ResMedica
clinical newsletter
NPPV edition

An interview with Dr Anita Simonds

Background

Dr Anita Simonds is a consultant in Respiratory Medicine at Royal Brompton Hospital, London, UK. In 1990 she took over the Sleep & Ventilation Unit at Royal Brompton Hospital, which now cares for around 900 adults and children receiving home ventilation and 3000 patients on CPAP. Children's neuromuscular and ventilation clinics are held at both Hammersmith and Brompton Hospitals.

1. What is NPPV?

This term describes noninvasive positive pressure ventilation (also known as NIV). Negative pressure ventilation is an alternative form of noninvasive ventilation. As it is only carried out in specialist centers, for practical purposes almost all noninvasive respiratory support services use positive pressure ventilation delivered by nasal/oral interface.

2. What are the applications in different diseases?

Although originally developed to support individuals with chronic ventilatory insufficiency due to neuromuscular disease, NPPV is now used widely to treat patients with acute exacerbations of COPD, to wean patients from conventional mechanical ventilation in the ICU, and to manage long-term ventilatory failure in a range of disorders in adults and children.

3. How extensively is NPPV used and how is the field advancing?

There are two major challenges ahead. Firstly, there is now overwhelming evidence to support the use of NPPV in acute hypercapnic exacerbations of COPD. Here NPPV reduces mortality, the need for intubation, and hospital stay. This is also a cost-effective strategy. A meta-analysis of randomized controlled trials shows that only eight patients need to be treated with NPPV to avoid one death and five treated with NPPV to avoid intubation. Similarly, there are many case series in the literature that show that long-term NPPV improves survival, reduces morbidity and increases quality of life in chest wall disease and stable/slowly progressive neuromuscular disorders. Randomized controlled trials would be unethical for these applications as the outcome without ventilatory support is death.

For these evidence-based indications there is an important need to disseminate this extensive outcome information. It is necessary to ensure that NPPV is available in all centers admitting patients with acute ventilatory failure and in units managing patients with chronic respiratory disorders. A recent prevalence study shows that NPPV is not available equitably throughout Europe and this is also likely to be the case elsewhere in the world. Educational initiatives and training in NPPV should be widely available to medical, anaesthetic, ICU, nursing and paramedical staff.

Secondly, the indications for NPPV are expanding rapidly but these need to be examined systematically. For example, home NPPV may be valuable in some subgroups with COPD eg, severely hypercapnic patients unable to tolerate long-term oxygen therapy or 'revolving door' patients admitted recurrently with acute exacerbations. However, this point needs to be settled definitively with a large, randomized, controlled trial. While NPPV alters the natural history and palliates symptoms in progressive neuromuscular conditions, the most appropriate time to introduce NPPV is not clear. In the cardiac world the relative utility of CPAP versus NPPV in acute and chronic cardiac failure needs to be resolved with further studies. Pediatric NPPV is a huge growth area but there are particular challenges in developing interfaces and ventilators to meet the needs of this group who are not just 'tiny adults.'

4. Does your hospital have a specialized department for acute patients?

We initiate NPPV acutely in our high dependency unit (HDU), in the general respiratory ward and in the ICU. Use of NPPV in the HDU is especially helpful as it allows closer monitoring and a higher nurse/patient ratio to care for sicker patients. NPPV can be carried out safely in the general respiratory ward, providing staffing levels and training are adequate.

Continued on page 2

From the editor

Our third issue of ResMedica deals with the rapidly growing field of noninvasive ventilation.

We are delighted to bring you an interview with Dr Anita Simonds, who heads the Sleep Ventilation unit at the Royal Brompton Hospital in London, England.

Our thanks to Dr Nick Hill, from Boston, US who has sent us an interesting vignette describing how VPAP assisted in managing a challenging patient.

We've also included an fascinating article on the prevalence of sleep-disordered breathing in a hitherto unsuspected sector of the population – healthy, young male football players. A US study suggests that the incidence of sleep apnea among these young footballer players is unexpectedly high and may have implications for broader populations of healthy young men.

Our case study this time is from France. It takes us through the struggles of treating a patient whose difficulties with using a volume ventilator eventually led her physicians to switch her to NPPV and a full face mask.

We also include the inspiring story of Australian polio patient Cathy Galt, who has found ResMed's VPAP device invaluable in coping with respiratory failure resulting from post-polio syndrome.

Researchers and educators will be interested to see details of ResMed's recently launched Sleep Disordered Breathing Foundation, which provides funding for scientific studies and public education on the subject of untreated breathing disorders.

And of course there is the usual round of useful abstracts, updates on coming events, and interesting facts and figures.

We hope this issue of ResMedica continues to provide you with useful, relevant information. Please be sure to send us your feedback via our website clinicalnews@resmed.com.au

Lisa MacKenzie

International Clinical Application Specialist

Editor

Continued from page 1

However, HDU or ICU admission is mandatory in unstable patients, in those who are severely acidotic eg, pH < 7.30, and patients with multiple medical problems or a high level of nursing dependency. The HDU also provides a useful focus for training medical, nursing, and paramedical staff in NPPV.

5. What are some of the key factors in setting a patient up on NPPV?

The secret (if there is one) lies in understanding the underlying pathophysiology of the respiratory failure, matching the patient's ventilatory needs, and ensuring the interface fits and is comfortable. It helps to understand the basic functioning of the ventilator. Certain modes (eg, bilevel pressure support) may be preferable in some situations (eg, in patients with a tendency to upper airway obstruction, high levels of intrinsic PEEP, or bullous lung disease).

6. Does your hospital have a special programme to enable patients to return home on NPPV?

Royal Brompton has patients on home NPPV around the UK. We share care with local physicians and GPs, but take responsibility for providing, servicing, and maintaining the ventilatory equipment in the home. We also review patients on a regular basis. Ventilator users and their families/care givers receive competency training before being discharged from hospital. The home-care package takes into account the level of ventilatory dependency of the patient and includes a risk assessment. For example, highly ventilator-dependent patients require back-up ventilators and battery packs. Each patient has access to a 24-hour help line for advice. Fortunately many individuals function well on night-time NPPV and are busy at work or school during the day. An increasing number of the pediatric neuromuscular patients are now completing school and embarking on university courses. Successful pregnancy has been possible in some long-term NPPV users.

