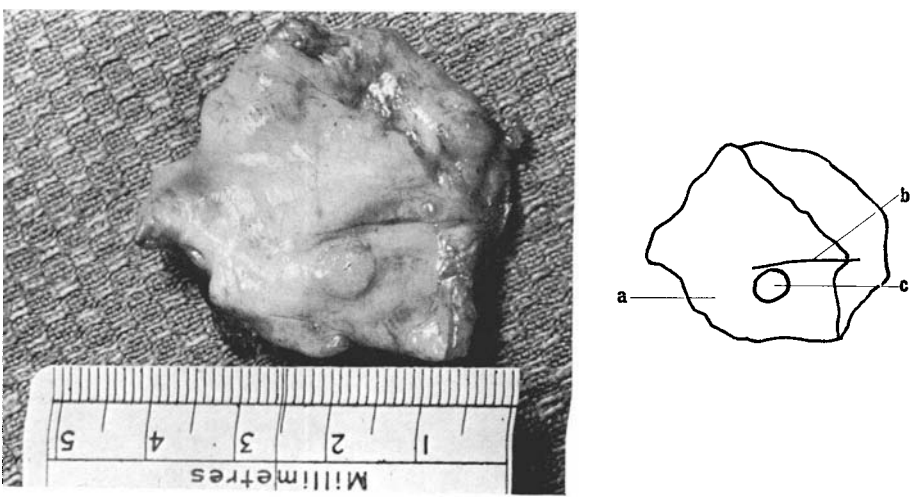


FIG. 5.
Case 2. Photograph of specimen for comparison with laryngogram.

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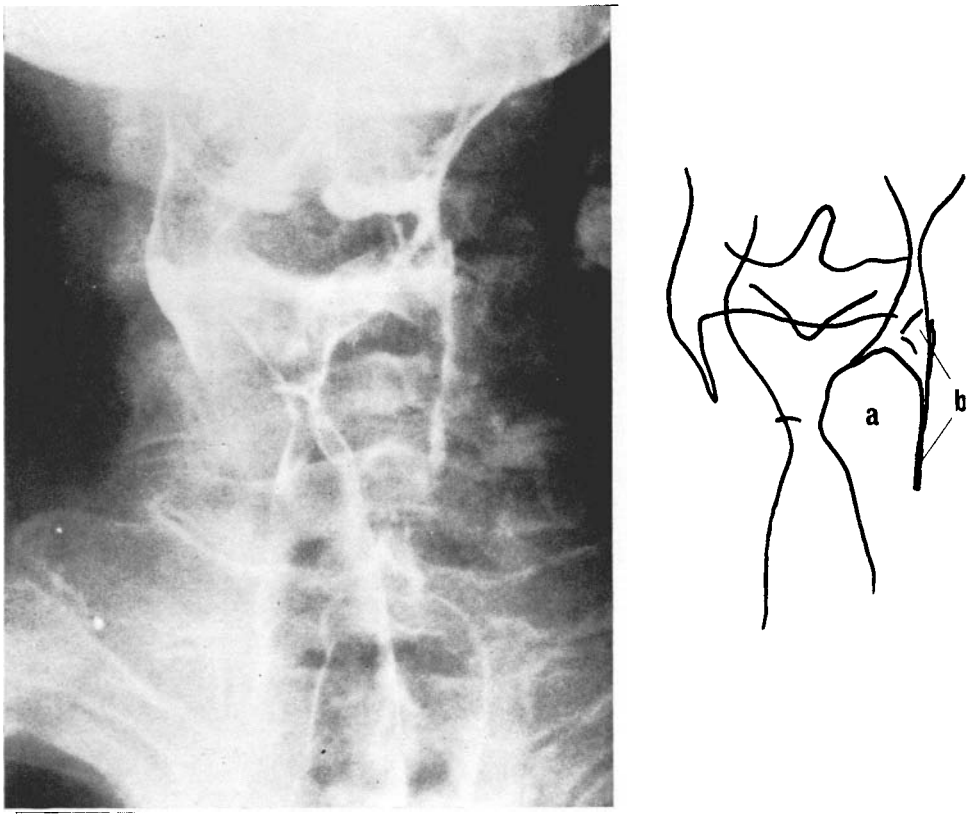


FIG. 6.

