*The Journal of Laryngology & Otology (2013)*, ***127***, *773–779*.

doi:10.1017/S0022215113001485

**MAIN ARTICLE**

# Voice rest after vocal fold surgery: current practice and evidence

A C COOMBS, A J CARSWELL, P A TIERNEY

*Department of Otolaryngology, Southmead Hospital, Westbury-on-Trym, Bristol, UK*

## Abstract

*Objective*: Voice rest is commonly recommended after vocal fold surgery, but there is a lack of evidence base and no standard protocol. The aim of this study was to establish common practice regarding voice rest following vocal fold surgery.

*Method*: An online survey was circulated via e-mail invitation to members of the ENT UK Expert Panel between October and November 2011.

*Results*: The survey revealed that 86.5 per cent of respondents agreed that 'complete voice rest' means no sound production at all, but there was variability in how 'relative voice rest' was defined. There was no dominant type of voice rest routinely recommended after surgery for laryngeal papillomatosis or intermediate pathologies. There was considerable variability in the duration of voice rest recommended, with no statistically significant, most popular response (except for malignant lesions). Surgeons with less than 10 years of experience were more likely to recommend fewer days of voice rest.

*Conclusion*: There is a lack of consistency in advice given to patients after vocal fold surgery, in terms of both type and length of voice rest. This may arise from an absence of robust evidence on which to base practice.

**Key words:** Laryngoscopy; Voice; Postoperative Care

## Introduction

Vocal fold pathologies are commonly seen in ENT practice, ranging from benign conditions such as nodules, polyps and granulomas, to malignant lesions. Although medical management, behaviour modification and speech therapy play a role in the management of some of these conditions, surgery is often necessary. In the UK, in the year 2010–11, over 6500 therapeutic microlaryngoscopy procedures were performed for such pathologies.[1]

Voice rest is commonly recommended after vocal fold surgery as it is thought that this optimises healing of the vocal fold mucosa and improves postoperative voice quality. Although this is common practice, few clinical studies have investigated the effects of voice rest after surgery, and this lack of evidence means that there is no established standard protocol for voice rest amongst surgeons.[2] The textbook *Scott-Brown's Otorhinolaryngology, Head and Neck Surgery* concedes that there is only level D evidence of the 'generally accepted rule' of 48 hours of complete voice rest post microlaryngoscopy, followed by 10 days of relative rest.[3]

It is important to consider the psychological and economic implications of voice rest. Adhering to voice rest can have a significant impact on patients' quality of life, leaving them feeling frustrated, socially isolated and unable to work, which in turn leads to poor compliance.[4] Persistent dysphonia or disease recurrence post-operatively can have similar negative effects on quality of life and inability to work, and may require further interventions or surgery.

A survey was distributed to ENT UK Expert Panel members in order to establish common practice regarding voice rest post vocal fold surgery, and to evaluate this information as a precursor to setting up a randomised controlled trial.

## Materials and methods

### *Survey design*

A seven-question survey was designed and circulated via e-mail invitation to members of the Expert Panel of ENT UK, the British Association of Otolaryngologists Head and Neck Surgeons, between October and November 2011. The ENT UK Expert Panel comprises doctors who are current members of ENT UK, who have opted-in to receive survey questionnaires that have been edited and approved by the ENT UK Survey Guardian. There are over 300 members of the Expert Panel, and members receive

Accepted for publication 12 December 2012 First published online 18 July 2013

Continuous Professional Development credits for completing questionnaires. The questions in the survey were multiple-choice and there was space for further comments after many of the questions.

Firstly, clarification of the definitions of two terms commonly used in the context of voice rest, 'complete' and 'relative' voice rest, was attempted. The expert panel was asked whether or not they agreed with the statement that 'complete voice rest means avoiding absolutely all sound production' and were asked how they defined 'relative voice rest'.

Although several factors may influence the advice given after surgery, the type of vocal fold lesion operated on is significant in determining the type and length of post-operative voice rest recommended. Therefore, five categories of different vocal fold pathologies were presented to the expert panel: benign lesions (nodules, cysts or polyps), laryngeal papillomatosis, granulomas, intermediate pathologies (carcinoma in situ, leukoplakia or dysplasia) and malignant lesions. The expert panel was asked about the type and duration of voice rest they routinely recommended post-operatively for these five categories.