7. What are some of the key long-term benefits to a home-care program?

There is little doubt that with appropriate patient selection, long-term NPPV increases survival and quality of life. Hospital admissions are reduced. As a result it is a highly rewarding field to be involved in.

An interview with Dr Anita Simonds
continued

8. Where do you see the future of NPPV therapy and the devices advancing /heading?

There is much work to be done in both the acute and chronic NPPV arena. Use of a specific ventilator to capture and reduce overall ventilation (eg, ResMed's AutoSet CS™) may improve left ventricular function and reduce mortality in sleep-disordered breathing in congestive cardiac failure, thereby offering an important adjunct to pharmacotherapy. The role of chronic NPPV in COPD and cystic fibrosis requires further exploration and newer modes of ventilation may help these obstructive lung disease patients. The right combination of inspiratory and expiratory muscle aids needs to be established in neuromuscular patients. ICU applications will surely increase and the wider use of NPPV on the HDU should relieve pressure on ICU beds. Pediatric patients are not well served by current ventilators, and new models are likely to be developed. On a more speculative note, most equipment has been designed to support breathing during sleep but many patients would like ventilatory assistance on exertion. Such devices will have to be highly portable and sophisticated enough to deal with rapidly changing ventilatory needs. The pace and enthusiasm for change over the last ten years suggests these challenges can be met.

A K Simonds

[1] Janssens JP, Derivaz S, et al. Changing patterns in long-term noninvasive ventilation: a 7-year prospective study in theGeneva Lake area. Pulmonary Division, Geneva University Hospital, Geneva, Switzerland. *Chest 2003 Jan;123(1):67-79*

[2] Wedzicha JA. Outcome of long-term noninvasive positive pressure ventilation. St. Bartholomew's Hospital, Dominion House, London EC1A 7BE, UK. *Respir Care Clin N Am 2002 Dec;8(4):559-73*

[3] Krachman SL, Criner GJ. Sleep and long-term ventilation. Temple University School of Medicine, Philadelphia,PA 19140, USA. *Respir Care Clin N Am 2002 Dec;8(4):611-29*

[4] Conti G, Antonelli M, et al. Noninvasive vs. conventional mechanical ventilation in patients with chronic obstructive pulmonary disease after failure of medical treatment in the ward: a randomized trial. Universita Cattolica del S. Cuore, Policlinico A. Gemelli, Largo F. Vito, 00168 Rome, Italy, g.conti@rm.unicatt.it *Intensive Care Med 2002 Dec;28(12):1701-7*

[5] Chadda K, Annane D, et al. Cardiac and respiratory effects of continuous positive airway pressure and noninvasive ventilation in acute cardiac pulmonary edema. Service de Reanimation Medicale, Hopital Raymond Poincare, Gauches, France. *Crit Care Med 2002 Nov;30(11):2457-61*

[6] Lightowler JV, Wedzicha JA et al. Non-invasive positive pressure ventilation to treat respiratory failure resulting from exacerbations of chronic obstructive pulmonary disease: Cochrane systematic review and meta-analysis. Department of Respiratory Medicine, St James's University Hospital, Leeds LS97TF BMJ 2003 Jan 25;326(7382):185 *Comment in: BMJ. 2003 Jan 25;326(7382):177-8.*

In the know . . . NPPV

There is growing interest around the world in NPPV for a number of applications, as exemplified in the following quotations from articles published since November 2002:

Decreases in hospitalizations after initiating NPPV have had positive impacts on the cost-effectiveness of NPPV in patients with chronic respiratory failure.[1]

The introduction of NPPV has been one of the most important advances in the management of patients at home with chronic respiratory failure.[2]

NPPV has been shown to eliminate sleep-disordered breathing and correct abnormalities in nocturnal gas exchange, resulting in an improvement in sleep quality. Improved daytime symptoms and gas exchange, with the suggestion of a decrease in morbidity and mortality, support the use of long-term mechanical ventilation during sleep in selected patients with these disorders (neuromuscular and restrictive disorders, COPD).[3]

The use of NPPV in patients with chronic obstructive pulmonary disease and acute respiratory failure requiring ventilatory support after failure of medical treatment avoided endotracheal intubation in 48% of the patients, had the same ICU mortality as conventional treatment and, at one-year follow-up was associated with fewer patients readmitted to the hospital or requiring long-term oxygen supplementation.[4]

NPPV was more effective at unloading the respiratory muscles than CPAP in acute cardiogenic pulmonary edema. In addition, NPPV and 10 cm H_2O CPAP produced a reduction in right and left ventricular preload, which suggests an improvement in cardiac performance.[5]

NPPV should be the first line intervention in addition to usual medical care to manage respiratory failure secondary to an acute exacerbation of chronic obstructive pulmonary disease in all suitable patients. NPPV should be tried early in the course of respiratory failure and before severe acidosis, to reduce mortality, avoid endotracheal intubation, and decrease treatment failure.[6]

Chronic Obstructive Pulmonary Disease (COPD)

Facts and Figures

COPD is characterized by progressive airflow limitation. It includes obstructive bronchitis, with obstruction of small airways. COPD also includes emphysema, with enlargement of air spaces and destruction of lung parenchyma, loss of lung elasticity, and closure of small airways. Most patients with COPD have both conditions but the relative extent of emphysema and obstructive bronchitis can vary. The disease progresses over decades.

In industrial countries, cigarette smoking accounts for most cases and smoking cessation is the only measure that will slow the progression of COPD. Treatment options include antismoking measures, bronchodilators, antibiotics, oxygen, corticosteroids, pulmonary rehabilitation, lung-volume reduction surgery, mediator antagonists, protease inhibitors, new antiinflammatory drugs, different drug delivery and NPPV.

