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Inspire

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FIRST WORD

1ST AUGUST 2014
VOLUME 15, ISSUE 2

Welcome to the summer issue of 'Inspire'.

Following the conference special in the previous issue (ARTP members-only link), this time a few more varied articles which you may consider while enjoying a well earned holiday.

Who recalls being a Clinical Physiology (or Physiological Measurement as it was called in 'my day') student? Do you remember being thrown into departments which may have been poorly prepared to accommodate you? My initial training consisted of several months in each of cardiology, respiratory, audiology, perfusion, etc. and I remember there being a wide variation in how well each location was set-up or able to teach or indeed welcomed students in the first place. Nevertheless, fond memories (I think) and my department recently accepted our first Clinical Physiology student. The process was well organised and much support was available to both student and institution! The student has written an article about her experience and perhaps it may encourage you to offer a placement in the future. Sticking with paediatrics we have an article describing the differences encountered while testing lung function in adults and children and indeed about the overall joy of being a respiratory physiologist and a potted history of Clydebank! Well worth a read!

The feel-good factor continues with two inspirational articles from the Chair and the President explaining what is happening in the respiratory world, how the ARTP contributes to this and intriguing glimpses into the next two conferences! Personally I am grateful for a timely article from the ARTP Workforce Committee about Professional Registration, with a clear explanation of the ideal versus the current (somewhat confusing to me) picture. 'OTB' completes the line-up of regular contributors with the usual comprehensive round-up of news from the manufacturers (news of more time to resolve WinXP problems?) and I have created a distinct 'NIV' section this time to reflect the number of NIV items featured in this issue.

Several months ago on the forum there was a question about testing lung function on tracheostomy patients. Who could answer this? Who else but Dr. Kendrick; the first in a two part article is HERE. You ask and 'Inspire' delivers!

At the time of going to press there were two late submissions of importance to readers. Firstly, the Home oxygen guideline is now on the BTS website for the public consultation period, with comments invited before the deadline of 29th August. See HERE for the document and expect updates on the website and future newsletters. Secondly, The GLI Implementation group had their first meeting in June. Details of the implementation strategy will be published on the ARTP website in due course and the group kindly request each laboratory completes a 10-minute questionnaire (HERE) to inform how to proceed with the changing of reference equations. The survey starts on 4th August and the results will be published on the ARTP website and in the next issue of Inspire.

My thanks to all the contributors to this issue.

Finally, You may notice that this issue contains a few stylistic changes. Feel free to let me know if you approve or not and if you have suggestions for future articles in 'Inspire' or have written a piece for consideration please email me at : inspire@artp.org.uk.

AIDAN LAVERTY

A WORD FROM THE CHAIR

Dr. Karl Sylvester

ARTP Honorary Chair

Another busy few months in between Inspire editions but also some great news and positive decisions being made by your Board. ARTP finances are looking much better and we are now back in the black after some consecutive years in the red. This has been a fantastic turnaround and special thanks must be given to Emma Spence, ARTP Treasurer who has been ably supported by our previous Treasurer, Jason Viner, our Non-Executive Finance Director, Mark Hubbocks and all the finance committee. This fantastic change in financial circumstances means we can now make some important decisions, including re-introduction of bursaries to attend the next ARTP conference in 2015. Our improved financial position is also allowing us to investigate means to improve the workings of our organisation and keep up with the times. These include the possibility of allowing future students to have their own e-portfolio, where they can upload all their evidence, assessments etc. for review by their assessors. This hopefully will make the whole process much smoother and do away with the need to collect lots of paper in an A4 lever-arch file which then needs to be posted off, further saving on the cost of postage etc. and the possibility of items being lost in the post. Another area we are investigating improvements for is the ARTP website. The site looks great as it is and Chris Jones, Chair Communications and webmaster, has done a fantastic job at bringing the site up to date. There are areas, however, where further improvements could be made, such as our ability to undertake e-commerce via the website, having available case studies for members to investigate and answer multiple choice questions, uploading selected presentations with linked video/ audio from our national conference. Those of you that access the ERS website will know the resources that are available to the members of that organisation, which are immense. However, the ERS has a much greater expendable budget than us but we hope to be able to mirror at least some of the available resources. In time we will be asking you all for your comments for further improvements to the website and we would really love to hear your suggestions and comments. What do you want from your website? How could we improve the functionality? What resources would you like to have available? Please do take the time to let us know your thoughts.