The respondents were asked about their number of years of ENT experience and if they had a sub-specialty interest.

### *Statistical analysis*

The data were analysed using the Statistical Package for the Social Sciences (version 19) software and R software (version 2.14.0). The Pearson chi-square test was used to test for associations between both sub-specialty of ENT surgeon and number of years of experience, and the following: agreement with the definition of 'complete voice rest,' type of voice rest recommended and length of voice rest recommended. The odds ratio of likelihood of agreement with the definition of 'complete voice rest' and number of years of experience was also calculated. For type of voice rest recommended, a nominal regression analysis was used to generate $p$ values to determine whether the most popular response was statistically greater (significantly more popular) than the next most popular choice for each category of vocal fold pathology. Ordinal regression analysis was used to examine differences in the length of voice rest recommended. Significance was defined as $p < 0.05$.

## Results and analysis

Two cycles of distribution via e-mail yielded 172 respondents to the survey out of a total of 361 invitations sent (47.7 per cent response rate). Over 75 per cent of the respondents had more than 10 years of experience of ENT surgery.

### *Definition of 'complete voice rest' and 'relative voice rest'*

The survey revealed that 86.5 per cent of respondents agreed that 'complete voice rest' means absolutely no sound production at all. There was no significant

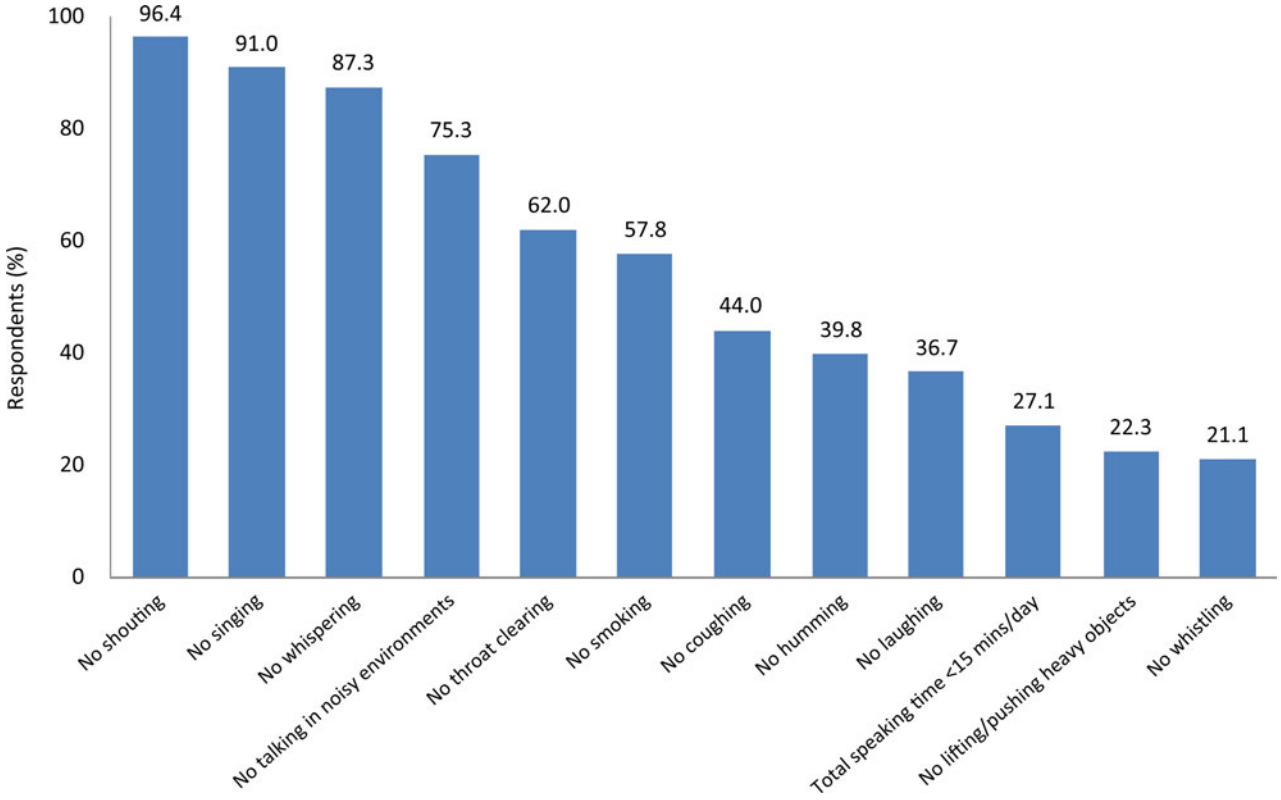


FIG. 1
Responses regarding the definition of 'relative voice rest' (what it encompasses).

