PARTIAL LARYNGECTOMY*

By H. J. SHAW (London)

ABOUT the time that satisfactory results of partial laryngectomy by laryngofissure were being reported in the 1920s and 1930s by St. Clair Thomson, Colledge, Jackson, Tucker, Chiari and others, it was also being recognized that fractionated doses of external irradiation or the use of interstitial radium could cure limited cordal cancer effectively with preservation of a normal voice. In consequence the advent of antibiotics and other valuable aids, although making surgery much safer, did not especially stimulate in this country the development of any new techniques of partial laryngectomy. Subsequently, the value of teleradiation for limited cordal cancer was confirmed here in the years following 1945, and it was felt that skilled irradiation would cure the majority of early growths, the failures being submitted to total laryngectomy. This belief in radical surgery for failures arose probably as much from fear of complications after partial resection following the older conventional high voltage X-radiation, as from concern about residual disease.

To a great extent this philosophy has prevailed in the United Kingdom to the present day. However in other countries where the development of radiotherapy was slower and where the social stigma of total laryngectomy was perhaps less acceptable, considerable efforts were made to devise techniques of partial laryngectomy suitable for relatively early cancer at other sites in the larynx. I refer mainly to the pioneer work of Alonso, Portmann and Hautant prior to 1940. This trend has been further stimulated in recent years by the work of Pressman, Ogura and Norris in the United States on the surgical pathology and lymphatic spread of laryngeal cancer. Their findings give strong support to the practice of the newer techniques described extensively by both European and American authors, and today powerfully supported by Professor Bocca's report. Furthermore, it has proved possible, as he has shown, to combine neck dissection with more extensive partial laryngectomy to achieve successful results.

Sometimes one feels that enthusiasm for the full gamut of partial laryngectomy has been uniquely influenced by climate, and even by ethnic characteristics. Certainly these techniques are more fully embraced and perhaps better practised by our warmer-blooded Latin cousins. Their

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vocal range and prowess exceeds by far that of their less gifted Northern neighbours, whose larynges in comparison are perhaps the more expendable.

Be that as it may, in this country we have continued to put our faith in irradiation for the early tumours (Stage I and II) that are otherwise amenable to partial laryngectomy. In this we have undoubtedly been justified by some excellent results (Lederman, 1961). However, during the past 10 years it has been gradually realized that some of these techniques may be used at times after failed teleradiation with effective cure of the disease, absence of complications, preservation of a natural airway and an adequate voice. Today excision of recurrent cordal cancer after modern teleradiation therapy is entirely safe, providing scrupulous indications are observed. It is also possible to use certain other techniques of partial resection in a few carefully selected cases; although after irradiation this type of surgery still presents very definite post-operative hazards of rehabilitation that are often distressing and unpredictable.

Techniques

There has been a tendency among many enthusiasts to obscure the picture by cumbersome terminology, and by describing under quite separate headings operations which possess only minor technical differences.

In reality all these procedures are based on a precise understanding of local anatomy, especially lymphatic drainage. The work of Pressman and Simon (1956 and 1961) has done much to emphasize this necessity in recent years by their demonstration of the submucosal laryngeal lymphatic compartments (Fig. 1) with the significance of their superficial and deep lymphatic plexuses and the lymph routes beyond the larynx.

It is therefore reasonable to subdivide these operations quite easily into vertical and horizontal types (Leroux-Robert, 1956 and 1961). The basic vertical operation being a simple laryngofissure or lateral partial laryngectomy with the classical midline approach; any greater procedure of this type that requires removal of the thyroid cartilage then being called an extended laryngofissure (Fig. 2*b*). Where the anterior commissure alone or anterior two-thirds of one cord with the anterior third of the opposite cord is involved it would be called frontal or fronto-lateral partial laryngectomy. (Fig. 2*a*.) If this resection should need to include the arytenoid and most of the thyroid ala cartilage it would be termed an extended fronto-lateral partial laryngectomy (Fig. 2*c*) (Norris, 1958). These latter resections will usually require free skin grafting to promote healing and reduce airway stenosis. The older and cruder varieties of hemilaryngectomy (Gluck, 1914; Soerensen, 1930; Hautant, 1936) involving removal of subglottic tissues and part of the cricoid ring are

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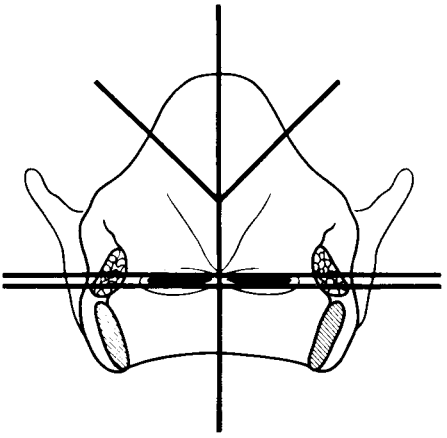


FIG. 1.