Statistics on COPD are conflicting because of imprecise and variable definitions of COPD. However, there are about 16 million COPD patients in the US, ranging from those with no symptoms to the nearly dead. It is ranked number four in the US as a cause of death, with an annual mortality rate of 112,000 in the US.[1] About 500,000 hospitalizations per year in the US are for acute exacerbation of COPD.

The Global Initiative for Chronic Obstructive Lung Disease (GOLD) has released guidelines[2] that state that the combination of NPPV with long-term oxygen therapy may be of some use in a selected subset of chronic COPD patients (notably hypercapnic ones).

For acute exacerbation of COPD, NPPV should be the first line of intervention in addition to usual medical care. NPPV should be tried early in the course of respiratory failure and before severe acidosis, to reduce mortality, avoid endotracheal intubation and decrease treatment failure. [3,5]

Benefits of using NPPV

The daily cost and staff time required for NPPV is similar to that required for invasive ventilation for the first 48 hours. After that, the staff time required is significantly less for NPPV.[4] For COPD it is clearer that NPPV is more effective and less expensive.[3,5] Where using NPPV enables ventilation to be done outside of an ICU, further cost savings are realized.[6]

NPPV gives the doctor an alternative to either not ventilating or providing invasive ventilation, as well as the possibility of grading the aggressiveness of treatment to match the severity of the illness.

[1] National Vital Statistics Reports, v48(11), July 24, 2000. Table 8. Deaths and death rates.

[2] http://www.goldcopd.com click on document and resoruces then click GOLD guideliens executive summary

[3] Lightowler JV, Wedzicha JA, et al. Non-invasive positive pressure ventilation to treat respiratory failure resulting from exacerbations of chronic obstructive pulmonary disease: Cochrane systematic review and meta-analysis. *BMJ 2003 Jan 25;326(7382):185*

[4] Nava S, Evangelisti I, et al. Human and financial costs of noninvasive mechanical ventilation in patients affected by COPD and acute respiratory failure. *Chest 1997, 111:1631-8*

[5] Keenan SP, Gregor J, et al. Non-invasive positive pressure ventilation in the setting of severe, acute exacerbations of chronic obstructive pulmonary disease: more effective and less expensive. *Critical care medicine 2000,28:2094-102*

[6] Elliott MW, Confalonieri M, et al. Where to perform noninvasive ventilation? *Eur Respir J 2002, 19:1159-66*

When Nicole, a 66-year-old French woman was presented with difficulties using a volume ventilator, her physician's decisions to move her to VPAP and nocturnal monitoring allowed her to resume a normal life.

Nicole's case raises issues such as

1. What can be improved by switching a patient from volume ventilation to pressure support with PEEP?
2. Can ventilator settings be compared in terms of volume and pressure support?
3. How important is nocturnal monitoring in determining the quality of ventilation?

Background

Nicole developed pneumonia in 1941. The resulting empyema was treated with multiple surgeries and, in 1943, a thoracoplasty.

Between 1946 and 1983 Nicole lived an ordinary life, marrying and giving birth to two boys. In 1983 she began to develop symptoms of respiratory failure, including daytime fatigue, morning headache and problems with activities of daily living (ADL).

In 1985 she was placed on noninvasive ventilation, involving a custom nasal mask and nocturnal volume ventilation of tidal volume (Vt) 600ml, respiratory frequency of 15 breaths per minute and room air. This worked effectively for ten years.

France

Case Study

NPPV - the first line of intervention?

However, between 1995 and 2000, Nicole began to experience difficulties. These included a decrease in PaO_2 and nocturnal SpO_2, an increase in $PaCO_2$, repeated infections, increasing secretion production, and renewed symptoms of under-ventilation.

The treatment

Over several months, various modifications to her treatment were attempted. Volume ventilator settings were changed, and supplemental oxygen was increased to improve Nicole's ventilation. These changes were of little or no help.

It was then thought that a tracheostomy would be necessary to help her.

The medical team treating Nicole had little or no experience using bilevel ventilation, and with the high pressures required with the volume ventilator, (at this time, her ventilating pressures were 30-35 cm H_2O during observation) they had little hope the VPAP would work.

The Embletta (a small ambulatory diagnostic device) was presented to the team at the same time as the VPAP so they decided to monitor Nicole's ventilation at night using the volume ventilator. They were very surprised to see that although her SpO_2 was maintained at a reasonable level, she was not being ventilated (refer Figure 1). The next night they tried the VPAP using a nasal mask.

The issue of how the team chose settings is interesting. EPAP was set at 2 cm H_2O because Nicole's condition had mainly a restrictive component; IPAP was titrated to comfort (18 cm H_2O); rise time was kept relatively fast because her respiratory rate remained high during ventilation; back-up rate was set randomly at 12.

The team carried out monitoring again using the Embletta. Although Nicole's ventilation was better, her SpO_2 was worse. The same level of oxygen (1 L/min) was used for both the volume ventilator and the VPAP.

The fact that the SpO_2 was worse was because FIO_2 using the volume ventilator was much higher than with the VPAP. The volume ventilator used an accumulator system to deliver the oxygen.

Nicole felt that she slept much better but complained of a dry throat, despite having used a heated humidifier. The nocturnal monitoring showed some waning of the ventilating pressures, indicating possible mouth leak. In addition, her respiratory rate frequently stayed at 12 during the night. Nicole agreed to try a full face mask. Her oxygen was increased to 2 L/min and the back-up rate was increased to 17 (refer Figure 2). Monitoring the second night with the VPAP was much better, and Nicole has been using the VPAP ever since, with good results.

Special thanks to Susan Sortor Leger for compiling this story.

