

Home sleep studies

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SUMMARY

Home sleep studies have evolved beyond home oximetry to a polysomnogram only marginally different from that found in a sleep laboratory.

They are now a well accepted way of investigating sleep apnoea and comprise up to 30% of all Medicare-funded sleep studies in Australia.

For a home sleep study to be effective, a number of important elements must be in place, including the input of the referring doctor, the correct use of the equipment by the patient, a skilful technician and accurate scoring of the raw data.

Interpretation of a sleep study by a sleep physician with the clinical and demographic information and recommendation of appropriate management is also essential.

Although home sleep studies allow more patients to be assessed and treated, particularly those in country areas, if any element is deficient the outcome may be suboptimal.

Introduction

The use of continuous positive airway pressure (CPAP) in obstructive sleep apnoea has spawned a multimillion dollar industry worldwide for the treatment of sleep disordered breathing.¹ The real prevalence of obstructive sleep apnoea in the community is difficult to ascertain as it varies with age, gender, body mass index, menopausal status and family history. How one defines 'abnormal' can also vary.^{2,3}

There is a large overlap in the symptoms of depression and sleep apnoea, which often coexist and may be intertwined in their aetiology. It is not uncommon to see sleep apnoea go undiagnosed for years in patients with depression. There are many other related comorbidities including obesity, hypertension, ischaemic heart disease, cerebrovascular disease, diabetes, dyslipidaemia, fatty liver and sexual dysfunction.

The social and financial cost of sleep apnoea is substantial, with numerous secondary effects such as motor vehicle and work accidents. Treating sleep

apnoea is very cost-effective in the long term not only for the individual but for the whole community.⁴

Patient selection for sleep investigations

The primary aim of home studies is to diagnose sleep-disordered breathing. If other conditions are considered likely, the patient should be referred to a sleep physician first.

There are numerous indications for a home sleep study. However to avoid their overuse, a global assessment of the patient should be done first. The common symptoms and clinical features, alone or in combination, which should invoke concern include:

- unrefreshing and restless sleep, particularly in a snorer
- nocturnal startles and choking episodes
- nocturia
- witnessed apnoeas
- night sweats, insomnia and restless sleep
- cognitive impairment
- sexual dysfunction
- depression
- sleep-related driving 'incidents'
- systemic or pulmonary hypertension
- nocturnal arrhythmias and angina.

A high clinical suspicion for sleep apnoea is recommended in patients with potentially dangerous occupations.

Measuring sleep disorders

The past 20 years have seen a steady increase in private and public sleep laboratories in Australia. They are costly to run with ever-changing computers and software as well as high labour costs. A ratio of one overnight sleep technician to three patients is common. Many patients still depend on public hospital sleep laboratories with their long waiting lists and limited resources.

There were 6400 sleep laboratory polysomnograms per month from January 2009 to February 2011, based on Australian Medicare data. Of these, the proportion of Medicare-funded home polysomnograms has increased from around 20% in early 2009 to 32% by December 2010.

A Canadian study comparing a sleep laboratory polysomnogram with an autotitrating CPAP pump

with no polysomnogram, found no overall difference in outcome in high-risk patients.⁵ An Australian study also showed no overall difference in outcome in those having a CPAP autotitration at home rather than one in a sleep laboratory.⁶ However, these findings need to be weighed against the potential for inappropriate use of home polysomnograms for marginal indications.

Home oximetry

The portable oximeter is a fairly sensitive test for sleep apnoea when the apnoea causes moderate to severe hypoxaemia. However, it is less sensitive for detecting mild to moderate cases of nocturnal hypoxaemia, which may still be very symptomatic because of sleep disruption from frequent respiratory arousals. As many symptomatic patients have little if any oxygen desaturation, nocturnal oximetry is a fairly insensitive tool for a significant proportion of sleep apnoea sufferers, as excessive daytime somnolence is more due to respiratory arousals than hypoxic events.

Sleep studies at home

Many patients prefer a sleep study in their own bed – it is more convenient and cheaper. It is now possible to produce data from a home sleep study that are equal to a sleep laboratory polysomnogram.

Portable polysomnogram monitors are about the size of a small transistor radio. They monitor nasal airflow, electroencephalogram, electrocardiogram, electromyography, oximetry and chest, abdominal and leg movements. These devices have been well validated in numerous studies with the gold standard of the sleep laboratory polysomnogram.⁷ The main difference between the home study and the sleep laboratory polysomnogram is not the data, but the technician in attendance all night to adjust electrodes, ensure data quality and observe the activities of the patient both asleep and awake.

One negative feature of inpatient studies is that some patients do not sleep as well in a sleep laboratory as they would at home. However, with home studies, if electrodes fall off the patient may be oblivious of this until morning and some home sleep studies do not monitor leg movements. In addition, they also may miss less common sleep disorders, such as nocturnal seizures or parasomnia.