Four main submucosal lymphatic compartments either side of the larynx. Smaller compartments are in Reinke's space, in the saccule of the ventricle and in the free margin of the epiglottis (After Pressman and Simon).

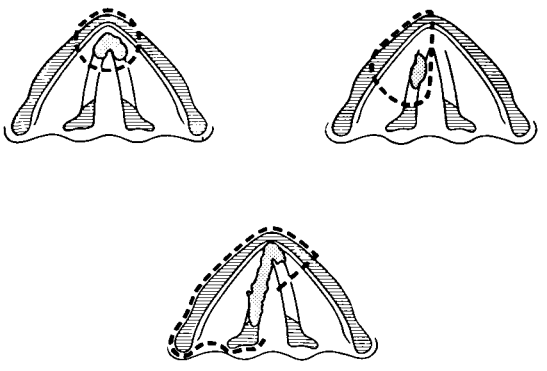


FIG. 2.

Three types of vertical (glottic) partial laryngectomy: (*a*) frontal resection, (*b*) extended laryngofissure or lateral resection, (*c*) extended fronto-lateral resection.

usually unsatisfactory owing to the frequently resulting stenosis or persistence of residual disease.

The basic horizontal operation for epiglottic and vestibular lesions is still that of Alonso (1946 and 1966), today well illustrated and described with modifications by Professor Bocca as supraglottic partial laryngectomy. The more ingenious modifications of this operation to include one vocal cord, the tongue base or the piriform fossa being then called

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extended supraglottic laryngectomy (Fig. 3) (Ogura *et al.*, 1961; Ogura and Dedo, 1965). The approach route for the smaller procedures is usually via a transverse pharyngotomy, whereas in the larger operations of the Alonso type an approach by lateral pharyngotomy using a one stage technique would appear to be the most useful method. However, when full courses of irradiation have been given a two stage operation may certainly be wiser.

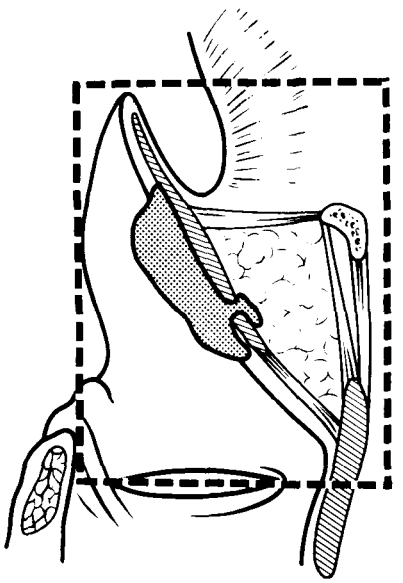


FIG. 3.

Principal boundaries of resection in horizontal (supraglottic) partial laryngectomy. Unilateral extensions may be planned in certain circumstances.

Ogura *et al.* (1961) have rightly emphasized the importance of preserving the arytenoid cartilages intact whenever possible, in order to ensure adequate protection of the larynx in swallowing, although full rehabilitation where one has been removed can certainly be achieved. They lay greater stress on the intact mechanism of swallowing rather than on strict preservation of the pharyngeal sensory nerve supply, to close the larynx effectively. The sacrifice of one superior laryngeal is certainly permitted. Recovery of swallow is even possible after division of both nerves.

I am sure this is correct. It also helps to explain the increased hazards found after surgery following irradiation where laryngeal and pharyngeal œdema with resulting mechanical distortion is so much greater and more persistent.

A further useful point made by these authors is the importance of

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routine cricopharyngeal myotomy as an aid to swallowing after all supraglottic resections.

Indications

Before considering these in detail it would seem wise carefully to define partial laryngectomy: "The removal of any part or parts of the larynx with preservation of an adequate airway, a normal swallow and a serviceable voice. When this is carried out for cancer it must not in any way compromise the chances of a successful cure."