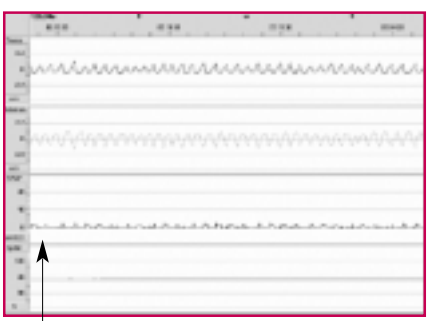


Figure 1: Under-ventilation

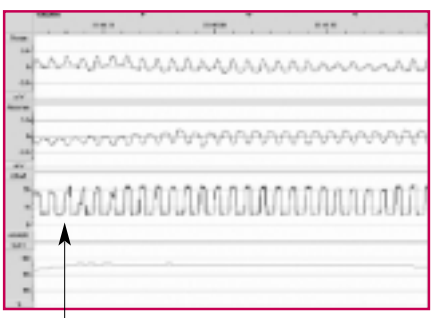


Figure 2: Adequate ventilation

The results

Nicole's experience suggests a number of conclusions:

- Without question the bilevel therapy provided more effective nocturnal ventilation.
- When transferring patients from other types of ventilator systems, it is important not to assume that the settings are equivalent.
- Nocturnal monitoring is an important tool for evaluating nocturnal ventilation.
- Improving sleep is vital to improving quality of life. The VPAP allowed this patient to have an active, enjoyable life without having to resort to a tracheostomy.
- A tracheostomy is not always necessary. NPPV therapy, with the right settings, can offer an effective alternative.
- Mouth leak compromises therapy–full face masks are an option to consider.

ResMed

Nursing the patient – noninvastive ventilation at home

Since the early 19th century, clinicians have been using noninvasive ventilation (NPPV) to support patients with respiratory failure. Over the past twenty years increasing numbers of patients have taken advantage of NPPV. Today, patients needing NPPV are usually cared for at home.

ResMed UK's Fenella Connell spoke with three nurses from Newcastle upon Tyne in the UK, where Newcastle General hospital operates a regional community home ventilation service. Helen Linsley and Alison Armstrong are currently responsible for the ventilatory care of patients on home ventilation. Mark Tomlinson is working on a research project at the Freeman Hospital to investigate the role of NPPV in Motor Neurone Disease (MND).

Evaluating the need for NPPV - the indications.

Mark is currently involved in a research project examining the natural evolution and pattern of respiratory change in Motor Neurone Disease (MND), a progressive neurological disorder resulting in weakness and wasting of dependent muscles, including those supporting respiration

One aspect of this is an evaluation of the role of NPPV in managing respiratory compromise that usually occurs in the latter stages of this disease. Almost all patients with MND experience some symptoms as a result of ventilatory underperformance.

Most patients are found to be in Type II Respiratory Failure and suitable for NPPV support. One of the aims of the research project is to evaluate the usefulness of NPPV in this patient group since it is not widely used in MND. In addition to symptom control, this involves an evaluation of the impact of NPPV on the patient across a range of quality of life (QOL) indices and on that of the main carer(s).

A second aspect of Mark's role has been to set up and run a Domiciliary Sleep Investigations Service for Obstructive Sleep Apnea, since all diagnostic investigations and treatment commencement were previously done on an in-patient basis only.

Helen and Alison manage the ventilatory aspects of the care of patients with respiratory failure in the community. They have approximately 140 patients within the North East region. They come across many types of conditions, which require NPPV therapy. These mainly include: neuromuscular 56%, chest wall conditions 26%, COPD 7%, and OSA 8%.

According to Mark, sleep-related symptoms in the presence of sustained hypercapnia are usually the main indication for considering noninvasive ventilation in patients with muscle disease. He has found that orthopnoea may be a useful clinical predictor for a good response in MND patients, as ventilation is compromised in a supine position. Excessive daytime somnolence is usually also present.

Helen and Alison's patients also have pulmonary function and blood gas analysis monitored, since chronic respiratory failure is part of the progression of the disease states mentioned above. However, the main criteria for starting a patient on NPPV, as with the MND group, are specific symptoms including morning headaches and problems associated with disturbed sleep.

Initiating NPPV - the challenge.

Prescribing NPPV and getting a patient started on therapy is a challenge.

In any patient group there are difficulties which stem from unfamiliarity with NPPV. The challenge is greater because of the patient's negative perception of a condition that needs some ventilatory support. Mark commented that many MND patients view the onset of respiratory symptoms as the final and most distressing phase of their disease journey. Patients need time to gain understanding of their respiratory problems and the range of interventions available to them.

MND patients also present practical difficulties. Facial muscle weakness and wasting can be problematic in achieving a good mask seal. The majority of MND patients have bulbar involvement manifesting itself in upper airway dysfunction and swallowing impairment. This can lead to an excessive build up of saliva in the mouth, which needs to be actively managed to prevent aspiration. A "full" or "total' face mask is usually required.

Other patient groups experience difficulties with the interface and getting a good fit. As with the MND group, many of the patients are mouth breathers so they need a full face mask. This raises safety issues. Because of their condition, many patients cannot easily remove the mask and may be in danger of aspirating if they vomit.

The nurses agree on the need for maintaining a common sense approach to managing problems, so

that patients persevere with the treatment. Fortunately the benefits of NIPPV are usually immediate and management thereafter becomes easier.

Seeing results with NPPV - the physiological factors.

Once the initial difficulties of commencing NPPV are resolved, what continuing problems do the nurses face?

Helen and Alison point out that if the patient does not experience symptom relief, they are less likely to comply with the therapy. The most common problems are dryness of the mouth and rhinitis. Humidification is used for dryness and nasal drops for stuffiness and rhinitis. Sometimes patients simply need to moisten the mouth with frequent sips of water, while other patients need to have secretions managed with drugs and suction to prevent aspiration.

In MND patients the major problems are poor coordination of excessive saliva or dryness. Secretion drying agents, such as Hyoscine, are effective in reducing copious secretions, and most patients are supplied with a portable home suction unit.

Mark also discussed the need to have the IPAP sufficiently high to adequately provide ventilation. EPAP also needs to be set at a level that will both support the upper airway, bearing in mind its instability, as well as facilitate good gas exchange. As MND is not a static disease, the patient's condition deteriorates, and adjustments need to be made to the level of NPPV support to maintain optimal benefit.

