

## The Groningen valve voice prosthesis in Sheffield: a 4-year review

A. J. PARKER, Ch.M., F.R.C.S., I. K. O'LEARY, M.C.S.T., R. G. WIGHT, F.R.C.S., R. T. CLEGG, F.R.C.S.

### Abstract

The Groningen valve was first used in Sheffield in 1986 in a patient who underwent laryngectomy for malignant disease. Since then a further 21 patients have made use of this device, 17 of whom underwent insertion at the time of surgery. All patients were male, two patients have since died and the median length of follow-up to date has been 22.0 (range 2–41) months.

Prostheses were replaced mainly under general anaesthesia if they leaked or resulted in difficult phonation. A total of 73 valve insertions have been performed with a median time of 4.0 (range 0.25–27) months between each. Of the 15 men in whom the prosthesis is currently in use, speech was generally good–excellent.

The Groningen valve provides a highly acceptable means of obtaining vocalization after laryngectomy in the patients in this series.

### Introduction

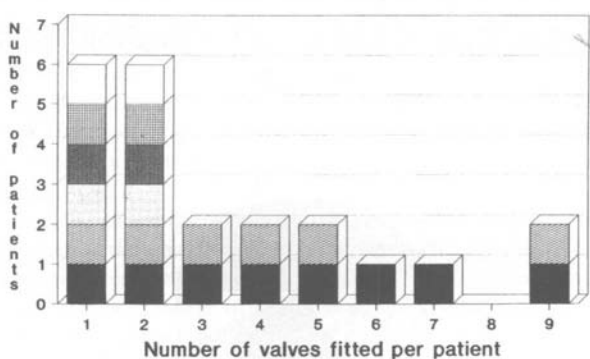
The rehabilitation of vocal function following laryngectomy is one of the greatest challenges in laryngology. There have been numerous attempts in the past dating from 1874 when Gussenbauer attempted to restore speech in a patient whose larynx had been removed by Bilroth (Dworkin and Sparker, 1980). There are essentially three main methods of restoring phonation. The first is an artificial larynx which takes the form of an electric pharyngeal speech vibrator that is applied externally to the neck. An alternative and less popular arrangement consists of a reed box connected to the tracheostome with an outlet tube introduced into the mouth. The vibrating air pulses are then articulated in to words using the lips and tongue (Edwards, 1974). Dental plate vibrators which remain intra orally have also been devised (Stell and Maran, 1978). Secondly, patients can be taught to use a pseudo-whisper where air is sucked into the buccal cavity by the facial muscles and as the air escapes articulation takes place by the mouth and tongue. The third means of voice production is that of oesophageal vocalization. Prior to phonation the patient swallows air, and using the oesophagus as a reservoir this is passed back out in a controlled fashion causing vibration of the pharyngo-oesophageal segment. Oesophageal vocalization tends to be rather limited in its duration, and because the patient has to

plastic valve has recently been introduced by Blom and Singer with good results (Blom and Singer, 1979). We have been using a direct descendant of this, the Groningen valve for four years and have been the only major centre in this country to do so on a widespread basis.

The Groningen valve (Fig. 1) is designed to be self-retaining and requires no maintenance by the patient (Nijdam *et al.*, 1982; Mathieu, 1987) which are its main advantages over the Blom-Singer valve. It is a biflanged device made of silicone plastic which operates at a higher pressure than the earlier Blom-Singer prosthesis. We have considered all of our patients undergoing total laryngectomy for the use of this device, with preference given to primary placement at laryngectomy rather than delayed or secondary insertion. It is interesting that no women have taken up the offer of voice restoration in this manner. As the major centre in this country using this device, we present a review of those patients who have used this device over the last four years, since the first was used in October 1986.

### (1) Patient population

The Groningen valve has been used to date in 22 male patients with a mean age at insertion of 60.0 (range 42.0–80.0) years. Seventeen patients underwent primary valve insertion and in five the prosthesis was inserted at a later date. The median length of follow-up to date has been 21.5 (range 2.0–41.0) months with a median time from first insertion of 29.0 (range 2.0–45.0) months. Two patients have since died, both of carcinoma of the bronchus presenting as a second primary. A further three have been lost to follow-up and two have had their fistulae closed surgically because of recurrent leakage. Fifteen patients were thus in current clinic attendance and results of speech therapy assessments will be presented in this group.