Plans for Conference 2015 in Blackpool are well underway and we have an excellent programme planned for you all again. Most speakers have now confirmed their attendance and I can tell you we have a session on altitude with two

exceptional speakers from the military sector. We will be having a session on how to assess the abnormal athlete from a respiratory perspective, as well as a session on respiratory complications in non-respiratory diseases. We will be running two masterclasses, one looking at interpretation of cardio-pulmonary exercise testing and another on oximetry testing. There will be the usual lunchtime workshops and we have factored in a little additional time over lunch to allow for attendees to arrive and depart these on time. There are also some very exciting plans afoot for your evening entertainment. I won't spoil the surprise but let's just say fun will definitely be the order of the day. Registration will be open for the conference soon, if not already by the time this edition of Inspire is published, so book early to ensure you get your place and accommodation on site, which is limited.

Believe it or not plans for 2016 have also begun. If we have calculated everything correctly, 2016 will be our 40th year as a professional organisation. So expect suitable celebrations. A potential venue has also been chosen which looks absolutely stunning.

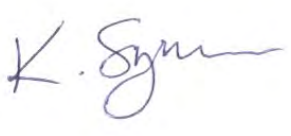
I'll just finish off with one event which I personally felt privileged to be able to attend. John B West (Picture 1) gave an evening lecture to attendees at the Medical School Addenbrooke's Hospital in Cambridge. He recounted the early days of altitude research on a trek to Mount Everest where some investigations were performed at its summit. Notably of interest is how

Picture 1. L-R Dr Rob Ross-Russell, Paediatric Consultant; Dr Karl Sylvester; John B West; Tom Dymond, Research Physiologist; Matt Rutter, Senior Clinical Physiologist; Muhammad Khan, Clinical Physiologist; Jess Waterfall, Clinical Physiologist; Natasha Jillott, Clinical Physiologist

A WORD FROM THE CHAIR

the summit of Everest is actually at the limit of human physiology, a coincidence perhaps? There were stories of heroism and some stupidity along the way. For example, one researcher who decided to attempt a solo climb to the summit as darkness descended. He had made it to the summit but lost his footing on the way back down and was left dangling from a ridge. He somehow made it back from this precarious position and was able to provide photographic evidence that he had actually reached the top of Mount Everest. One researcher had lost his ice axe and decided to try and attempt a summit climb using a tent pole. As luck would have it he happened to stumble across an ice axe left behind by an unsuccessful mountaineer whose body was left behind on the mountain, not so lucky for the deceased mountaineer obviously! At a monastery the team visited on the way to Everest they asked one of the monks what they needed to be able to climb Mount Everest. They were expecting an inspired spiritual answer. The answer they got was luck! It would appear this monk was not wrong. And finally, another of the researchers, having reached the summit, decided the first thing he would do was throw a Frisbee into Nepal so that he could claim the Guinness World Record for the highest Frisbee throw. I imagine he still must hold this record, unless someone has tried it since as Mount Everest continues to increase its altitude.

So that's another Chair's message for this edition of Inspire. As always I'm happy to receive any comments from you all at the Chair's email address—chair@artp.org.uk.



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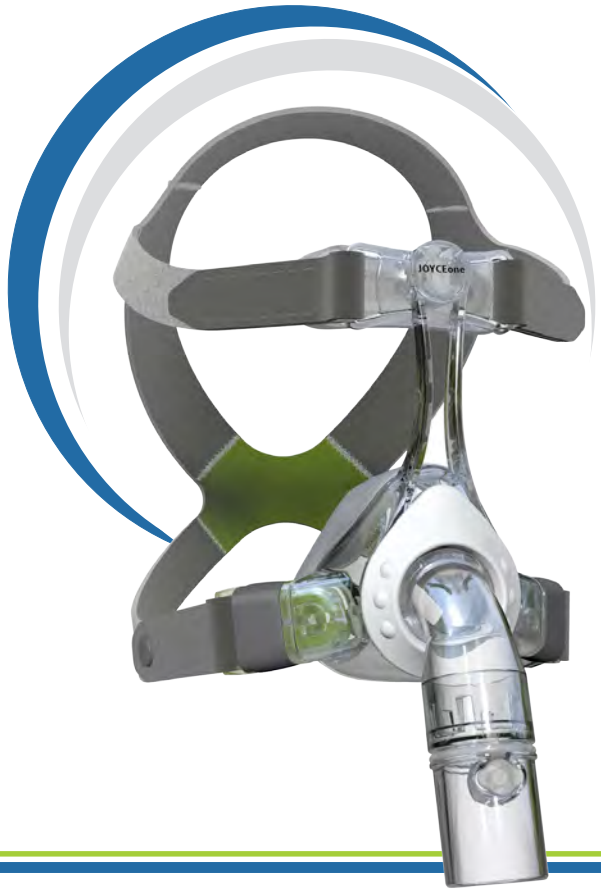

