FESS, fingers and other things - you are not alone! *

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Abstract

Background: The objectives of the study were: firstly, to determine the prevalence and severity of musculoskeletal symptoms attributed to the use of endoscope or body posture during endoscopic sinus surgery (ESS) among members of the British Rhinological Society (BRS); and secondly, to review the available literature and highlight posture recommendations during ESS.

Methodology: The study design consisted of a cross-sectional survey carried out among members of the BRS. The survey was distributed electronically and data was collected for statistical analysis.

Results: A total of 82 members responded to the questionnaire (22.4%); 78 respondents (94%) answered the main questions in the survey regarding the symptoms attributed to the use of endoscope or body posture during ESS. Fifty-three respondents (64%) completed all 19 questions. 58% and 59% of the 78 respondents reported suffering from pain and stiffness respectively. We found positive correlations between musculoskeletal symptoms and operating in the standing position and musculoskeletal symptoms and age.

Conclusion: This survey reveals a high prevalence of musculoskeletal symptoms, attributed to ESS and body posture during surgery, among the British rhinologists who responded to the survey. ESS is evidently physically demanding on the surgeon with potential personal health hazards. This emphasizes the need to increase awareness among surgeons, familiarize ourselves with good operating posture habits and new ergonomic instruments and to create a drive to change operating theatre culture in an attempt to reduce these health risks.

Key words: endoscopic sinus surgery, ergonomics, musculoskeletal symptoms, survey

Introduction

The benefits of minimally invasive surgery in various surgical specialties are compelling [(1)]. It offers less morbidity, quicker postoperative healing with better cosmetic results as well as a shorter hospital stay. With technological advances, minimally invasive surgery has become the gold standard for many common surgical procedures. Smith et al. estimate that nearly 500,000 surgical procedures are performed annually to treat those with chronic rhinosinusitis in the USA [(2)]. Thorough understanding of complex anatomy and the availability of image-guided navigation systems have pushed the boundaries of endoscopic sinus surgery far beyond what was initially described by Messerklinger and Wigand [(3,4)], to include sinonasal tumours [(5)] and anterior skull base surgery [(6,7)] with comparative or even better outcomes than those of traditional open surgery [(8-10)].

Whilst endoscopic sinus surgery (ESS) can be shown to improve patient quality of life [11)], little attention has been directed at the toll of minimally invasive surgery on the surgeon's physical well-being [(12)]. Work-related upper limb disorders, repetitive strain injury and occupational overuse syndrome develop as a result of repetitive movements and awkward postures and may severely hamper the working population [(13)].

In a recent review, Ramakirshnan and Montero [(14)] identified the ergonomic differences between endoscopic and open surgery, stating that in endoscopic surgery the surgeon's vision is directed away from the surgical site causing spine rotation, neck

extension and rotation, and upper extremity elevation in addition to prolonged static posture; these factors increase physical strain during surgery. Kaya et al. found many potential concerns for surgeons during video endoscopic surgery including neck and back pain as a consequence of the static body posture required and the poor ergonomic conditions of the operating room during endoscopic surgery [15]. Musculoskeletal symptoms can lead to surgical fatigue syndrome as described by Cuschieri [16] in which the surgeon's dexterity, judgment and performance may decline; this can have detrimental effects for both the patient and the surgeon.

The ergonomics of the surgeon's position, operating table and monitor placement have been studied for laparoscopic surgery with the establishment of guidelines [17]. The dentistry profession investigated the effect of non-ergonomic posture and concluded that musculoskeletal disorders affecting the neck, back, wrists and hands represent a significant problem for the dental profession with a prevalence rate of between 68-93% [18].
The objectives of the study were to determine the prevalence and severity of musculoskeletal symptoms attributed to the use of endoscope or body posture during ESS among members of the British Rhinological Society and also to highlight posture recommendations during ESS

Materials and methods

Survey

A web-based survey of all 370 members of the British Rhinological Society (BRS) was undertaken; distributed via the ENT-UK BRS email list with a hyperlink to the survey website; members were asked to fill in the survey only once. The IP address of the referring computer was logged but no personal information was retained. Entries from duplicate IP addresses were rejected. The survey results were collected over a period of thirty days in May and June 2014. The survey consisted of 19 items (Appendix 1).