https://doi.org/10.1017/S0022215113001485 Published online by Cambridge University Press

association between sub-specialty and agreement or disagreement with this statement (Pearson chi-square test, $p = 0.594$). There was no statistically significant association between number of years of experience and response using the Pearson chi-square test ($p = 0.072$). The calculation of odds ratios showed that respondents with fewer than 10 years of experience were 3.9 times more likely to agree with the statement compared with those with more than 15 years of experience (95 per cent confidence intervals: 0.85, 17.97).

There was variability in terms of how respondents defined 'relative voice rest', and eight respondents said that they did not use or recognise the term. There was considerable consensus that 'relative voice rest' encompassed the following: no shouting (96.4 per cent), no whispering (87.3 per cent), no singing (91.0 per cent) and no talking in noisy environments (75.3 per cent). However, there was a lack of agreement about the remaining suggestions as to whether or not they were included in the respondents' definitions of 'relative voice rest' (Figure 1). Many respondents also commented that they have their own 'relative voice rest' regimes with other specific criteria; for example, no talking on the telephone, only 5 minutes of speech per hour and not speaking to anyone who is 'more than an arm's length away'.

*Type of voice rest recommended*

For all of the categories of vocal fold pathology apart from malignant lesions, relative voice rest was the

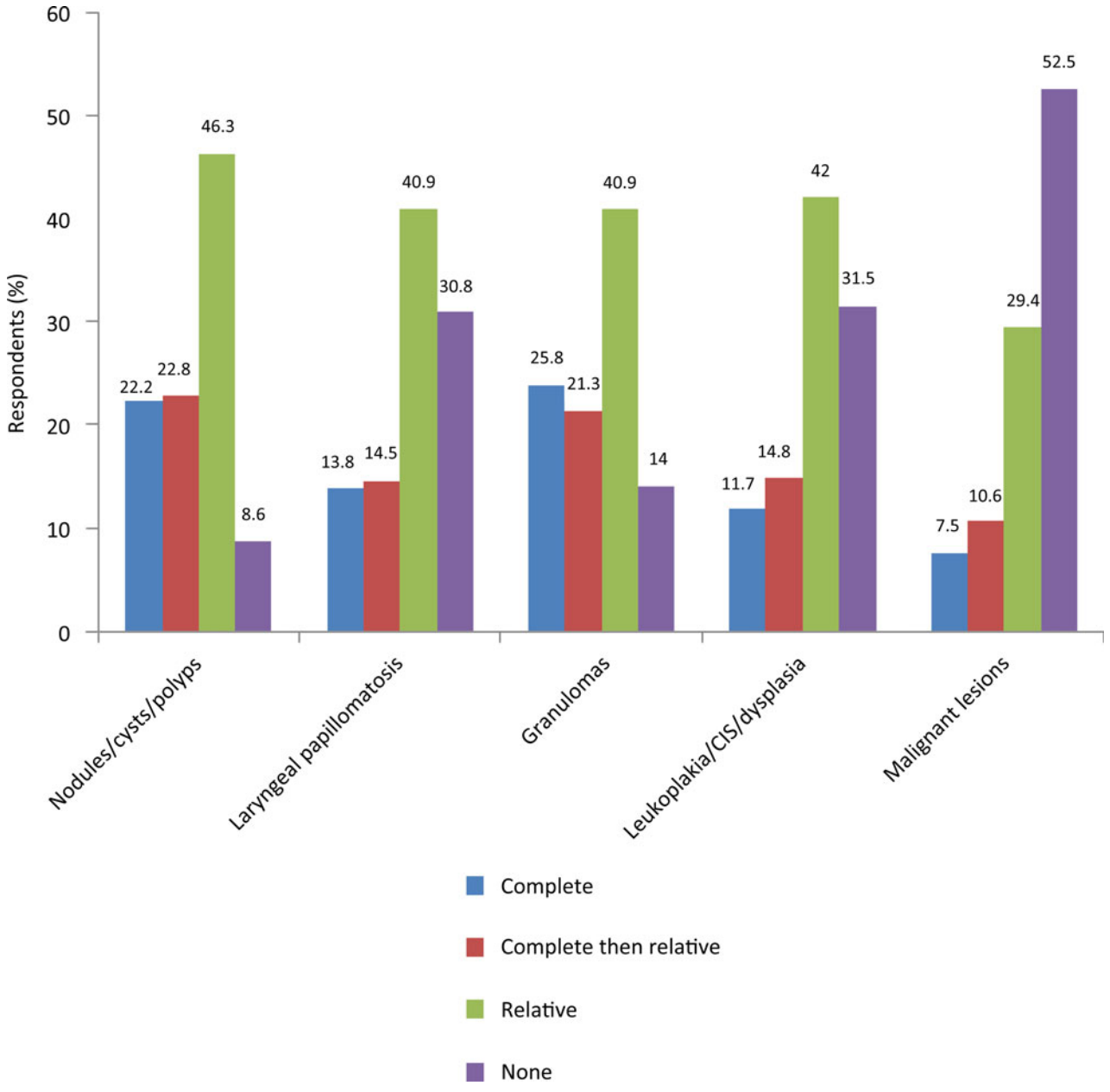


FIG. 2

Responses regarding the voice rest type routinely recommended after surgery for different types of vocal fold lesions. CIS = carcinoma in situ

https://doi.org/10.1017/S0022215113001485 Published online by Cambridge University Press

most common advice given, recommended in over 40 per cent of patients (Figure 2). Following surgery for papillomatosis and intermediate pathologies, nearly a third of respondents (30.8 per cent and 31.5 per cent respectively) did not recommend any voice rest. For malignant lesions, over half of the respondents (52.5 per cent) did not routinely advise any voice rest, but 12 respondents (7.5 per cent) recommended complete voice rest.