In this last sentence lies the difficulty. From this it is clear that indications must be very precise and despite all investigations, a final decision must sometimes be postponed until the larynx is opened and the tumour under direct inspection:—

1. For excision of benign tumours at any site within the larynx where simple endoscopic removal is unsuitable and total laryngectomy unnecessary.

2. For removal of Stage I carcinoma of any glottic or supraglottic laryngeal site residual or recurrent after irradiation.

3. For removal of certain Stage II glottic or supraglottic carcinomas residual or recurrent after irradiation.

4. For primary treatment of some Stage II or even III tumours of the supraglottic larynx.

5. To complete or facilitate the removal of certain benign or malignant tumours of the laryngo-pharynx adjacent to the laryngeal margin.

6. For primary treatment of all the above types of case when skilled irradiation is not available (Figs. 4 and 5).

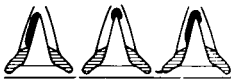
TUMOUR	Histology	Treatment
	Squamous Ca. All grades	1. Irradiation. 2. Partial Laryngectomy. (Simple Laryngofissure)
	,, ,,	1. Irradiation. 2. Partial Laryngectomy, (Extended Laryngofissure or Fronto-lateral resection), 3. Total Laryngectomy.
 S	,, ,,	1. Irradiation. 2. Partial Laryngectomy. (Extended Fronto-lateral resection), 3. Total Laryngectomy.
 F	Poor differentiation— reverse sequence.	1. Total Laryngectomy. 2. Irradiation.

FIG. 4.

Choice of treatment in glottic cancer. The use of partial resection is indicated.

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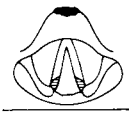
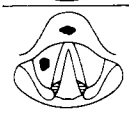
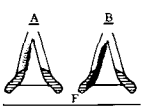
TUMOUR	Histology	Treatment
	Squamous Ca. All grades	1. Irradiation. 2. Partial Laryngectomy. (Simple Epiglottectomy)
	,, ,,	1. Irradiation. 2. Partial Laryngectomy. (Supraglottic resection)
	Poor differentiation— reverse sequence.	1. Partial Laryngectomy. (Extended Supraglottic resection) or Total Laryngectomy. 2. Irradiation.
	Poor differentiation— reverse sequence in *B*.	*A*: 1. Irradiation. 2. Total Laryngectomy. *B*: 1. Total Laryngectomy. + Irradiation.

FIG. 5.

Choice of treatment in supraglottic and subglottic cancer. The use of partial resection is indicated.

Contraindications

1. In some Stage II (with cord fixed) and Stage III or IV cancers of one whole side of the larynx before or after irradiation.

2. In any discrete subglottic cancer at any time.

3. Where there is extensive involvement of both vocal cords or Stage II or III cancer on one side with gross keratosis of the opposite cord.

4. Where there is evidence of perichondritis or direct spread of tumour outside the larynx.

5. Extreme age, senility, other serious illness.

Anything more extensive than the simple lateral resection of laryngofissure is unwise in the elderly owing to increased rehabilitation difficulties.

Complications

The most serious problem must always be that of residual disease remaining in the larynx, but with increasing skill and experience the chances of this have been shown to diminish.

Other complications such as perichondritis and fistula formation are common to many operations on the larynx, particularly after irradiation, and suitable precautions must always be taken.

The greatest immediate post-operative hazards are the restoration of the natural airway and a normal swallow. These problems are again increased after irradiation and are directly related to the extent of the partial resection. More is now known about rehabilitation in these

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patients and with precise technique such difficulties can be greatly diminished. Unfortunately however, there is still an unpredictable element in the post-operative restoration of function after this type of surgery which must be considered when advising treatment.