The first part of the survey enquired about demographic characteristics, following which respondents were asked whether they perform ESS. If they responded positively, a number of questions followed enquiring as to the number of ESS procedures they undertake per year, for how many years they have been performing ESS, whether they perform ESS standing or sitting and whether they use a monitor or a beam splitter. A set of questions followed about musculoskeletal symptoms that they might attribute to the use of the endoscope or their body posture during ESS. We enquired as to how long they had suffered with any such symptoms, and asked them to rate their severity on a visual analogue scale. We also asked if they had required time off work or sought medical advice because of their symptoms, whether their symptoms interfered with other activities and whether they were diagnosed with a specific problem.

Data analysis

Data was coded and analysed using the Statistical Package for the Social Sciences (SPSS) v.22.0 (SPSS inc. Chicago, IL, USA). Descriptive statistics were used and non-parametric tests were performed.

Results

Of the 370 members of the BRS, 82 responded to the questionnaire, which is over one fifth of the members (22.4%); 53 respondents (64%) completed all 19 questions. Seventy-eight respondents (94%) answered the main questions in the survey regarding the symptoms attributed to the use of endoscope or body posture during ESS. Seventy-three (88%) were men and 10 (12%) were women.

Figures 1-3 show age distribution, the number of ESS procedures per annum and duration of practice. The majority of respondents (87%) operate in the standing position while 13% operate sitting; 89% were right handed surgeons. Seventy eight per cent of the surgeons in this survey stand to the right of the operating table and 22% operate standing to the left side. Seven per cent of surgeons prefer to use a beam splitter, while the majority (93%) operate from a monitor.

Whilst 26% had no musculoskeletal symptoms, 58% and 59% of the 78 respondents reported suffering from pain and stiffness respectively when asked if they experienced symptoms they could attribute to the use of the endoscope or body posture during ESS; 18% experienced paraesthesia (the site of paraesthesia was not elicited by the survey). The most affected areas of the body were the back (71%) followed by the neck (60%), with shoulder pain in 45% and finger stiffness in 17%. Fifty nine per cent reported their symptoms to be bilateral, while 28% suffer from symptoms on the side on which they hold the endoscope.

The majority of respondents (52%) have had their symptoms for 1-5 years while 32% had symptoms for 5-10 years. The pain score was rated by 19% of respondents to be mild, by 40% to be moderate and by 9% to be severe pain.

With regard to pain interfering with hobbies, recreational and social activities, 23% reported that their symptoms affected their activities. Twenty-three per cent had sought medical advice or treatment for their symptoms and 12 surgeons (19%) had been diagnosed with a prolapsed vertebral disc. In addition, 3 surgeons (5%) had required time off work due to the severity of their symptoms.
Our results show a positive correlation between musculoskeletal symptoms and operating in the standing position ($p = 0.022$). There was also a positive correlation with age ($p = 0.014$) and between symptoms and being a right-handed surgeon

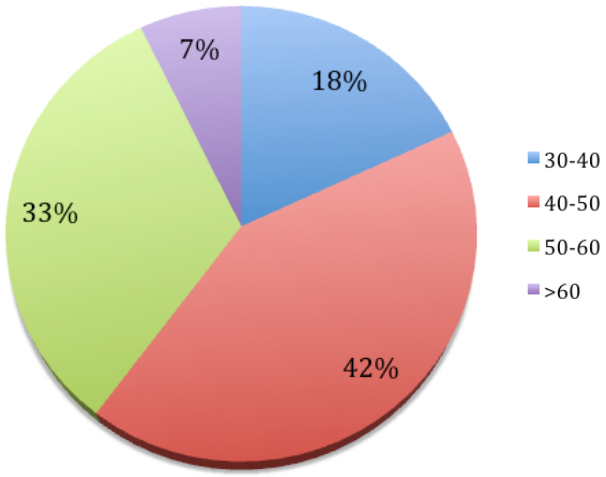

Figure 1. Age distribution of respondents.