The $p$ values calculated by nominal regression showed that, for benign lesions, granulomas and malignant lesions, the most common response was significantly more popular than the next most common response ($p < 0.001$, $p = 0.007$ and $p = 0.001$ respectively). However, for laryngeal papillomatosis, the number of doctors recommending relative voice rest (40.9 per cent) was not significantly greater than the number who recommended no voice rest (30.8 per cent) ($p = 0.135$). There was also no significant difference between the percentages of respondents recommending relative or no voice rest for intermediate pathologies ($p = 0.120$).

For all types of vocal fold pathology, there was no significant association between the type of voice rest recommended and either the sub-specialty of the ENT surgeon or their number of years of experience (Pearson chi-square test, Table I).

TABLE I
ASSOCIATIONS BETWEEN VOICE REST ADVICE, AND SUB-SPECIALTY AND EXPERIENCE

| Vocal fold lesion | Associations | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Voice rest type & sub-specialty | | | Voice rest type & experience | | | Voice rest dur & sub-specialty | | | Voice rest dur & experience | | |
| | Resp ($n$) | Pearson $\chi^2$ | $p$ | Resp ($n$) | Pearson $\chi^2$ | $p$ | Resp ($n$) | Pearson $\chi^2$ | $p$ | Resp ($n$) | Pearson $\chi^2$ | $p$ |
| Nodules, cysts, polyps | 144 | 4.593 | 0.597 | 160 | 3.503 | 0.744 | 126 | 7.558 | 0.272 | 142 | 14.864 | 0.021* |
| Laryngeal papillomatosis | 142 | 8.403 | 0.210 | 157 | 9.813 | 0.133 | 97 | 13.382 | 0.037* | 107 | 11.269 | 0.080 |
| Granulomas | 145 | 8.768 | 0.187 | 162 | 9.630 | 0.141 | 120 | 10.009 | 0.124 | 135 | 14.862 | 0.021* |
| Leukoplakia, CIS, dysplasia | 144 | 10.275 | 0.114 | 160 | 7.378 | 0.287 | 97 | 8.511 | 0.203 | 105 | 13.019 | 0.043* |
| Malignant lesions | 143 | 7.570 | 0.271 | 158 | 11.385 | 0.077 | 68 | 10.419 | 0.108 | 74 | 16.559 | 0.011* |