Experience of Others

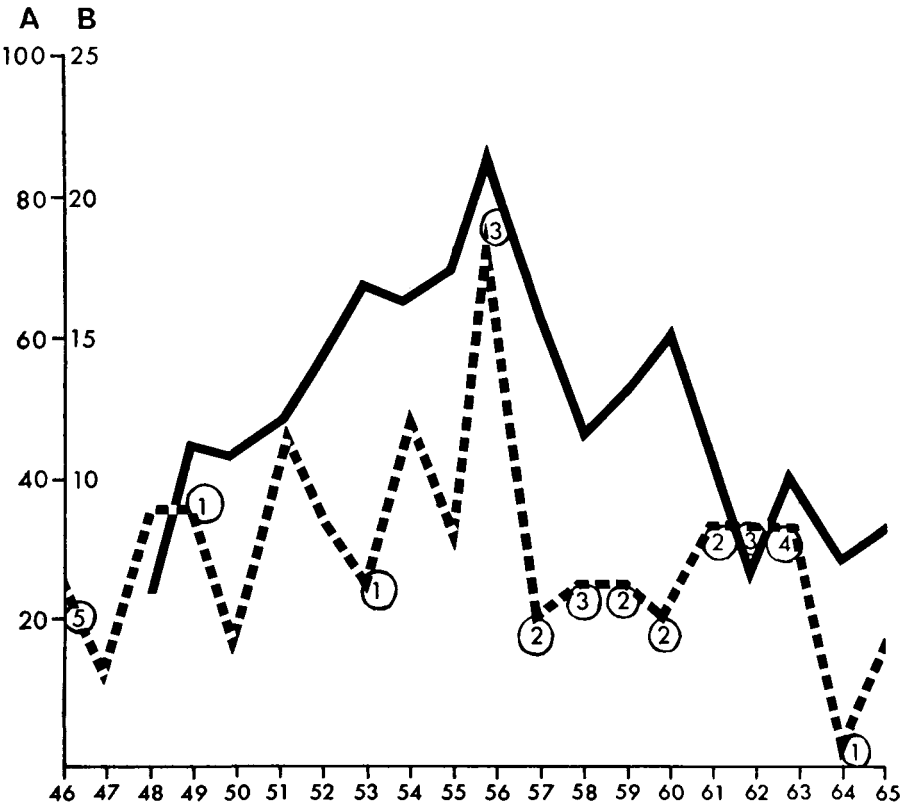
The operation of laryngofissure was technically perfected in this country before the First World War although at that time complications took a heavy toll. Since then the steady increase in surgical and nursing aids has virtually eliminated such difficulties, and today it is a standard and effective procedure though in less frequent use here during the last 20 years owing to what Wilson (1961) has called the "maturity" of radiation therapy. The value of irradiation in limited glottic cancer is readily acknowledged today, but as Ormerod (1958) and Lewis (1961) have stated, it need not be a bar to certain types of secondary conservative laryngeal surgery, especially laryngofissure. Lewis pointed out that he first performed laryngofissure after failed irradiation in 1950 with a successful result and since then has repeated this sequence many times. The total numbers of laryngofissure operations carried out annually by the staff of the Royal National Throat Nose, and Ear Hospital are illustrated in Fig. 6 and the small figures on the *B* line indicate the number of operations successfully carried out each year after failed irradiation. It should be noted that since 1949 these have steadily increased. Although healing is slightly delayed in some cases complications have been just as rare as in the primary operation. This has therefore become a safe and established sequence of therapy under the best modern conditions.

Table I shows the total numbers of operations carried out during the past 20 years, and Table II a breakdown of end-results showing the different types of partial laryngectomy with details of survival carried out at the Royal National Hospital during the 15-year period 1946–60. Apart from laryngofissure very few partial resections have been performed owing to the dominance of teleradiation as a primary treatment for suitable lesions and to an understandable reluctance to submit patients to anything less than total laryngectomy if simple laryngofissure was not applicable. Table III which summarizes the recent experience of partial laryngectomy at the Royal Marsden Hospital is even more striking in this respect.

Professor Bocca's valuable contribution has focussed attention again on the horizontal partial laryngectomy procedures originally introduced by Alonso in 1940. He has ably demonstrated the usefulness of this operation in supraglottic cancer especially when combined with neck dissection; although I beg leave to disagree that "functional neck dissection" is universally a desirable substitute for radical neck dissection

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in attempting to eliminate metastatic cervical cancer. Other workers in Europe, such as Leroux-Robert (1956 and 1961), Falbe-Hansen (1955 and 1964), also Portmann and Robin (1951), have given detailed accounts of many of these procedures. Alonso himself stated at the VIIth Inter-



A. ——— New cases of Laryngeal Cancer attending.
B. ■ ■ ■ ■ Trends in Partial Laryngectomy: 1946-1965.
(Royal National Throat, Nose and Ear Hospital.)