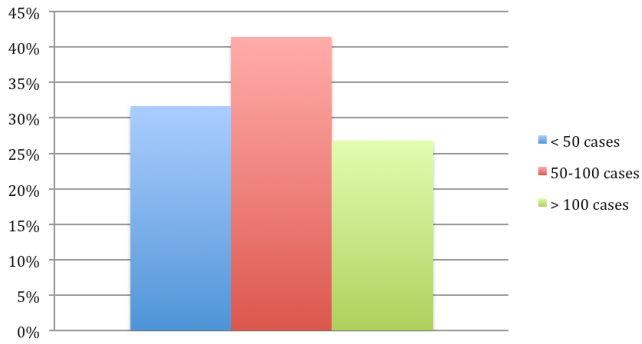

Figure 2. Number of ESS per annum among respondents.

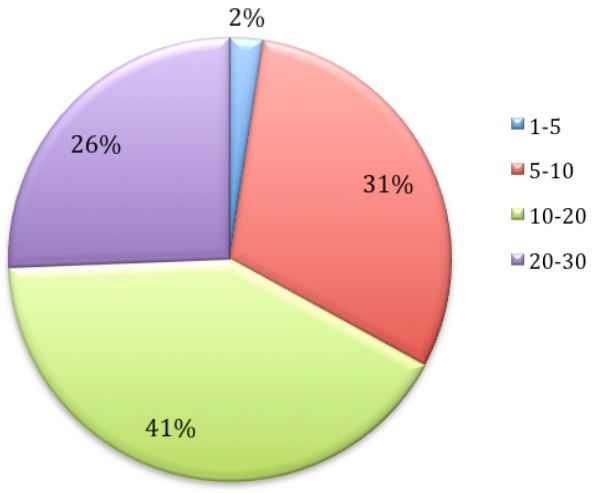

Figure 3. Duration of ESS practice in years among respondents.

(p = 0.022). We found no statistically significant difference in symptoms among surgeons using the monitor or those using the beam splitter.

Discussion

Web-based (online) surveys, typically involving email requests with web survey links, are popular for collecting data. They have the benefit of low cost, availability of survey design, and implementation tools. However, one major concern for online surveys is the typically low response rates. Hardigan in an analysis of response rate and economic costs between mail and web-based surveys among 6,000 dentists, demonstrated that the response rates were best for the mail group (26%) with the worst response rate coming from the web group (11%). However, a cost-effectiveness analysis revealed that web surveys were 2.68 times more cost effective [19]. In a recent survey regarding the risk of vertebral disc prolapse, 506 email links were sent to the members of the British Society of Gynaecological Endoscopy and 128 (24%) responded [20]. Hence our response rate of 22.4% would be in keeping with these levels of response. Our results are comparable to those by Little et al. [12], in a similar study on ESS involving 62 surgeons in USA, with 93% of the respondents in both studies using monitors as opposed to beam splitter. Although our sample shows that the majority of respondents (87%) perform ESS while standing, this is in marked contrast to the American study where less than half of surgeons (49%) perform ESS standing and the rest use either a sitting position or a combination of both. Our survey shows 58% of surgeons have symptoms attributable to ESS procedures while the US study found that 77% of surgeons who regularly perform ESS suffer from physical discomfort or symptoms attributed to these procedures. Despite the difference in magnitude, these figures are of concern.

It is interesting to note that despite the fact that 23% of respondents sought medical advice or treatment for their symptoms and 19% were diagnosed with prolapsed vertebral disc, only 5% of the surgeons required time off work due to the severity of their symptoms. This could be an actual reflection of the severity of symptoms or the commitment of the surgeons in the face of pressures to deliver a service. Whatever the cause, these findings indicate a potential health risk to the surgeon, which could result in shorter surgical careers, operating theatre cancellations and an increased financial burden on the health system. Cass et al. [5] concluded that there is a need to improve the operating room environment and increase awareness among surgeons to prevent "a pandemic of injuries".