*Indicates significance, $p < 0.05$. Dur = duration; resp = responses; CIS = carcinoma in situ

*Length of voice rest recommended*

For all five categories of vocal fold pathology, 1–2 days was the most commonly advised length of post-operative voice rest, recommended by over a third of respondents, but over 7 days of rest was advised by many surgeons (Figure 3). The $p$ values calculated by ordinal regression showed that for all categories (except malignant lesions), the proportion of surgeons recommending 1–2 days of rest was not significantly greater than the next most popular response (benign lesions $p = 0.102$, papillomatosis $p = 0.227$, granulomas $p = 0.140$ and intermediate pathologies $p = 0.055$). For malignant lesions, the 44 per cent response rate for 1–2 days of post-operative voice rest was significantly greater than the 24 per cent response rate for 3–5 days of voice rest ($p = 0.039$).

For all types of vocal fold pathology except papillomatosis, there was a statistically significant association between the number of years of experience and the recommended length of voice rest; surgeons with less than 10 years of experience were more likely to recommend fewer days of voice rest ($p$ values calculated using Pearson chi-square test; Table I). There was no significant association between the sub-specialty of the surgeon and the length of voice rest recommended, except for laryngeal papillomatosis ($p = 0.037$ using the Pearson chi-square test); head and neck surgeons were more likely to recommend fewer days of voice rest for this disease.

https://doi.org/10.1017/S0022215113001485 Published online by Cambridge University Press