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PHILIPS RESPIRONICS

THE PRESIDENT'S ADDRESS

Dr. Brendan Cooper

ARTP Honorary President

TELLING THE WORLD ABOUT THE ARTP

Here it is .....the first President's address (well actually, it's just up the road at Pennsylvania Avenue!) Sadly, I didn't have time to see Mr Obama on this rapid trip to Washington DC, but if he pops over the pond to Birmingham any time, I'm sure I could fit in his visit in between clinics! (Unlike Mr Putin, Mr Obama, doesn't take these things too seriously.)

Well already, nearly six months have passed since the excellent ARTP Conference in Blackpool and another year of ARTP business is well underway. As your President, I have been representing and promoting ARTP at numerous meetings and on as many occasions as possible throughout the year. I believe this is why you elected me as your President and I will do my best to fulfil your expectations at all times. Indeed, during the very reason for my USA visit, I even mentioned ARTP to the Food & Drug Administration (FDA) panel I attended as the "world leading professional body for lung function professionals".

Meanwhile back in the UK, at the NHS England Spirometry Group meeting, ARTP Chair, Dr Sylvester and I, managed to persuade the group that the

only way to achieve training in quality spirometry, is to adopt the ARTP Foundation, Interpretation and Full Spirometry Certificates model. ARTP has been leading the cause for quality spirometry since 1998 and have taught thousands of nurses across the UK in the skills and competencies (and not the "mystery" that some believe) of spirometry, so it only makes sense that we should continue to lead on UK spirometry standards and registration.

In May, I attended a consultation seminar in London with the Academy of Health Care Sciences, again promoting the ARTP viewpoint, expressing our concerns and voicing our opinions amongst other clinical physiology and scientific professional bodies.

Also in the last month, I have attended two important ERS meetings in Amsterdam, one to thrash out the "equivalence" of ARTP Spirometry Certificates with the European Spirometry Driving Licence and the other to map out suitable modules for ARTP SLEEP qualifications at STP and HSST level through the ERS Sleep Task Force Sleep Training Course. ARTP is making further positive headway with the ERS for the benefit of members. I was speaking with the current President of ERS, Prof Peter Barnes (a great supporter of ARTP) at the Spring Meeting in Zurich and he wants to negotiate a new deal with ARTP to have a Joint Membership with ERS at greatly reduced fees compared to current arrangement. We will try and secure the details of this before the ERS Congress in Munich.

ARTP has been leading the cause for quality spirometry since 1998

You will be pleased to learn that all of these visits were funded externally from ARTP Funds! We continue to influence UK respiratory physiology with input into the IQIPS programme for laboratory accreditation and the Modernising Scientific Careers, Higher Specialist Scientific Training programme. We have also contributed significantly to the imminent, new BTS Home Oxygen Guidelines. It is great to see ARTP at the centre of respiratory medicine as usual.

One interesting recent development from leading lights in respiratory medicine is the perception that UK needs a "Respiratory Voice" that incorporates the voice of ARTP, BLF, BTS, ARNS, ACPRC and all relevant stakeholders to respond to government proposals, to promote campaigns and strategies on behalf of stakeholders or to speak up for important issues such as action against tobacco, identifying patients with respiratory disorders in our communities, better patient pathways, etc. As your President I will ensure the ARTP voice is heard and we are appropriately represented in any new forum/alliance. It is only working together nationally, like we do clinically that as a "respiratory team" of scientists,

physiologists, nurses and doctors we can improve our patient's health and lives.

As we head towards the holiday season, many of you will be juggling work and home life as you "clear the decks" before your leave, and then getting on top of responsibilities upon your return. Before you know it, the closing date for ARTP Abstracts and, for some, ERS abstracts will be upon us in no time. Those of you involved in research projects or writing up final year projects should consider getting your data in order for preparing the message of your abstract/poster and consider collecting a few more data points to improve the power of your studies. Others may be completing audits of clinical service, but nevertheless the lifeblood of our profession is innovation, development and continual improvement. All ARTP members are actually scientists (even our nurse and physiotherapist members!), and doing more than just the clinical service – important though that may be – the promotion of our science is essential to all our hospital and practice services.