Our results show a positive correlation between musculoskeletal symptoms and operating in a standing position (p = 0.022) and between musculoskeletal symptoms and age (p = 0.014), which

Table 1. Summary of survey findings.

There is a positive correlation between musculoskeletal symptoms and operating in the standing position and musculoskeletal symptoms and age.
ESS is evidently physically demanding on the surgeon with potential personal health hazards.
There is a need to increase awareness among surgeons, familiarize ourselves with good operating posture habits and new ergonomic instruments.

can be partially attributed to natural tissue ageing process. The positive correlation between symptoms and being a right-handed surgeon ($p = 0.022$) is possibly due to the small number of left handed surgeons among respondents. We found no statistically significant difference in symptoms among surgeons using the monitor or those using the beam splitter, again possibly due to the small number of surgeons using a beam splitter in this survey. We found no positive correlation between symptoms and the number of ESS performed per year, which is most likely a sample size bias that we hope to correct with a planned larger Pan-European study, which is being conducted. Twelve surgeons (19%) were diagnosed with a prolapsed vertebral disc, which is a high incidence given the lifetime risk of 1.6%-2.2% in the general population in both the USA and UK [21]. Of the 78 respondents, 58% and 59%, respectively, reported suffering from pain and stiffness with back pain representing 71% of their symptoms in contrast to the lifetime risk of back pain in the general population of 11.9% [22].

Several factors in the operating theatre environment affect the ergonomics and posture of the surgeon during endoscopic surgery. The position of the monitor affects the posture of both the surgeon and assistant, if present [23]. The optimal posture while performing a task using a monitor should be neutral without torsion of the back or neck and with the head flexed at an angle of 15-45 degrees to the horizontal [24,25]. Studies of optimal task performance in laparoscopic surgery suggest placing the monitor directly in front of the surgeon with a slightly depressed angle to bring the visual axis in line with the motor axis [26,27], to minimize musculoskeletal fatigue.

Some surgeons prefer to use a beam splitter for better colour definition and depth of perception; this group formed 7% of the respondents while in Little et al. [12] study it represented 5%. This represents a potential source of neck and upper torso strain as well as eye-strain due to the loss of peripheral vision [12]. A systematic review of ergonomics in the ESS literature [28] concluded that there were no advantages in surgical performance when using direct visualization versus the use of a monitor. This statement is largely true although we experience better colour definition when using an endoscope for KTP laser surgery in the management of hereditary hemorrhagic telangiectasia patients.

The findings of this survey (Table 1) are a good reminder to rhinologists of the 15 recommendations by Ramakirshnan and Montero [14] that attempt to reduce musculoskeletal strain during ESS procedures. These recommendations include proper instrument maintenance, appropriate monitor placement, adjusting the table height to keep the hand in line with the elbow, taking periodic breaks to stretch and restore blood flow, and not to hover the foot over control pedals.

Both industry and the surgeon should bear responsibility to minimize these problems through the development of more ergonomic instruments and by other strategies to improve well-being. There are simple posture modification techniques such as the Alexander technique, which is designed to promote well-being by retraining one's awareness and habits of posture to ensure minimum effort and strain [29]. Reddy et al. [30] investigated the impact of this technique on improving posture and ergonomics during endoscopic surgery and concluded that it resulted in improved posture and endurance and decreased surgical fatigue.

ESS remains a very common procedure as evident by the National Comparative Audit of Surgery for Nasal Polyposis and Chronic Rhinosinusitis (2003), where 3128 patients underwent ESS over a period of six months across 80 NHS Trusts in England and Wales [31]. Given the potential impact of endoscopic surgery on the health of the surgeon, it is disappointing to note that surgical ergonomics are not considered during surgical training and this problem is not addressed by the spurious mandatory back care courses that are on offer throughout the National Health Service (NHS). This survey aims to highlight the musculoskeletal problems experienced by ESS surgeons in the hope that it may encourage the implementation of surgical ergonomics in the training of residents, and perhaps influence industry in the ergonomic design of new instruments and the operating theatre environment.