Case 3. Frontal view in inspiration showing smooth enlargement of the left larynx (*a*), and mucosal irregularity in the left pyriform fossa (*b*).

Discussion

The several conventional radiographic methods of examining the larynx together with any disadvantages, are summarized in Table I. The introduction of the lateral soft tissue film of the neck is attributed to Coutard (1922) and more recently Baclasse (1949) has underlined its value. However, while it demonstrates well the outline of mid-line features, bilateral structures are superimposed. Interpretation is made more difficult when laryngeal cartilage calcification is extensive.

Radiographs obtained in the antero-posterior position are made virtually valueless by the dense cervical spine, which effectively obliterates the faint shadow of air in the larynx. Young (1940) has suggested that films in the postero-anterior position, with the X-ray tube

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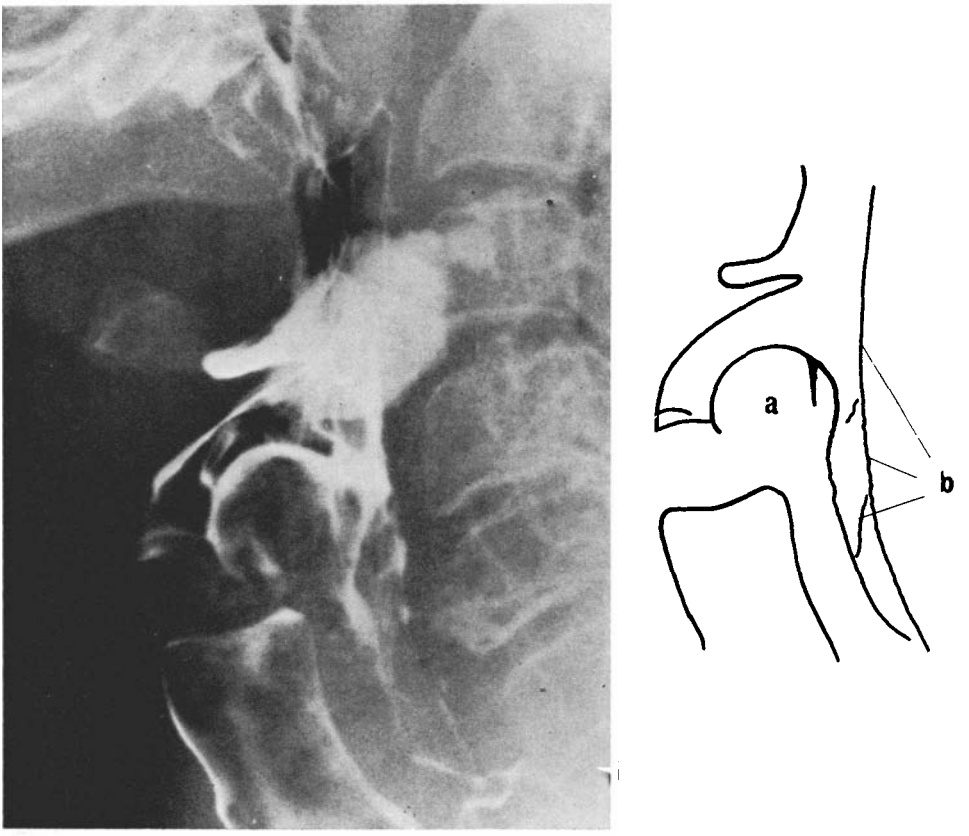


FIG. 8.

Case 3. Lateral view showing oedema of the arytenoid (*a*) and the postero-lateral extension of the tumour into the hypopharynx (*b*).