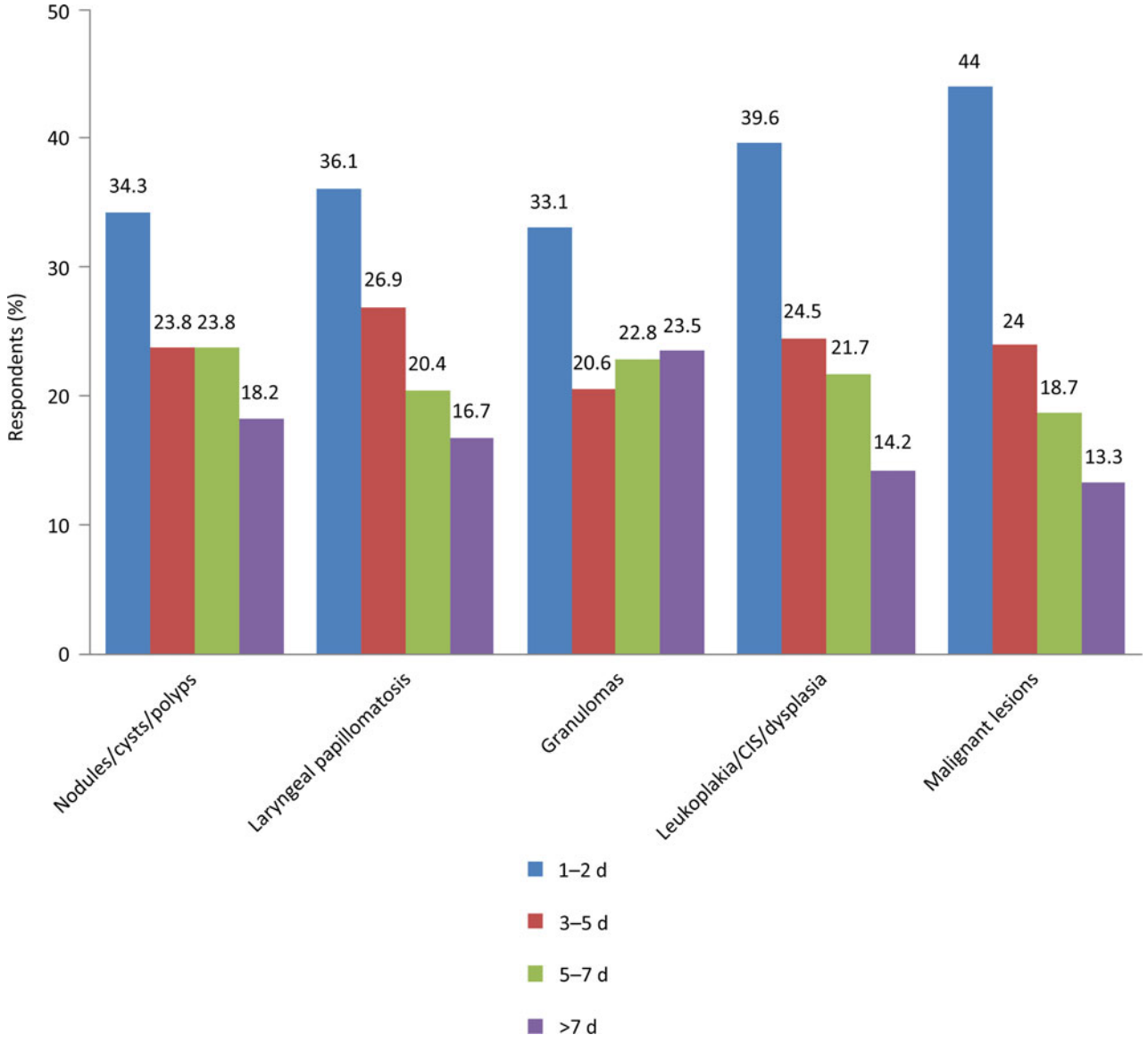


FIG. 3

Responses regarding the total voice rest duration routinely recommended after surgery for different types of vocal fold lesions (if applicable). CIS = carcinoma in situ; d = days

## Discussion

### *Synopsis of key findings*

The results of the survey confirmed that there is a lack of consistency in advice given to patients after vocal fold surgery, in terms of both the type and length of voice rest. The fact that there was no statistically most popular response for the recommended duration of voice rest for all pathologies except malignant lesions indicates a lack of consensus. In addition, there was no significantly most common choice for the recommended type of voice rest after surgery for laryngeal papillomatosis or intermediate pathologies, again reflecting a variation in practice. Although the percentages of respondents advising 'relative voice rest' after surgery for simple, benign lesions and granulomas were significantly greater than the percentages for other types of voice rest, there was variability in how surgeons defined 'relative voice rest', which again suggests that there will be variation in the advice given to patients. Surgeons with fewer years of experience were more likely to agree that 'complete voice rest' means no sound production at all, and they recommended fewer days of voice rest in comparison with more experienced surgeons.

### *Strengths and weaknesses of the study*

To our knowledge, this is the first survey of voice rest after vocal fold surgery amongst UK ENT surgeons, and there was a good response rate (47.7 per cent). However, the survey only reflects what is recommended to patients, and does not address patient compliance or post-operative voice quality. The

https://doi.org/10.1017/S0022215113001485 Published online by Cambridge University Press

survey did not ask about other factors which may influence post-operative voice rest advice, such as the extent of resection, steel versus laser technique or patient characteristics. Of particular note, we did not ask about the location of the lesion, which is a factor that can significantly affect post-operative advice, with longer periods of rest being recommended for lesions involving the free edge of the vocal fold, in comparison with lesions on the superior surface.

*Comparisons with other studies*

A survey of 1208 otolaryngologists in the US by Behrman and Sulica demonstrated similar inconsistencies in post-operative advice to those highlighted in the UK in this survey.[2] In that study, doctors were asked about routine practice following surgery for nodules, cysts and polyps, which revealed that 51.4 per cent favoured a period of complete voice rest, but 15 per cent did not recommend any type of voice rest post-operatively (compared with 45.0 per cent and 8.6 per cent respectively in our survey). The duration of voice rest reported in the study by Behrman and Sulica ranged from 1 to 21 days post-operatively, with 7 days being the most common duration (in comparison with 1–2 days in this survey).

The variation in post-operative advice demonstrated by both surveys is a reflection of the lack of clinical trials and evidence on this topic. There are only two published clinical studies in humans that describe the role of voice rest in recurrence and healing after vocal fold surgery, and both studies have limitations.

Koufman and Blalock conducted a retrospective review of 127 patients who had undergone microlaryngeal surgery for a variety of conditions (nodules, polyps, cysts, granulomas, Reinke's oedema, leukoplakia and carcinoma in situ).[5] Twenty-six per cent of those patients had been recommended complete voice rest following surgery and the remainder were recommended relative voice rest, with varying periods for both types of voice rest. Persistent dysphonia lasting longer than 4 weeks post-operatively occurred in 27 per cent of the patients who had been advised to completely rest their voices, in comparison with 41 per cent of the relative voice rest group, but this difference was not statistically significant. This led the authors to conclude that relative voice rest was as effective as absolute voice rest in preventing post-operative dysphonia. The only statistically significant factors conferring protection from dysphonia were pre-operative voice therapy and good patient compliance, with gender, smoking and surgical technique having no influence. However, the conclusions that can be drawn from that study are limited due to the fact that there was varying patient compliance in both groups. In addition, the assignment of patients to voice rest groups (relative *vs* complete voice rest) was not randomised, and the criteria for this assignment were not specified.

