



CLINICAL REVIEW

Role of surgery in adult obstructive sleep apnoea

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SUMMARY

A surgical approach to treatment of obstructive sleep apnoea (OSA) remains an area of intense debate, both within and without the surgical community itself. Continuous positive airway pressure (CPAP) therapy remains the gold standard for the treatment of OSA, however surgery may be indicated to facilitate CPAP and/or improve compliance in cases where CPAP is poorly tolerated.

This article summarises the current range of surgical treatment options together with the evidence base for their intervention in otolaryngology, maxillofacial and bariatric surgery. The continued evolution of technology has brought new surgical techniques to the fore and it seems likely their utilisation together with a multi-level surgical approach to the airway will continue to influence forthcoming research in OSA. Patient selection and precise evaluation will remain crucial in ensuring that when surgery is indicated, the correct procedure or procedures are performed at the correct anatomical level.

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Introduction

Sleep related breathing disorder (SRBD) is used to describe a broad clinical spectrum of recurring partial or complete occlusion of the upper airway. This ranges from snoring to severe obstructive sleep apnoea (OSA). Population based studies demonstrate OSA syndrome affecting approximately 4% of males and 2% females, a level of prevalence comparable to Type I Diabetes [1]. The morbidity and mortality related to OSA is well recognised as an independent risk factor for hypertension, cardiovascular, and cerebrovascular diseases [2]. In addition neurobehavioral morbidities of daytime sleepiness and impaired cognitive function may contribute to motor vehicle and job-related accidents [3,4]. Overall, OSA significantly increases the risk of stroke or death from any cause and in a community based sample moderate-to-severe sleep apnoea is independently associated with a large increased risk of all-cause mortality [5]. The obesity epidemic means problems faced by health professionals in relation to OSA is only likely to increase in the immediate future.

Abbreviations: BMI, body mass index; CPAP, continuous positive airway pressure; CT, computed tomography; MRI, magnetic resonance imaging; OSA, obstructive sleep apnoea; SIGN, Scottish intercollegiate guidelines network (develops evidence based guidelines for the NHS in Scotland); SRBD, sleep related breathing disorder; TMJ, temporomandibular joint.

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The selection of surgical treatments in OSA remains an area of intense debate, both within and without the surgical community itself. Fundamentally continuous positive airway pressure (CPAP) therapy remains the gold standard for the treatment of OSA, however surgery may be indicated to improve compliance and outcome in cases where CPAP is poorly tolerated. Other non-surgical measures that warrant consideration with demonstrated efficacy include use of oral appliances [6] and sleep position training [7]. Increasing recognition of the multi-level nature of anatomical obstruction means consequentially there exists a large variety of differing surgical techniques used by different surgical specialties in an attempt to combat this problem. In many countries the financial implications of surgical private practice has perhaps contributed to a degree of cynicism as to the range of available surgical procedures for OSA [8] (Table 1).

In this article we summarise the current range of surgical treatments together with the evidence base for their intervention. As such we explore measures enlisted not only by otolaryngologists but maxillofacial and bariatric surgical colleagues. The key aspect of surgery in OSA is selecting the right operation to tackle the individual's specific problem at the correct time. There is a clear distinction that needs to be made with respect to surgery indicated for simple snoring and surgery indicated for OSA.

OSA research: difficulties for the clinician

It is well recognised that there is a paucity of high quality randomised controlled trials for surgical interventions in OSA but it may additionally be highlighted that this is problem faced by

Table 1
Range of surgical techniques for obstructive sleep apnoea in adults.