Department of Otolaryngology—Head and Neck Surgery, Royal Hallamshire Hospital, Glossop Road, Sheffield, England.  
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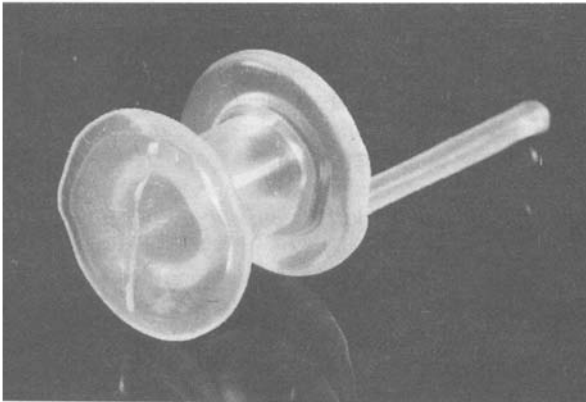


FIG. 1

**(2) Tumour statistics**

The majority of the patients had their larynx removed for squamous cell carcinoma. Most were glottic in origin and stage T<sub>3</sub> at diagnosis. (Figs. 2 & 3). Over half had no clinical evidence of nodal metastasis. The majority received simple total laryngectomy. A radical neck dissection was combined if there were mobile nodes also present and partial pharyngectomy was also performed with direct repair if the tumour had involved the pharynx (Fig. 4). In each case surgery was deemed to be curative. Ten had received pre-operative radical radiotherapy and 12 had been treated by primary surgery, two of whom have had subsequent radical radiotherapy for local recurrence.

**(3) Valves used**

A total of 73 valves have been fitted in the study period. The majority were the 7.0 mm size which we have found to be of suitable size for most patients. Almost all were replaced for either leakage or increasing effort of phonation as the valve became 'stiff' (Table I). Three valves were inserted because the previous prosthesis had disappeared. Subsequent investigation failed to demonstrate their whereabouts including the tracheo-bronchial tree. The majority of patients have required one or two valves but some have needed up to nine devices to maintain satisfactory vocalization (Fig. 5). The median time from insertion to replacement was 4.0 (range 0.25–27.0) months and of the total number of valves used 54 have been replaced, 16 are still in situ, and three were never recovered as has been discussed earlier.

**TUMOUR SITE AT DIAGNOSIS**  
n = 22

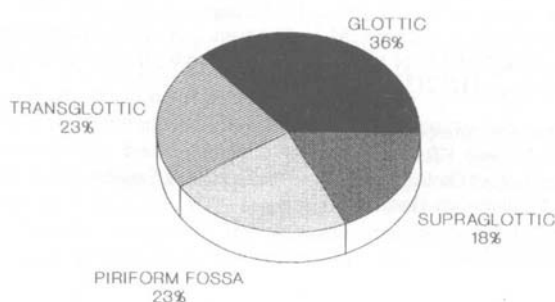


FIG. 2

**TABLE I**  
REASON FOR VALVE CHANGE OF REMOVAL

n = 54	
Leakage	31
Increased effort to speak	19
Good oesophageal voice	2
No speech	2

**(4) Speech assessment**

Of the 15 patients in regular clinic attendance, the speaking ability of nine was studied. Six were excluded because of the following reasons: two were undergoing further treatment for their initial malignant disease, two were unable to attend due to other illness and two had valves inserted for less than eight weeks and were not yet able to use them for speech.

We have presented a detailed appraisal with respect to valved speech in this population using naive listeners documenting speech acceptability and intelligibility in a previous study (O'Leary *et al.*, 1991). In the present report assessments of acceptability were made using a continuous scale of between 1–7, with one representing no speech and seven representing excellent speech. Essentially this was a subjective judgement made with respect to pitch, fluency, rate, intelligibility, expressiveness and vocal quality. Each patient so studied was assessed by the same listeners using 'free' conversational speech and that from a series of standard passages. Patients were contacted by telephone or letter requesting them to report for this assessment on a random basis so as to offset bias which may be introduced by seeing them, for example, immediately before or after new valve insertion had been performed.

The median score was 4.6 (range 3.2–6.8) which compares favourably with a similar uncontrolled analysis of the Blom-Singer valve (Tardy-Mitzell *et al.*, 1985).