...the lifeblood of our profession is innovation, development and continual improvement.

As the Chair of the ARTP Council, at our upcoming Council meeting this month I will be leading our discussions on ARTP strategy, drawing up issues related to governance of our organisation and reviewing the actions of our hard-working Board in dealing with the day to day issues of the profession. The Chair's message, in this edition of Inspire, outlines some of the progress on the ARTP objectives made since the last Conference. We would always value any views, opinions and suggestions you may have about the direction and scope of ARTP.

Finally, I was sent this wise tale from a great colleague and recent ARTP Special Award Winner, Professor Philip Quanjer, which has a great resonance with team working and reminds us that we are not just working in "silos" but both locally (within your hospital) and nationally (for ARTP as a professional body). Follow the safe link; http://www.wordfocus.com/word-act-blindmen.html or see overleaf.

The summer is here, and I can tell because today I rode my bike back from a meeting at ARTP HQ in Lichfield and got totally drenched in a thunderstorm!

Blind Men and the Elephant

poem by John Godfrey Saxe

(1816–1887)

It was six men of Indostan
To learning much inclined,
Who went to see the Elephant (Though
all of them were blind),
That each by observation
Might satisfy his mind

The First approached the Elephant,
And happening to fall
Against his broad and sturdy side,
At once began to bawl:
*"God bless me! but the Elephant
Is very like a wall!"*

The Second, feeling of the tusk,
Cried, *"Ho! what have we here
So very round and smooth and sharp?
To me 'tis mighty clear
This wonder of an Elephant
Is very like a spear!"*

The Third approached the animal,
And happening to take
The squirming trunk within his hands,
Thus boldly up and spake:
"I see," quoth he, *"the Elephant
Is very like a snake!"*

The Fourth reached out an eager hand,
And felt about the knee.
*"What most this wondrous beast is like
Is mighty plain,"* quoth he;
*" 'Tis clear enough the Elephant Is very like
a tree!"*

The Fifth, who chanced to touch the ear,
Said: *"E'en the blindest man
Can tell what this resembles most;
Deny the fact who can
This marvel of an Elephant
Is very like a fan!"*

The Sixth no sooner had begun
About the beast to grope,
Than, seizing on the swinging tail
That fell within his scope,
"I see," quoth he, *"the Elephant
Is very like a rope!"*

And so these men of Indostan
Disputed loud and long,
Each in his own opinion
Exceeding stiff and strong,
Though each was partly in the right,
And all were in the wrong!

Moral

*So oft in theologic wars,
The disputants, I ween,
Rail on in utter ignorance
Of what each other mean,
And prate about an Elephant
Not one of them has seen!*

LUNG FUNCTION TESTING IN TRACHEOSTOMY AND LARYNGECTOMY PATIENTS

A REVIEW AND PRACTICAL GUIDE. PART 1—LITERATURE REVIEW

Adrian H Kendrick, Consultant Clinical Scientist, University Hospitals, Bristol

Introduction

Lung function testing, in its traditional sense, requires careful measurement of a range of measurements that meet national and internationally recognised standards [1 – 4]. These standards are based on the ability of the subject to achieve the required seal of their lips around a mouthpiece to ensure that all of the flow of air and inhaled gases (as in CO Diffusion measurements) are measured accurately. Even with a normal upper airway, a small proportion of patients struggle to achieve these basic test requirements adequately.

When faced with a patient who has a tracheostomy or who has had a partial or total laryngectomy, the operator has some interesting challenges of a) achieving an adequate seal, b) dealing with the presence of upper airway secretions and c) the effects of changes in the upper airway structure that may alter the airflow dynamics of the measurements. Achieving therefore the test requirements and interpreting the results presents new challenges for the operator.

This two-part review will, in the first part, outline the role of the normal upper airway and the potential effects of changes in the upper airway structure on lung function testing. In the second part, the practicalities of making the measurements of lung function with relatively simple adaptations to connect the measuring device to the patient will be outlined.

The Upper Airway

The upper airway includes the nasal cavity, nasopharynx, velopharynx behind the soft palate, oropharynx, hypopharynx, and larynx (Figure 1).

This pathway has many important functions including the filtering and conditioning the inspired air for entry into the main bronchi and hence ultimately into the alveoli, as well as olfaction, mastication and deglutition, phonation, coughing, and protection of the lower airways and lungs from large particulate material [5, 6]. In addition, the upper airway has important impacts on the mechanical properties of the airways and lungs [7].