A prospective study of 10 patients undergoing removal of unspecified vocal fold lesions by Baker *et al.* similarly did not find a significant correlation between post-operative voice use (including abusive voice behaviour) and persistent hoarseness.[6] However, the interpretations of these findings are again restricted by: the limited patient numbers, the lack of randomisation of patients, the lack of information about the specific vocal fold conditions being treated and the subjectivity of the assessment of hoarseness.

A prospective study by Rousseau *et al.* addressed the impact of voice rest on patients' quality of life and examined patient compliance.[4] They studied 84 patients undergoing voice rest for a variety of pathologies (of whom 59 were post-operative patients). The duration of voice rest ranged from 3 to 28 days, with no comments made about the type of voice rest prescribed. They found that voice rest adversely affected patients' quality of life, with longer periods of rest exacerbating this effect. During voice rest, about half of the patients were unable to work. Patients felt frustrated, had difficulties communicating and had less interaction with others. In addition, self-reported compliance was low at 34.5 per cent.

A review of the literature by Ishikawa and Thibeault demonstrates that although there is a lack of clinical studies, there are other forms of research and evidence that may be applicable to the examination of voice rest after vocal fold surgery.[7]

There has been extensive research into exercise versus rest on connective tissue healing in orthopaedic literature, with recent orthopaedic studies indicating that mobilisation improves functional recovery after ligament damage.[8,9] However, these findings cannot be directly extrapolated to the vocal fold due to the significant differences between the structure and constituents of ligament and the lamina propria of the vocal fold.[8]

Animal models have been used to study the wound healing process in the vocal fold, and the effect that mechanical stress and phonation can have on this process. The literature on vocal fold wound healing, which includes studies in canine, rat and rabbit models, demonstrates that collagen production begins and re-epithelialisation occurs between 5 and 7 days post injury,[10–12] prompting the suggestion that voice rest should last this long. A canine model used by Gray and Titze showed excessive phonation to be detrimental to the vocal fold, with 4–6 hours of artificially-induced phonation causing destruction of the basement membrane and lamina propria.[13] A study in dogs by Cho *et al.* simulated voice rest and phonation after surgery, and concluded that voice rest promotes the restoration of normal vocal fold tissue after surgery.[10] However, the extrapolation of data from animal models of vocal fold healing is limited by the differences in vocal fold structure between animals and humans.

https://doi.org/10.1017/S0022215113001485 Published online by Cambridge University Press

- **Voice rest is commonly recommended after vocal fold surgery, but there is no standard protocol**
- **Voice rest may benefit healing of the vocal fold, but can have a negative impact on patients' quality of life**
- **There is little evidence on which to base advice regarding post-operative voice rest**
- **This survey of UK ENT surgeons indicated a lack of consistency in advice given to patients after vocal fold surgery**
- **More research is required to establish evidence-based guidelines for voice rest post vocal fold surgery**

More recent *in vitro* research has demonstrated that cells in the vocal fold are responsive to mechanical stress. Induced phonation in rabbit vocal folds has been shown to increase the expression of genes in the biochemical pathways that are involved in the maintenance of vocal fold connective tissue.[14] Changes in gene expression in response to mechanical stress have also been demonstrated in human vocal fold fibroblasts (Titze *et al.*[15]) and in human dermal fibroblasts (Kutty and Webb[16]). Such research suggests that phonation regulates the extracellular matrix of the vocal fold connective tissue, and may have a role to play in vocal fold healing and remodelling. Further research is required in order to understand how the frequency and intensity of mechanical stress affects this process.