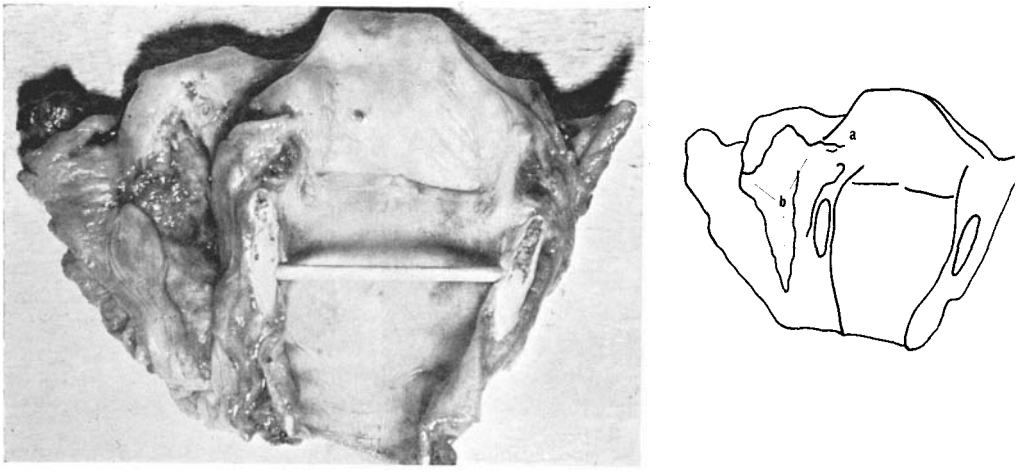


FIG. 9.

Case 3. Photograph of specimen for comparison with laryngogram.

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FIG. 10.

Case 4. Frontal view showing filling defect in right vallecula (*a*).

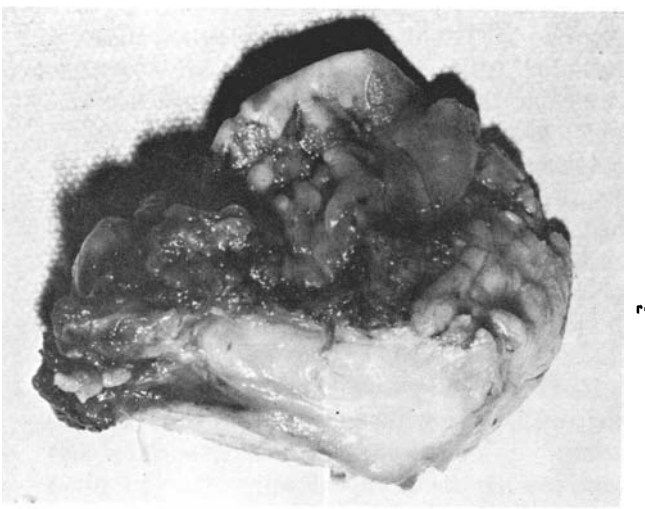


FIG. 11.

Case 4. Photograph of specimen, showing tumour (*a*), tip of epiglottis (*b*), median glosso-epiglottic ligament (*c*), cut edge of back of tongue (*d*) and hyoid (*e*).

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close to the back of the neck, are of greater value, since the spine image tends to be less sharp than the laryngeal image. Utilizing the same principle, Lewis (1962) advocates spot films taken during plain fluoroscopic examination but the results are not encouraging. Intra-pharyngeal films were suggested by Réthi in 1912 in order to avoid the superimposition of the spinal shadow, but more recent reviews of this method have confirmed that it is not of sufficient practical value to warrant its general use. Oblique views of the larynx have recently been introduced by Kovács (1960) as an additional manœuvre in conjunction with conventional films.

In 1936 Leborgne published the first of several articles on the application of tomography to diseases of the larynx. This examination was taken up with enthusiasm and during the next few years the results were widely published. It was claimed that the radiographs obtained by this method indicate separate sections of the interior of the larynx, thereby allowing an assessment in both frontal and lateral planes. Ardran and Emrys-Roberts (1965) have now confirmed that this is not so; without the use of very sophisticated tomographic apparatus it is not possible to obtain these separate sections. One must therefore conclude that the main advantage of tomographic examination is the obliteration of the spinal shadow. This must be weighed against the lack of definition due to the slight relative movement of structures in planes close to the focal plane. Tomograms in the lateral view have little to offer. Examination of the hypopharynx and upper oesophagus by barium swallow examination is of limited value in laryngeal disease. Coating of the hypopharynx is generally uneven but the manœuvre is of use in assessing the post-cricoid region.