Finally, Helen and Alison have come across problems with nasal bridge soreness. The mask fit is obviously important, and the patient and carer need to be educated so that they do not over-tighten the headgear. The interface can be alternated to vary the pressure. If a sore does occur, dressings such as duoderm or a hydrocolloid dressing are used.

Seeing results with NPPV - the psychological factors.

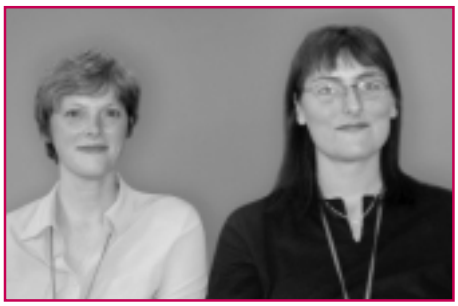
Many of these patients have specific psychological needs. MND involves continuous change and loss, so ongoing psychological support is an integral part of care. Mark explained that a well-established support network exists for MND patients and patients are well briefed about the disease and its stages. NPPV gives them some control in managing their symptoms and thereby a significant boost.

Helen and Alison commented that while some patients are well informed and well supported, others are less prepared to accept the intervention.

Family members also need support, advice and information, especially since they are usually central in providing care.

Helen and Alison's patients are also usually cared for in their own home by family members or formal carers and for this reason, levels of understanding vary.

Training is practical but always involves an explanation of what NPPV is and what it can realistically be expected to provide.



Helen Linsley [L] and Alison Armstrong [R]

Seeing results with NPPV - the "network" factor.

The nurses liaise with other agencies such as hospital-based multi-disciplinary teams, community healthcare and support staff.

Seeing results with NPPV - patient and carer needs.

Mark, Helen, and Alison agreed that machines need to be easy to use. They should also be relatively portable for home use and for disabled patients who still want to lead an active life, so batteries are an important feature. Mark commented that features such as IPAP min™ and IPAP max™ can be useful to achieve optimum ventilation in a patient group that can have difficulty in transitioning from inhalation to exhalation. Alarms on the ventilator may also be important to reassure carers that the mask has been correctly applied and that ventilation is working.

Making a difference with NPPV - the rewards.

This client group is, generally, at the end stage of their illness or condition and some of them are very young. However although they are often severely physically disabled, effective ventilation can help achieve significant improvement in their quality of life. This provides the nurses with both a challenging and a satisfying role that makes a real difference to people's lives.

Special thanks to Fenella Connell for compiling this story.

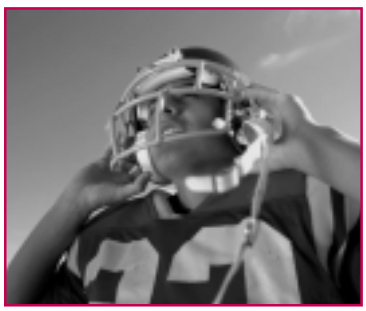
Reference

Mehta S, Hill NS Noninvasive ventilation. American Journal of Critical Care Medicine, 163:540-577 (2001)

ResMed

United States of America

Study finds sleep apnea in young football players



The New England Journal of Medicine (January 23, 2003) has published research suggesting that young professional football players in the United States suffer from unexpectedly high rates of undiagnosed sleep apnea.

The study was conducted in 2002 and involved more than 300 professional football players from eight National Football League teams.

Some 14% of the football players were found to have sleep apnea, a figure nearly five times higher than noted in previous studies of similarly aged adults.

Among higher risk players–sturdier men who played in lineman position–the prevalence of sleep apnea rose to 34%.

The study was conducted by Charles George, MD, Professor of Medicine, University of Western Ontario, with management provided by SleepTech Consulting Group and sponsorship from the ResMed Sleep Disordered Breathing Foundation. Team physicians and trainers assisted with the study.

A total of 52 overnight polysomnographic studies were performed to record patients' vital signs and physiology during a night of sleep. The study indicated that the offensive and defensive linemen accounted for 85% of the positive cases of sleep apnea among the players. These players also had the largest neck size and body mass index.

The findings raise several issues.

First, the study suggests that sleep apnea, once thought to be a relatively rare disorder limited to middle-aged and older men, is widespread and affects people who appear to be otherwise healthy.

Second, the study raises the question of the prevalence of sleep apnea in other young men of similar size and age, whose physical health may not be as good as the athletes tested.

"Professional football players have some of the risk factors associated with sleep apnea but their age and physical condition previously would not have suggested a prevalence of the disorder until they were much older," said Dr George. *"Many physicians have never considered such a diagnosis in young, healthy individuals because sleep apnea was previously thought to be associated with middle-aged or older individuals. The study strongly suggests that sleep apnea be considered as a possible condition for larger patients under 30 years of age."*

Vyto Kab, co-Managing Director of SleepTech Consulting Group and a former NFL tight end, pointed out that sleep apnea is a problem that goes well beyond football players.

"While our study tested professional football players, it is critical to note that sleep apnea is a problem for many who may not realize that they have the condition," he said. *"We know that there is a link between sleep and performance. Proper sleep boosts metabolic efficiency, which helps burn body fat; increases the release of growth hormones, which helps build muscle and accelerate recovery; and improves concentration and reaction times. And that's an issue whether you're an NFL player, a weekend athlete, operate a truck, or work behind a desk."*

ResMed supports research in the US through National Sleep Foundation

ResMed has established a foundation to support research, education and advocacy in the area of sleep-disordered breathing.

The ResMed Sleep Disordered Breathing Foundation is a non-profit, private, charitable organization that was founded in June 2002.

The mission of the Foundation is *'to promote research and both public and physician awareness of the inherent dangers of untreated sleep-disordered breathing.'*

These inherent dangers include the relationship of sleep-disordered breathing to traffic and workplace accidents as well as heart disease, hypertension, stroke, and obstructive lung disease. The Foundation also plans to promote leading research for publication in appropriate scientific and medical journals.