## Conclusion

Voice rest is commonly advised after vocal fold surgery with the aim of improving post-operative results. However, this survey shows that there is great variation in terms of the type and duration of voice rest recommended by ENT surgeons. This lack of a standard protocol is due to the fact that there are no clinical studies from which substantial conclusions can be made. The rest of the literature does not provide any convincing evidence on which to base practice. The orthopaedic literature supports early mobilisation to aid healing, but these findings may not be applicable to the vocal fold tissues. Animal studies of vocal fold healing highlight the detrimental effects of uncontrolled voice use, but *in vitro* research shows that phonation contributes to the remodelling of the vocal fold matrix and may perhaps aid repair.

The variation in practice shown in this survey indicates that more research into the effects of voice rest after vocal fold surgery is required in order to establish evidence-based standards of care for these patients and optimise post-operative voice quality, whilst taking into consideration the psychological effects of voice rest.

## Acknowledgement

We acknowledge the voluntary contribution of ENT UK Expert Panel members, who help to develop knowledge within our specialty by sharing their reflections on practice.

### References

1 Hospital Episode Statistics 2011. In: http://www.hesonline.nhs.uk/Ease/servlet/ContentServer?siteID=1937&categoryID=215 [16 January 2012]
2 Behrman A, Sulica L. Voice rest after microlaryngoscopy: current opinion and practice. *Laryngoscope* 2003;**113**:2182–6
3 Harries M. Phonosurgery. In: Gleeson MJ, ed. *Scott-Brown's Otorhinolaryngology, Head and Neck Surgery*, 7th edn, vol 2. London: Hodder Arnold, 2008;2236–47
4 Rousseau B, Cohen SM, Zeller AS, Scearce L, Tritter AG, Garrett CG. Compliance and quality of life in patients on prescribed voice rest. *Otolaryngol Head Neck Surg* 2011;**144**:104–7
5 Koufman JA, Blalock PD. Is voice rest never indicated? *J Voice* 1989;**3**:87–91
6 Baker BM, Fox SM, Baker CD, McMurry GT. Persistent hoarseness after surgical removal of vocal cord lesions. *Arch Otolaryngol* 1981;**107**:148–51
7 Ishikawa K, Thibeault S. Voice rest versus exercise: a review of the literature. *J Voice* 2010;**24**:379–87
8 Frank CB. Ligament healing: current knowledge and clinical applications. *J Am Acad Orthop Surg* 1994;**4**:74–83
9 Cantu RI, Steffe JA. Soft tissue healing considerations after surgery. In: Maxey L, Magnusson J, eds. *Rehabilitation for the Postsurgical Orthopaedic Patient*, 2nd edn. St Louis: Mosby, 2007;2–10
10 Cho SH, Kim HT, Lee IJ, Kim MS, Park HJ. Influence of phonation on basement membrane zone recovery after phonomicrosurgery: a canine model. *Ann Otol Rhinol Laryngol* 2000;**109**:658–66
11 Branski RC, Rosen CA, Verdolini K, Hebda PA. Acute vocal fold wound healing in a rabbit model. *Ann Otol Rhinol Laryngol* 2005;**114**:19–24
12 Tateya I, Tateya T, Lim X, Sohn JH, Bless DM. Cell production in injured vocal folds: a rat study. *Ann Otol Rhinol Laryngol* 2006;**115**:135–43
13 Gray S, Titze I. Histologic investigation of hyperphonated canine vocal cords. *Ann Otol Rhinol Laryngol* 1988;**97**:381–8
14 Rousseau B, Ge P, French LC, Zealear DL, Thibeault SL, Ossoff RH. Experimentally induced phonation increases matrix metalloproteinase-1 gene expression in normal rabbit vocal fold. *Otolaryngol Head Neck Surg* 2008;**138**:62–8
15 Titze IR, Hitchcock RW, Broadhead K, Webb K, Li W, Gray SD *et al*. Design and validation of a bioreactor for engineering vocal fold tissues under combined tensile and vibrational stresses. *J Biomech* 2004;**37**:1521–9
16 Kutty JK, Webb K. Vibration stimulates vocal mucosa-like matrix expression by hydrogel-encapsulated fibroblasts. *J Tissue Eng Regen Med* 2010;**4**:62–72

Address for correspondence:
Dr A C Coombs,
Bridge House,
Gara Bridge,
Totnes TQ9 7JT, UK

Fax: 01548 821362
E-mail: coombs.alice@googlemail.com

Dr A C Coombs takes responsibility for the integrity of the content of the paper
Competing interests: None declared