Ringed figures show laryngofissure operations performed after failed irradiation.

FIG. 6.

TABLE I.

PATIENTS TREATED AT THE ROYAL NATIONAL THROAT, NOSE AND EAR HOSPITAL, 1946-65.

Partial Laryngectomy	Primary	Secondary	Total
Laryngofissure	93	24	117
Other types	9	3	12
Total	102	27	129

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TABLE II.

END-RESULTS OF PARTIAL LARYNGECTOMY: 1946-60. (ROYAL NATIONAL THROAT, NOSE AND EAR HOSPITAL.)

Treatment	Total	D.P.O.	D.O.D.	D.O.C.	A. & W. (5 yrs.+)
Laryngofissure alone	63	2	3	9	49
Laryngofissure + total Laryngectomy ..	7	2	1	2	2
Laryngofissure + total Laryngectomy + Radiation	1		1		
Laryngofissure + Radiation	1		1		
Laryngofissure + Radiation + total Laryngectomy	2		1		1
Radiation + Laryngofissure	14		1	1	12
Fronto-lateral Laryngectomy	2		1		1
Fronto-lateral Laryngectomy + total Laryngectomy	1				1
Extended Fronto-lateral Laryngectomy	4			3	1
Radiation + Supraglottic Laryngectomy	2			1	1
Total	97	4	9	16	68

D.P.O. = Died post-operation.
D.O.D. = Died of disease.
D.O.C. = Died of other causes.
A. & W. = Alive and well.

TABLE III.

PATIENTS TREATED AT THE ROYAL MARSDEN HOSPITAL 1946-62.

Partial Laryngectomy	Primary	Secondary	Total
Laryngo-fissure	6	7*	13
Other types	2	0	2
Total	8	7	15

* Alive and well after 3 years. (One subsequent total laryngectomy.)

national Conference of Otolaryngology in 1961 that he had obtained 35 per cent. 5-year survivals for supraglottic cancer by partial laryngectomy alone in over 100 cases. However, it is probably the satisfactory results being obtained by Ogura and his co-workers of St. Louis, using their highly sophisticated techniques combined with elective neck dissection that have most greatly stirred our interest in the last 5 years. They have recently reported an 86 per cent. 2-year and 75 per cent. 5-year absolute survival rate in a small series of supraglottic tumours treated primarily

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by the partial horizontal operation with preservation of function (Ogura and Mallen, 1965). If maintained this can seriously challenge the results of treating these tumours by total laryngectomy and represents a great improvement on treatment by primary irradiation which for epiglottic cancer gives a disappointing cure rate of about 20–25 per cent. Norris, also in North America, has demonstrated the value of both the extended vertical operation and the supraglottic horizontal procedure, with minimum complications and a good survival rate providing strict indications are observed (Norris, 1958 and 1959). An important point made by this author is that about half of the few failures due to local recurrence can be salvaged successfully by total laryngectomy.

Personal Experience

For reasons already stated in regard to the traditional philosophy of treating laryngeal cancer in this country, I have personally carried out very few of these procedures. They comprise a small total of 21 laryngofissures, of which two were for benign tumours and eight followed irradiation. Also five supraglottic partial laryngectomies, of which four followed irradiation, and two extended frontolateral partial laryngectomies both after irradiation. All were one stage procedures. There were no especial complications among the laryngofissures, normal swallowing was resumed early, although healing was a little slower in the post-irradiation group.

The single primary one stage supraglottic laryngectomy also did well, being decannulated in 1 week and discharged home in 3 weeks. However, of the other four following irradiation, two required total laryngectomy after 3 months complete inability to swallow fluids. Another eventually managed to regain his swallow after 6 weeks, but still complains about difficulty in swallowing although he maintains his weight. The last of these cases underwent an extensive resection including the whole hyoid bone, epiglottis and pre-epiglottic space but was decannulated and swallowing normally 12 days after surgery.

The two extended frontolateral partial resections both followed irradiation and although all was well eventually, normal swallowing was not restored for 4 and 10 weeks respectively. We have still been unable to decannulate the last of these due to persistent œdema even after 3 months. No complications such as perichondritis, stenosis or fistulae have so far been encountered.