The Foundation provides equal funding for two areas–scientific study and public awareness.

The Foundation offers individual grants of between US$5,000 and $50,000. Grants over this amount may also be considered, as will proposals for longer-term studies. Applications for grants are considered on an annual basis.

For more information, *visit www.resmed.com US site. Click on philanthropy*

United States of America

Case Study
NPPV vignette

It has been thirty years since the last of the world polio epidemics and many patients are beginning to suffer from post-polio syndrome and the respiratory conditions associated with it.

In this case study, Dr Nick Hill describes how NPPV helped a patient improve energy levels, reduce sleepiness during the day and eliminate morning headaches.

The patient is a 39-year-old with severe restriction due to kyphoscoliosis related to post-polio syndrome. Approximately a year ago, she developed symptoms of increased fatigue, daytime hypersomnolence, and morning headaches. A sleep study showed severe obstructive sleep apnea with an AHI of 43. She also had sustained desaturations with an average O_2 saturation overnight of 88% and frequent dips with a nadir of 72%. An arterial blood gas result showed a daytime pH of 7.39, $PaCO_2$ of 53, and PaO_2 of 87 on 2 L/min O_2. The patient commenced nasal BiPAP therapy at pressures of 20 cm H_2O inspiratory, and 4 cm H_2O expiratory, combined with oxygen at 2 L/min. However there was no significant clinical improvement. Nocturnal hyperventilation was thought to be contributing, and this was perhaps related to insufficient inspiratory pressure. She was then treated using a PLV 102 positive pressure ventilator with an A/C mode, V_T 600 ml and rate of 15 bpm. Oxygen-supplementation was continued. On these settings, the patient symptomatically improved but was not happy with the quality of her sleep because she frequently awoke feeling dyspneic and continued to have morning headaches. A nocturnal study showed she was triggering only two thirds of her breaths.

Her persisting symptoms seemed related to leaking at night and the resulting asynchrony with the PLV ventilator. Finally her therapy was switched to a bilevel ventilator, the VPAP with Vsync™ at an inspiratory pressure of 22 cm H_2O, expiratory pressure of 2 cm H_2O, and a backup rate of 15 bpm. Minimum inspiratory time was 0.75 sec, and maximum 1.5 sec, with a rise time of 0.3 sec. On these settings, she felt as though she was getting more air per breath and sleep quality subjectively improved. Repeat arterial blood gases showed a pH of 7.39, a $PaCO_2$ of 46, and a PaO_2 of 80 mmHg on 2 L/min O_2. Nocturnal oximetry continued to show occasional episodes of desaturation to a nadir of 82% but average nocturnal oxygen saturation was greater than 90%. The intermittent desaturations were thought to be related to some persisting upper airway instability leading to occasional obstructive apneas. However she was unable to tolerate any increases in the expiratory pressure because of discomfort. Overall, however, she responded very well symptomatically. Her energy levels improved and she no longer suffered daytime hypersomnolence and morning headaches.

The VPAP provided a flow-contour that was easily adjusted to optimize comfort and synchrony and facilitated management of this challenging patient.

About Dr Nick Hill

Dr Hill is a professor of Medicine at Tufts University School of Medicine and Chief of Pulmonary, Critical Care and Sleep Division at Tufts-New England Medical Center in Boston. He is a Fellow and vice chair of the Home-care Network in the American College of Chest Physicians and a member of the Leadership Committee for the Pulmonary Circulation Assembly and of the Program Committee for the Critical Care Assembly of the American Thoracic Society. Dr Hill's main research interests are in the acute and chronic applications of noninvasive positive pressure ventilation for treating lung disease.

Websites of Interest

www.cochrane.org

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ResMed

Around the world with Cathy Galt

Equipped with a zest for life, and a ResMed VPAP, this gutsy lady shows that it is possible to overcome all kinds of obstacles to lead a full and rewarding life.

Like many people with disabilities, Cathy Galt packs a lot into her life and much of it revolves around helping other people.

When Cathy was just five months old, she contracted polio during the last of the polio epidemics that occurred in Australia. Forty years later, she is a partial paraplegic, relying on calipers and sometimes a wheelchair to get around. She has curvature of the spine and finds it difficult to breathe easily because of a weakened diaphragm.

Cathy hasn't allowed her disabilities to get in the way of a full and rewarding life. She is married, has a 19-year-old son, and works as an office manager for a local plumber. Within her Blue Mountains community, she runs a Christian youth group, is a director and treasurer of an organization for intellectually disabled people, belongs to a patchwork quilting group, and is currently studying to become a chaplain through the Presbyterian Theological College.

However like all polio patients, Cathy suffers the continuing problem of post-polio syndrome. Over the years, healthy nerves have taken over the jobs of those destroyed by her illness; but as she gets older Cathy's healthy nerves are beginning to 'wear out.' Her paralysis is increasing and, some months ago, she found that she was experiencing major breathing difficulties that left her exhausted and frustrated as her independence ebbed away.

Cathy's specialist referred her to a sleep clinic, where she learned she was suffering from respiratory failure. Cathy has been using a ResMed VPAP machine for the past seven months.

Here Cathy talks about her experience.

What symptoms led to your referral to the sleep clinic?

I was feeling breathless, lethargic, with no energy and morning headaches. I couldn't finish most things around the house, which frustrated me. I've worked hard for my independence and the last thing I wanted was for my husband to become a 'carer' now—I still wanted to be an equal partner in my marriage.

How did you feel when you heard you were suffering from respiratory failure?

Total disbelief! I was stunned and very angry at first, however the evidence of the sleep study was irrefutable. It seemed that after all I'd been through, life was dealing me yet another blow. My doctor, Professor Mackenzie, told me that all was not lost and that it was possible for me to feel very much better—but I didn't believe him.

What was your initial reaction to using a mask and a bilevel device for NPPV (ResMed's VPAP)?