Limitations of the study

No research is without limitations and this survey is no exception. One of the limitations is that the survey only targeted British Rhinological Society members and does not capture the wider rhinology practice in Europe. Another limitation is the relatively small number of participants.

Conclusion

This survey reveals a high prevalence of musculoskeletal problems attributed to the use of the endoscope and/or body

posture during ESS among members of the British Rhinological Society. These potential health hazards are likely to increase with the expanding scope of endoscopic indications and have implications on both surgeons' careers and patient care with associated financial burden. We would encourage the implementation of surgical ergonomics in the training of residents and consideration from industry to invest in more ergonomic instrumentation. It is hoped that this study, a snap shot of the scale of the problem among British rhinologists, will also encourage wider and diverse studies in mainland Europe to better evaluate the impact of endoscopic surgery on the surgeon.

Authorship contribution

All authors contributed equally to the work.

Conflict of interest

None declared.

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APPENDIX

These questions and statements apply if you have aches, pains, stiffness or paraesthesia in areas such as the neck, head, shoulders, elbows, wrists, thumbs, fingers, back, hips, knees, ankles, feet or anywhere else!

1. How old are you 30-40 ☐ 40-50 ☐ 50-60 ☐ > 60 ☐

2. Are you Male ☐ Female ☐

3. Do you Perform endoscopic sinus surgery (ESS)?
Yes ☐ No ☐
If you do not perform ESS please stop here.

4. How many ESS procedures do you undertake per year?
Less than 50 ☐ 50-100 ☐ more than 100 ☐

5. How many years have you been performing ESS?
1-5 ☐ 5-10 ☐ 10-20 ☐ 20-30 ☐

6. In your practice do you perform ESS sitting or standing?
Sitting ☐ Standing ☐

7. Are you Right or Left Handed?
Right handed ☐ Left handed ☐

8. Do you stand on the right side of the operating table or the left side of the operating table?
Right side ☐ Left side ☐

9. During ESS do you use the beam splitter or the monitor screen only to operate?
Beam splitter ☐ Monitor screen only ☐

10. Do you or have you experienced any of these symptoms that you can attribute to the use of endoscopy or your body posture during ESS procedures? If so please indicate the type of symptoms:
Pain ☐ Stiffness ☐ Paraesthesia ☐ None ☐

11. If you have experienced any of these symptoms that you can attribute to the use of endoscopy or your body posture during ESS, which area of your body was affected?
(Tick as appropriate)
Neck ☐ Head ☐ Shoulders ☐ Elbows ☐ Wrists ☐ Thumbs ☐ Fingers ☐ Back ☐ Hips ☐ Knees ☐ Ankles ☐ Feet ☐
Anywhere else ☐……..... (Please specify)

12. Is the affected area of your body (Tick as appropriate)
On the side which you hold the endoscope ☐
On the side where you hold the surgical instruments ☐

13. How long have you suffered with your current symptoms?
1-6 months ☐ 1-5 years ☐ 5-10 years ☐
more than 10 years ☐

14. How would you rate the severity of your symptoms? Please circle one (10 being the worst pain).
1 2 3 4 5 6 7 8 9 10

15. Have your symptoms interfered with your hobbies, recreational or social activities?
Yes ☐ No ☐

16. Have you required time off work because of the severity of your symptoms?
Yes ☐ No ☐

17. Have you sought medical advice, treatment or surgery because of your symptoms?
Yes ☐ No ☐

18. Have you had a specific problem diagnosed such as prolapsed disk ?
Yes ☐ No ☐

19. Have you any comments or advice for new ESS surgeons to avoid/minimize these potential occupational hazards.