**Discussion**

The Groningen valve has distinct advantages over oesophageal speech and the Blom-Singer voice prosthesis, which tends to be the most frequently used valve in this country. The duration of valved speech is limited to the phases of respiration in the same way as normal phonation and tends not to be restricted to one or two words or brief sentences as with oesophageal speech. The speech quality of the patients in our group has been assessed and generally found to be good–excellent. Several of them have continued in professional

**TUMOUR STAGE AT DIAGNOSIS**  
n = 22

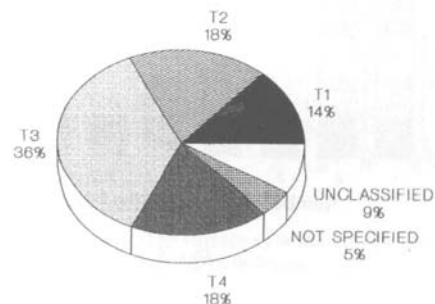


FIG. 3

## FIRST OPERATION

n = 22

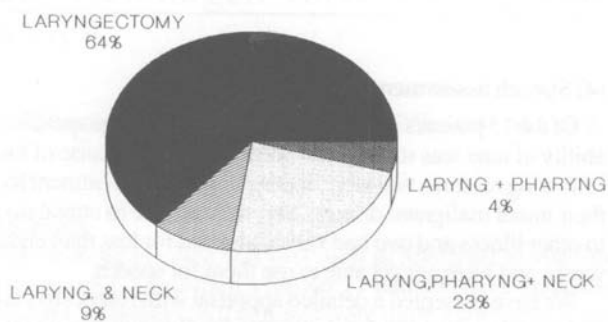


FIG. 4

employment relying on the valve to give them acceptable speech to retain their managerial and technical posts. Our previous detailed speech studies (O'Leary *et al.*, 1991) have shown the Groningen valve to assist in the production of speech which is of comparable quality to that produced by the Blom-Singer prosthesis, and superior to oesophageal vocalization itself. Its disadvantages include the use of the hand to occlude the stoma, the risk of leakage with its associated complications and the need for periodic changing.

Whilst the Blom-Singer device is primarily patient serviced, the Groningen prosthesis has been designed for only occasional attention by the surgeon.

The results of our retrospective study compare favourably with a recent report from Nijmegen, The Netherlands where the valve was first used, although our patient population is somewhat smaller. Manni and Van den Broek (1990) present a retrospective study of 132 patients with a mean age of 61 years, the majority of whom were men. Data concerning the first valve insertion only was presented as the majority of patients underwent insertion as a primary procedure. In our series, 45.5 per cent had received pre-operative radiotherapy but this percentage was higher from The Netherlands (72.7 per cent). Prosthesis related complications were of the order of

## VALVES FITTED PER PATIENT

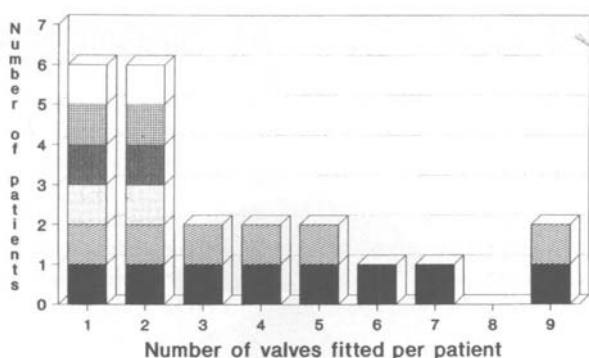


FIG. 5

28 per cent and these were most often related to granular formation around the device. It is also of interest in that three valves in the Dutch series also disappeared without trace.

The vast majority of valve changes in this series have been performed with the patient under general anaesthesia for either leakage or increased effort of speech. There is no real reason having mastered the technique, why this cannot be accomplished under local anaesthetic in the clinic as it is abroad (Manni and Van den Broek, 1990). This would offset the need for admission, time in hospital and the mortality and morbidity associated with general anaesthesia. This highly cost effective procedure has so far been performed twice in our outpatient clinic without problems.

The Groningen valve has much to recommend it. Patients who use it are generally pleased that it does not require maintenance on their part and are familiar with the open access clinic system that we run when the valve starts to fail. There is, however, scope for improvement. A valve with similar properties, but which opens at a lower pressure and has a lower forward resistance would be desirable. Further studies are needed to determine a means of predicting speaking ability from parameters which can be determined prior to valve insertion.

### Acknowledgements

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Address for correspondence:

Mr R. T. Clegg, FR.C.S.,  
Department of Otolaryngology—Head and Neck Surgery,  
Royal Hallamshire Hospital,  
Glossop Road,  
Sheffield S10 2JF.

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