Evolution of speech in man has required laryngeal motility, leaving the human upper airway reliant on surrounding soft tissues for support and thus vulnerable to collapse. All of these functions are controlled by highly evolved neuromuscular systems under both voluntary and involuntary control [8 – 9]. These systems work efficiently in health but can come into conflict in diseases of the lungs and chest wall, and the upper airway in particular. In health and during wakefulness, common co-ordinated activities of this complex neuromuscular control system include cough, hiccups, aspiration recovery, vomiting, and sneezing.

A clear airway is of great importance in maintaining normal pulmonary ventilation. A normal upper airway maintains a free airway by removing mucous and particles, which may obstruct the respiratory tract during cough and will regulate and distribute airflow to the alveoli. The airway resistance due to the structure of the nasal passages influences the pulmonary mechanics of breathing through reflex actions and a similar response may be observed between the larynx and the pulmonary function [7].

Tracheostomy and Laryngectomy

One of the major changes after laryngectomy is in respiratory function. These changes occur in addition to any pre-laryngectomy changes that may

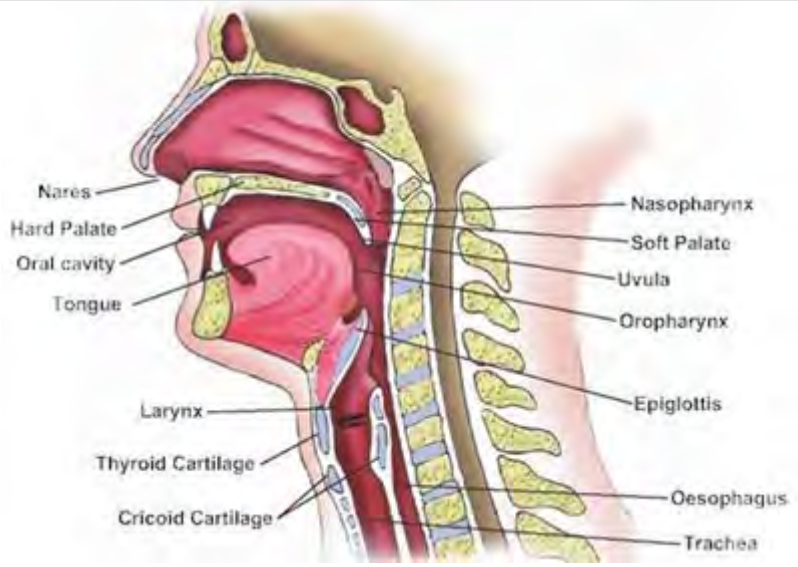

Figure 1. The upper airway showing the major features. From ARTP Pt 1 Handbook 2014 with permission and LifeArt from Lippincott Williams & Wilkins, Baltimore, MD

have occurred due to smoking habits and other causes of changes in lung function.

There is a shortening of the conducting airway with breathing now through the tracheostoma (Figure 2).

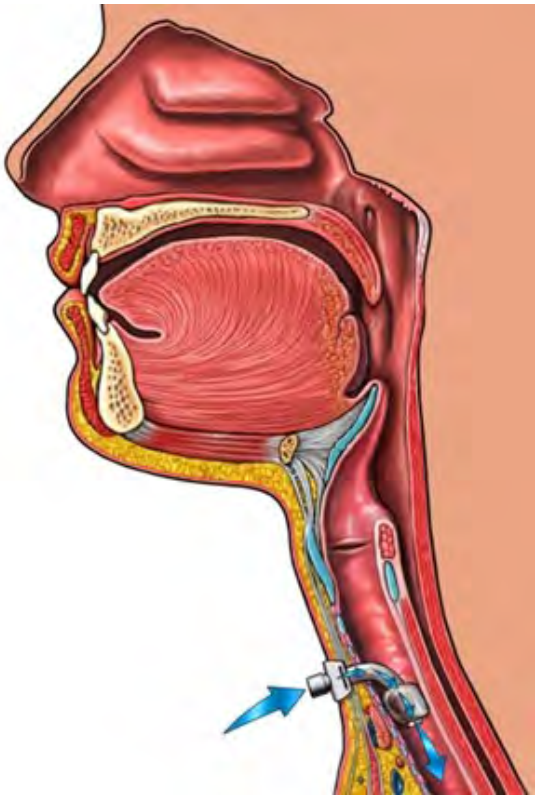

Figure 2. The upper airway showing the siting of the tracheostomy. From http://www.stopsnoringseattle.com/ with permission of Dr Pinczower. Original source unknown.