Surgical site	Examples of surgical techniques available	Advantages	Potential difficulties
Nasal	Septoplasty	<i>Adjunct for better tolerance of CPAP and lower pressures</i>	<i>Septal perforation can adversely affect future CPAP use.</i>
	Septorhinoplasty Turbinates reduction	<i>Improve nasal airway</i>	<i>Requires expert assessment of nasal symptoms/examination to identify pathology</i>
	Endoscopic sinus surgery		
Oropharyngeal surgery	Tonsillectomy Uvulopalatopharyngoplasty Laser assisted uvulopalatoplasty	<i>Prevent retropalatal restriction</i>	<i>Pain May affect future CPAP tolerance</i>
	Radiofrequency thermotherapy (Soft palate)	<i>Combined with other procedures in multi-level approach</i>	<i>Absence of long-term data in OSA.</i>
	Hypopharyngeal surgery	Radiofrequency thermotherapy (tongue base) Hyoid suspension	<i>Combined with other procedures in multilevel approach</i>
Midline glossectomy Epiglottic wedge resection		<i>Directly deals with anatomical abnormality</i>	<i>Morbidity associated includes dysphagia, odynophagia, dysphonia and aspiration. Robotic approach is resource intensive and restricted to specialised centres May require 'covering' tracheostomy in post-op period</i>
Maxillofacial	Maxillomandibular advancement	<i>Highly effective</i>	<i>Highly Invasive Need for prolonged fluid diet Velopharyngeal incompetence</i>
Tracheal	Tracheostomy	<i>Bypasses obstructive segment Highly efficient</i>	<i>Invasive Technically difficult to perform in obese individuals</i>
Bariatric surgery	Roux-en-Y gastric bypass	<i>Objective improvement demonstrated-decrease CPAP requirements</i>	<i>Maintenance in weight loss required for benefits</i>
	Vertical banded gastroplasty	<i>Further health benefits</i>	<i>May not be deemed 'curative'</i>

surgery in general [9]. A recent systematic review indicates the heterogeneous end-points used failing to provide any consistency of effect from laser-assisted uvulopalatoplasty or radiofrequency ablation on daytime sleepiness, apnoea reduction, quality of life or snoring [10]. Additionally defining successful treatment is also increasingly difficult given the degree of variance in terminology of success and range of outcome measures used. The research focus should be patient-centric with recognition that although objective, the apnoea–hypopnoea index (AHI) represents a surrogate outcome measure of treatment and we would caution the belief that it is the ultimate arbiter of success [11].

There is much discrepancy within the literature related to defining 'success' of surgical intervention in OSA. Currently, a commonly accepted definition for surgical success is respiratory disturbance index or apnoea–hypopnoea index less than 20 with a reduction greater than 50% and few desaturations less than 90% with improvement of subjective symptoms [12]. Patient-relevant end points are to control the symptoms of OSA and minimise the risk of premature death rather than an arbitrary laboratory derived figure of AHI and this should naturally be taken into consideration on review. A study in 2010 demonstrates the potential benefit in the continuous nature of non-optimal surgical therapy overnight as opposed to a partial use of CPAP [13]. Mathematical modelling demonstrates that the use of CPAP compliance rates appears somewhat arbitrary and in fact disguises insufficient reductions in AHI.

Any coordinated attempts at strengthening the evidence base is naturally to be welcomed and has been recommended in a recent

Cochrane review [14]. Work is ongoing in this area highlighting potential trial designs with the requisite clinical equipoise and relevance to influence clinical practice in the treatment of OSA [15].

Intrinsic appeal of surgery for OSA

In the UK, clear Scottish intercollegiate guidelines network (SIGN) guidelines have been provided with a clear focus on primary non-surgical management for OSA given the interpreted poor current evidence base for intervention [16]. However success through CPAP, oral appliances or sleep position training is dependent on patient compliance [6,17]. It is important for clinicians to recognise the difficulties patients face with an appliance-based approach to OSA. Unfortunately, adherence rates are poor with estimates that between 40 and 60% of patients use CPAP as prescribed, many reject therapy within the first few months of their intended treatment [18]. For many patients the long term, daily burden of such devices leads them to seek an alternative in the form of surgery. It is by this nature that surgical techniques become an acceptable avenue for this subgroup of patients. Indeed a survival benefit of surgical intervention as opposed to CPAP has been demonstrated in a population of U.S veteran soldiers with a high likelihood of poor adherence [19].

Assessment of OSA: a surgical perspective

Clinical assessment begins with observations of any obvious morphological features such as retrognathia or dental mal-occlusion,

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