The essential elements

For a successful home sleep study, from my experience many elements are required. If any element is deficient, the outcome may be suboptimal.

General practitioner

The general practitioner needs a working knowledge of sleep apnoea to ensure that referrals are

appropriate. Inappropriate referrals often present difficulties in interpretation and recommendations for the reporting sleep physician. The general practitioner should consider the practicalities of eventual treatment options before the sleep study is done. For example, a frail elderly patient is unlikely to cope with a CPAP mask and pump.

It is essential to select patients who are able to apply the sleep equipment and keep it on during the night. A home sleep study on an elderly patient with cognitive impairment or severe Parkinson's disease is usually doomed to failure. Correct patient selection for the home studies, or for that matter an inpatient study, is an essential element which may ultimately dictate the success or failure of the test. For most home studies, patients who are 'computer savvy' are more capable of managing electrodes and oximeters.

Equipment

This is the least problematic of the elements as it is robust. Electrodes and an oximeter are relatively easy to apply and remove. The commonest problems encountered are an oximeter trace dropping off during the night or from improperly applied electrodes. The equipment usually comes with photographs showing how to place the electrodes and oximeter.

Technician

The technician needs a good working knowledge of not only sleep apnoea, but also other common sleep pathologies and comorbidities. The technician should take a history, record medications, measure body mass index and provide demographic data which are essential for the reporting physician.

Data analysis

After the study, the technician uploads the data to a remote centre where it is collated and scored by sleep scientists. It is then sent to the sleep physician with the raw data and the patient's history, symptoms, medications and demographics.

Sleep physician

The sleep physician reports the results of the sleep study and recommends treatment. They ascertain whether the sleep scoring is reliable and consider the results in light of the clinical indications and other patient factors such as comorbidities and occupation, such as school bus driver. Knowing the patient's medications is also important and may explain, for example, the lack of REM (rapid eye movement) sleep, why a person is excessively sleepy or is having a lot of central sleep apnoea (for example from opioids). Reporting is hindered by inadequate clinical details.

DIAGNOSTIC TESTS

Home sleep studies

Although I recommend that patients having difficulties with CPAP should see a sleep physician, only a small proportion of them do. Sleep physicians often fine-tune treatment of sleep apnoea in more difficult cases including complex sleep apnoea. Their global assessment adds significant value to the general management of these patients, particularly in finding the cause and diagnosing and managing other comorbidities. The sleep physician's broad training, not only in sleep disorders but in general medicine and the psychiatric aspects of sleep, provides an important oversight. All patients with sleep apnoea adversely affecting their driving or with a potentially dangerous occupation should be seen by a sleep physician. To do otherwise could have legal ramifications.

Other requirements

Other secondary elements are also needed, for example dietitians and dentists for mandibular splints.

Patients may also need a support person to assist them with treatment.

Conclusion

Home sleep studies are a viable alternative to laboratory sleep studies and are here to stay. I predict they will eventually be the main screening tool for sleep apnoea in the community complementing the important role of the sleep laboratory polysomnogram. For home sleep studies to be effective, several elements are required, including a patient who can use the equipment. Patients with more complicated sleep apnoea, multiple comorbidities and serious other sleep disorders should see a sleep physician. <

Professor Allen does reporting of home sleep studies for Healthy Sleep Solutions, but has no financial interest in the company.



SELF-TEST QUESTIONS

True or false?

11. The devices for home sleep studies have not been validated against sleep laboratory polysomnograms.

12. Opioids can cause central sleep apnoea.

Answers on page 71

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Medicinal mishap

Dabigatran – a new safe drug to replace an old poison?

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Case

An 89-year-old woman was admitted to hospital with melaena. She had a history of atrial fibrillation, type 2 diabetes complicated by hypertension, ischaemic heart disease and nephropathy (creatinine clearance of 29 mL/min, using the Cockcroft-Gault equation).

The patient was taking several drugs for her conditions. These included warfarin which she had taken for 12 years, without any adverse events. Three weeks before admission she was switched to dabigatran, 110 mg twice a day, for prevention of stroke in association with atrial fibrillation.

On admission, her serum creatinine was elevated (172 micromol/L with an estimated creatinine

clearance of 18 mL/min) and her haemoglobin was 61 g/L. Despite warfarin therapy ceasing three weeks earlier, the INR was 2.5 and the activated partial thromboplastin time (aPTT) was 84 seconds (normal range 25–35 seconds).

There is no specific antidote for dabigatran. She was given fresh frozen plasma, vitamin K and six units of packed red cells.¹ Upper gastrointestinal endoscopy found no pathology and the bleeding settled spontaneously.

The patient required prolonged rehabilitation after the haemorrhage. She was not discharged home until two months later.

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