I hated the idea, especially the thought of lying on my back or side with the mask on. You see, in order for me to relieve my back and muscles overnight, I must sleep face down. I struggled for a while before I found the best way to sleep on my stomach, by positioning pillows to allow room for the mask and tubing. It would have been great if someone had been able to help me through that phase. Clinicians need to understand how important positioning is in sleep for people who have these types of physical disabilities. If I hadn't persisted, I might not be on the treatment today.

It sounds as though you felt quite negative about the therapy. What were some of the main hurdles you had to overcome?

Feeling 'freaky' wearing the mask and the impact on my relationship with my husband. Although he is always supportive, I found it hard to discuss this with him and I felt like I was compromising my 'femininity.' I thought 'How could he want a freak for a wife who has to wear a mask to bed?!'. I really couldn't cope with the thought that my husband would now have to DO more for me. Again, the need to sleep prone with a mask was a real hurdle. Once these problems were solved, and I started getting some sleep, I began to feel the benefits.

What happened to help you cope with the therapy?

I met two people at a Post-polio Syndrome Association meeting, who encouraged me to persist with the device. They too had gone through what I was experiencing and inspired me to try harder.

How long did it take for you to adapt to using VPAP?

About a month. The first week, when I tried to sleep on my back, was difficult and I only got a couple of hours sleep each night. After that I worked out a way of lying on my stomach. Then one night, I went without the machine. The next day I realized just how much I needed the VPAP - my morning headache had returned! I also realized that I had actually been feeling better in the mornings because I was breathing better and it all began to fall into place. I now sleep a good eight hours every night.

How has the therapy changed your quality of life?

No headaches! I'm far more active during the day and complete my tasks such as sewing and cooking. I have much more energy and therefore more independence. I have much more control over my situation and have more choices than I had before.

You recently traveled around the world. How did you prepare for this?

We planned the entire trip so that I could have an extra day everywhere as a 'catch up'. What was fantastic was that I didn't need it; in fact, I often had more energy than the others! The other planning was for my wheelchair, crutches, and the VPAP, which is to be expected. We traveled with Qantas all the way and they were excellent–they always knew what to do with the VPAP and other equipment. I used the VPAP in-flight with no hassles.

Were there any surprises in terms of what you accomplished?

I fully expected not to be able to participate in some things, however, I actually did everything and saw everything! I had more energy to walk in some places, walk up and down stairs for example, where wheelchair access was not provided in the New York subway! This made it so much easier for everyone, and I felt much more independent.

What of the future?

Before treatment with VPAP I was 'just managing' most things. But now I see a future full of possibilities. In fact I'm now taking wheelchair tennis lessons, which is great fun, and I'm considering a career change and learning new skills. Our son is grown up now and my husband and I can concentrate on what we want to do.

I particularly want to help others like me, which is why I am happy to do this interview. I want to encourage others to give it a go, and not to give up. Life is too short. I want to help others realize that their potential to fully enjoy life does not have to be limited by their respiratory problems.

ResMed's VPAP III is not available for sale in the US but is subject of a submission for FDA clearance.

Recent research articles

1. Management of respiratory deterioration in a pregnant patient with severe kyphoscoliosis by noninvasive positive pressure ventilation.

Kahler Christian M; Hogl Birgit; Habeler Roman; Brezinka Christoph; Hamacher Jurg; Dienstl Anton; Prior Christian

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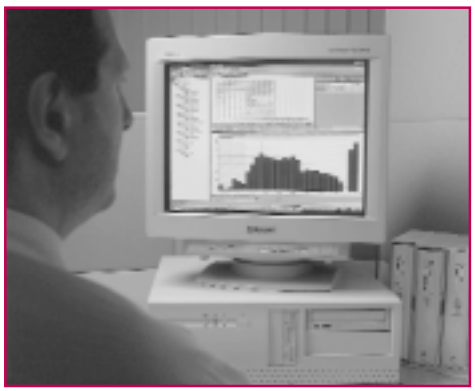
Wiener klinische Wochenschrift Oct 31 2002, 114 (19-20) p874-7

The problem of kyphoscoliosis in combination with pregnancy is uncommon and published cases are rare. Until now, little and controversial information on the outcome, optimal management and course of pregnancy in patients with kyphoscoliosis has been available. The majority of maternal deaths seem to be attributed to cardiorespiratory failure, while obstetric complications account for relatively few complications. We present the case of a 34-year-old pregnant woman with congenital kyphoscoliosis and a forced vital capacity (FVC) of about one liter. A further deterioration of lung function was expected. In fact, severe limitations in exercise capacity (bed rest), fatigue and hypersomnolence, as well as a severe increase in pulmonary hypertension occurred during the second and third trimester. Nasal intermittent positive pressure ventilation (NIP-PV) with bilevel positive airway pressure (BiPAP) was started in the 20th week of gestation and adapted throughout pregnancy. Nasal BiPAP was well-tolerated and corrected exercise tolerance, fatigue and nocturnal oxygen desaturations. At 32 weeks of gestation, the patient was admitted for an elective Caesarean section under combined spinal-epidural anaesthesia with ongoing NIPPV, and delivered a healthy baby. Home nocturnal ventilatory support was continued as nocturnal episodic desaturations were also assessed during the postpartum period.At time of discharge, the patient's exercise capacity and lung function were nearly equal to levels before pregnancy. We conclude that pregnancy in selected kyphoscoliotic patients with severe limitations in lung function is relatively safe for both the mother and the child when NIPPV is used for overcoming respiratory deterioration and for preventing further cardiorespiratory failure.