It is against this background that the value of double contrast laryngography must be considered. Although Iglauer showed in 1926 that iodized oil could be used to outline the larynx as well as the trachea and bronchi, the laryngographic aspects of his work were forgotten. Occasional reports of contrast examination of the larynx appeared in the literature but it was not until 30 years later when Ogura and his associates (1960) in the United States published their experiences, that sustained interest was stimulated. In a review of a large number of cases where operative and pathological proof was available, contrast laryngography was found to be more accurate than direct laryngoscopy.

Providing surface anaesthesia is adequate we have found no difficulty in coating the hypopharynx and larynx with an even and thin layer of opaque medium which accurately outlines the mucosal surface and greatly increases the contrast between the laryngeal wall and its contained air. This makes it possible to determine with greater certainty anatomical and functional abnormalities.

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Positive Contrast Laryngography

1. Anatomical abnormalities. These may be recognized as:
   (*a*) abnormal projections of tissue into the lumen,
   (*b*) irregularities in the mucosal surface, or
   (*c*) increase in the depth of submucosal tissue.
2. Functional abnormalities:
   (*a*) abnormality of cord movement which may be due to neoplastic infiltration, oedema or true paresis,
   (*b*) rigidity of normally distensible areas such as the pyriform fossae.

The positive contrast laryngogram has particular advantages in the examination of certain regions.

1. The base of the epiglottis and the anterior commisure. ("Death lurks under an overhanging epiglottis"—Jackson and Jackson, 1945.)

2. The inferior margin of the true cords and the subglottic space.

3. The area beyond a bulky supraglottic tumour, when it may be impossible to see the inferior limit of the lesion and to evaluate the true cords.

The interpretation of the laryngogram is not difficult when normal anatomy and physiology are borne in mind. The vestibule and glottis are best seen on inspiration and phonation. Evaluation is facilitated by comparison of the bilateral structures since symmetry is almost complete. The subglottic region is delineated in the true Valsalva manœuvre when the closed glottis and raised intratracheal pressure produce a smooth curve, concave downwards. The arytenoids and the pyriform fossae are shown to best advantage in the modified manœuvre when the hypopharynx is distended. It must be remembered that some asymmetry may occur in the pyriform fossae, particularly of the lateral walls, and also in the valleculae. Posterior displacement of the vestibular margin of the epiglottis and also the anterior commisure may occur in phonation and Valsalva. Care must be taken to differentiate this normal movement, which disappears in inspiration, from neoplastic infiltration.

We have found that the laryngogram provides most of the information required during the radiological examination of the larynx, though the soft tissue lateral radiograph and oblique films are valuable in the elucidation of thyroid cartilage destruction and in the interpretation of the pre-epiglottic space.

The disadvantages of contrast laryngography are few. Administration of surface anaesthesia requires a little time and patience. The contrast medium, Dionosil Oily, tends to drain into the lung bases but this is usually cleared within 24 hours. These considerations must be weighed against the undoubted value of the examination. There is a danger in patients with almost total obliteration of the laryngeal lumen, that the instillation of fluid may complete the obstruction and necessitate

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tracheotomy. These circumstances may therefore be considered to constitute an absolute contraindication to the examination. It is not of course suggested that the contrast laryngogram is a substitute for clinical and endoscopic examination; rather it is complementary.

Summary

Irrespective of differences of opinion in the choice of treatment of carcinoma of the larynx between radiotherapy, conservation surgery and radical surgery, a logical decision must be based on the fullest and most accurate preliminary assessment. We believe that radiology and, in particular, double contrast laryngography contributes towards a more complete initial survey.

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