Conclusion

The position in this country is certainly clearer in respect to the vertical procedures. In treating cordal cancer of Stage I, many Stage II

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and even in some early Stage III cases there is little doubt but that teleradiation is the best initial therapy. If this fails then I think there is much to be said for the use of vertical partial resections although in the extended procedures, rehabilitation may prove troublesome. In late Stage III or IV tumours of the cords where hemilaryngeal involvement with fixation and probable subglottic spread has occurred I would consider partial resection too risky and would advocate total laryngectomy with elective neck dissection in most cases.

Supraglottic tumours are usually more advanced when first seen, tend to metastasize earlier, often to both sides, and, except those in Stage I which are uncommon, they do not do well with irradiation. If this fails, the position is difficult to assess with accuracy owing to œdema and radiation reaction, so that total laryngectomy often appears obligatory. Also it is likely that horizontal partial resections may give high complication rates after irradiation which are frequently distressing and persistent.

However, in view of the good results now being obtained by some experienced surgeons in epiglottic and vestibular cancer of Stage I, II and even III using the horizontal supraglottic operation, I feel that there is certainly a real case for this technique to be used more frequently as initial therapy. This is given greater emphasis by the known poor results of primary irradiation for most of these tumours, especially those of the epiglottis excepting the tip (Shaw, 1959). The operation can easily be combined with radical neck dissection, and even if unsuccessful, it may allow the patient a second chance by total laryngectomy.

There is no doubt that some of these procedures are technically difficult, indications must be very precise and clinical judgment is exacting. Ideally therefore they should be carried out in the larger centres.

Equally, it must be clear that where skilled teleradiation is available, there is today no valid excuse for primary laryngofissure in the majority of cases of cordal cancer. This operation should be reserved chiefly for the small minority that fail to respond to irradiation.

Acknowledgments

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REFERENCES

ALONSO, J. M. (1947) *Trans. Amer. Acad. Ophthal. Otolaryng.*, **51**, 633.
——— (1966) *Laryngoscope* (*St. Louis*), **76**, 161.
FALBE-HANSEN, J. (1955) *J. Laryng.*, **69**, 255.
——— and SVANE-KNUDSEN, V. (1964) *J. Laryng.*, **78**, 1.
GLUCK, T. and SOERENSEN, J. (1913) *In* Handbuch der speziellen Chirurgie des Ohres und der oberen Luftwege, edited by L. Katy, H. Preysing and F. Blumenfeld. Würzburg. Vol. **4**, p. 1.
HAUTANT, A. (1936) *Z. Hals-, Nas.- u. Ohrenheilk.*, **40**, 15.
LEDERMAN, M. (1961) *Ann. Radiol.*, **4**, 433.
LEROUX-ROBERT, J. (1956) *Ann. Otol.* (*St. Louis*), **65**, 137.
——— (1961) Rapports II du VII[e] Congrès international d'Oto-Rhino-laryng. In *Fortschr. Hals-nas,-Ohrenheilk.*, Fasc., **9**, p. 44.
LEWIS, R. S. (1961) *J. Laryng.*, **75**, 794.
NORRIS, C. M. (1958) *Laryngoscope* (*St. Louis*), **68**, 1240.
——— (1959) *Ann. Otol.* (*St. Louis*), **68**, 487.
OGURA, J. H. and DEDO, H. H. (1965) *Laryngoscope* (*St. Louis*), **75**, 865.
——— and MALLEN, R. W. (1966) Personal communication.
———, SALTZSTEIN, S. L. and SPJUT, H. J. (1961) *Laryngoscope* (*St. Louis*), **71**, 258.
ORMEROD, F. C. (1958) *Acta oto-rhino-laryng. belg.*, **12**, 527.
PORTMANN, G. and ROBIN, J. L. (1951) *Rev. Laryng. Bordeaux*, **72**, 1.
——— *et al.* (1939) A treatise on surgical technique of otorhinolaryngology. Baltimore.
PRESSMAN, J. J. (1956) *Ann. Otol.* (*St. Louis*), **65**, 766.
——— and SIMON, M. B. (1961) *Laryngoscope* (*St. Louis*), **71**, 1019.
SHAW, H. J. and EPSTEIN, S. S. (1959) *Cancer* (*Philad.*), **12**, 246.
SOERENSEN, J. (1930) Die Mund- und Halsoperationen. Berlin. pp. 107–270.
WILSON, C. P. (1961) *J. Laryng.*, **75**, 785.

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