2. An overnight comparison of two ventilators used in the treatment of chronic respiratory failure.

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European respiratory journal - official journal of the European Society for Clinical Respiratory Physiology (Denmark) Oct 2002, 20 (4) p942-5

Differences between bilevel ventilators used for noninvasive intermittent positive pressure ventilation (NIPPV) have been demonstrated during bench testing. However, there are no clinical studies comparing these machines. The authors have previously shown that the Quantum pressure support ventilator and Sullivan variable positive airway pressure II ST differ in performance during bench testing. To examine the clinical significance of this, these two machines were compared in the overnight treatment of subjects with chronic respiratory failure. Ten clinically-stable subjects with thoracic scoliosis were recruited. The subjects were already established on NIPPV, but none were using either of the ventilators to be tested. After familiarisation, the patients used the two ventilators in random order on consecutive nights. Peripheral oxygen saturation and transcutaneous carbon dioxide tension (Pt, CO_2) were measured continuously, and sleep was recorded using polysomnography. There were no significant differences in arterial oxygen saturation, Pt, CO_2 or sleep duration and quality between the two nights.

Despite previously illustrated variation in laboratory performance, no differences were seen between the two ventilators when comparing overnight gas exchange and sleep in vivo. Further study is required to evaluate the significance of the differences found during bench testing in the clinical setting.

3. Current status of noninvasive ventilation in German ICU's a postal survey

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Anasthesiologie, Intensivmedizin, Notfallmedizin, Schmerztherapie - AINS (Germany) Jan 2003, 38 (1) p32-7

The status of noninvasive ventilation (NIV) in intensive care units (ICU) in Germany was analysed by a national survey. Questionnaires consisting of multiple-choice and short-answer questions were sent to ICUs of university hospitals, hospitals with >1000 beds, with 500 - 1000 beds, and hospitals with <500 beds separated with regard to different specialties (anesthesia ICUs, surgical ICUs, cardiac surgical ICUs, neurosurgical ICUs, internal ICUs, interdiscipline ICUs). Of the 716 questionnaires sent 223 (32%) were returned and analysed. The use of NIV in all specialties increased during the last 3 years. 14% of ICUs in some specialties treated more than 30% of patients with NIV. CPAP (88%), BIPAP (45%) and ASB/PSV (48%) were most frequently used as NIV-strategies. 10% of all ICUs reported to have experience with proportional assist ventilation. NIV was most frequently used for disease states like COPD (82%), pneumonia (64%), pulmonary oedema (50%), bronchial asthma (35%) and ALI/ARDS (22%). The use of NIV was considered when clinical signs of ventilation (93%) and oxygenation [arterial blood gas analysis (92%) and oxygen saturation (66%)] were inadequate. Complications observed during NIV were panic reaction (83%), ulceration of nose (38%) and aspiration (14%). The reasons to reject NIV were (total 13%): lack of ventilators (64%), expenditure of personnel (57%) and risk of the procedure (11%). 38% of the ventilators used were older than 5 years. 56% of the ICUs were content with the equipment for NIV. 76% of the ICUs were interested to buy new equipment of NIV. 99% of the survey declined NIV as an alternative method of ventilation. In summary we found NIV as an accepted additional method of ventilatory support in respiratory failure in German ICUs. We found no significant increase in frequency of NIV in the last three years.

4. Assisted ventilation for heart failure patients with Cheyne-Stokes respiration.

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European respiratory journal - official journal of the European Society for Clinical Respiratory Physiology (Denmark) Oct 2002, 20 (4) p934

Patients with chronic congestive cardiac failure (CCF) frequently suffer from central sleep apnea syndrome (CSAS). Continuous positive airway pressure (CPAP) has been suggested as a treatment. The authors hypothesized that bilevel ventilation might be easier to initiate and superior to CPAP at correcting the sleep-related abnormality of breathing in patients with CCF. After excluding those with a history suggestive of obstructive sleep apnea, 35 patients with CCF (left ventricular ejection fraction <35%) were screened with overnight oximetry and the diagnosis of CSAS was established with polysomnography in 18. Two 14-day cycles of CPAP (0.85 kPa (8.5 mbar) or bilevel ventilation (0.85/0.3 kPa (8.5/3 mbar) in random order, were compared in a crossover study. Sixteen patients (13 males), mean age 62.0+/-7.4 yrs completed the study. The pretreatment apnea/hypopnea index of 26.7+/-10.7 was significantly reduced by CPAP and bilevel ventilation to 7.7+/-5.6 and 6.5+/-6.6, respectively. The arousal index fell from 31.1+/-10.0 per hour of sleep to 15.7+/-5.4 and 16.4+/-6.9, respectively. Significant and equal improvements with CPAP and bilevel ventilation were found for sleep quality, daytime fatigue, circulation time and New York Heart Association class. The authors conclude that continuous positive airway pressure and bilevel ventilation equally and effectively improve Cheyne-Stokes respiration in patients with congestive cardiac failure.

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2003 2004 *Calender of events*

May 21-24, 2003	Valencia, Spain	12th European Stroke Congress
May 22-24, 2003	Copenhagen, Denmark	The 10th Conference of Scandinavian Sleep Research Society
June 3-8, 2003	Chicago, IL, USA	APSS 17th Annual Meeting (Associated Professional Sleep Societies)
June 30 - July 3, 2003	Helsinki, Finland	7th World Congress on Sleep Apnea
August 30 - Sept 3, 2003	Vienna, Austria	European Society of Cardiology Congress 2003
September 27 - October 1	Vienna, Austria	13th European Respiratory Society Congress 2003
October 7-9, 2003	Atlanta, GA, USA	Medtrade 2003
October 10-12, 2003	Auckland, New Zealand	ASA 2003 (Australasian Sleep Association)
October 25 - 30, 2003,	Orlando, FL, USA	Chest 2003
November 9-11, 2003	Orlando, FL, USA	AHA Scientific Sessions 2003 (American Heart Association)
November 21-23, 2003	Zhuhai, China	4th ASRS Congres (Asian Sleep Research Society)
December 8-11, 2003	Las Vegas, NV, USA	49th International Respiratory Congress
March 4-10, 2004	New Orleans, LA, USA	ACC 2004 (American College of Cardiology)
May 21-26, 2004	Orlando, FA, USA	ATS 2004 (American Thoracic Society)
May 12-16, 2004	Vienna, Austria	14th European Congress of Physical Rehabilitation Medicine

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