As a result, the inspired air is neither saturated with water vapour, nor warmed to body temperature before it reaches the lower respiratory tract. Furthermore, there is a significant reduction in the filtering processes of air-borne particles and aerosols, which the normal intact nasal passages and upper airway, in combination with the mucociliary escalator would deal with. This ultimately leads to a whole range of changes that occur in lung function. What is also of note is that when pre-laryngectomy impairments are combined with the effects of the post-laryngectomy airway disadvantages, it is perhaps not surprising that these patients have symptoms of cough, sputum production, dyspnoea, as well as the symptoms already associated with the their pre-laryngectomy disease – COPD, emphysema and acute infections.

Post Laryngectomy Lung Function and Exercise Performance Studies

There are a number of studies that have assessed lung function indices in patients post laryngectomy and provide evidence of the presence of altered lung function. It is difficult to determine, however, how much the surgical procedure and the pre-surgical lung status may have affected the lung function, particularly of the upper airways.

One of the earliest studies was that of Heyden in 1950, who investigated the effects of laryngectomy in 32 patients on resting lung function and exercise performance [10]. There was a reduction in VC and TLC, whilst on exercise, oxygen uptake (VO_2), minute ventilation, respiratory rate and pulse rate, were unaffected by laryngectomy. Studies repeated at between 1½ and 7 months post-surgery showed no significant changes in either lung function or working capacity.

Fourage [11] studied patients before and after laryngectomy and showed no major deterioration of spirometric data 1 – 2 months post-surgery. Most of the patients studied had reduced FEV and FIV, and it was noted that post surgery, the FIV in many patients improved considerably once the extrathoracic obstruction due to the cancer had been removed. There were no significant changes in arterial blood gases.

Torjussen [12] observed in 14 patients, that MVV (mean 65.6% predicted) and the FEV_1%VC (mean predicted 63.9%) were significantly reduced, although the VC was within normal limits (mean % predicted 100%). These results indicated that there is generally significant airways obstruction present in their patients. This, in part may be related to the stoma size as judged in a model using a healthy subject and stoma sizes 16mm, 8mm and 5 mm where a curvilinear relationship was noted, with the smaller stoma size greater effect on both FEV_1 and MVV. This is perhaps not surprising if one applies Poiseuille's equation relating resistance, flow rates and airway radius! Interestingly the authors showed that in this group of patients the Air Velocity Index (AVI: MVV%predicted ÷ VC% predicted) was, in all but one patient less than 1.0. This index, introduced by Gaensler [13], should have a value ≥ 1.0 to exclude airways obstruction. All but one of the patients had an AVI > 1.0, with the mean being 0.65.

Pantazopoulos et al [14] studied 18 patients before laryngectomy and showed that their VC was within normal limits and the FEV_1%VC was normal in 66% of patients – which appears to be defined as > 70%! The MVV was generally decreased and the resting respiratory frequency was increased. The mean AVI was 0.79, with 3/17 patients in whom data was presented having a value > 1.0.

Five of the patients were studied one month after surgery, the remaining patients being unable to undertake post-operative studies due to excessive tracheobronchial secretions. VC decreased by 43% (range 9% – 60.5%), FEV_1%VC was unchanged but MVV decreased further. The resultant AVI calculated from the individual case information, decreased from 0.72 to 0.45 suggesting further issues of ventilatory capacity and potentially further limitations on potential exercise capacity.

Harris & Jonson [15] studied 5 patients over a 12 month period making a range of measures at 2 weeks, 2, 6 and 12 months post-surgery. Apart from FRC, static lung volumes showed no real variation at 12 months compared to the pre-op values when measured using plethysmography. FRC was slightly increased. The pre-operative values for FRC and RV were higher than expected suggesting poor elastic recoil of the lungs. The elastic recoil pressure of the lungs was observed to be lower than in normal subjects especially at lower lung volumes (Figure 3A). The relationships of TGV and recoil pressure did not change after surgery.

Measurements of resistance were made from pleural space to mouth (R1) and include the extrathoracic airway, pleura to trachea (R2) and functional resistance (Rf; pleura to trachea) during exercise. R1 was significantly raised in 3/5 subjects, whereas R2 was within the normal range in 4/5 subjects. At 12 months, the R2Post/R2Pre ratio for the group was 2.52 (range 1.4 to 4.5) and may in part be explained by the stenosis caused by the tumour as well as inflammatory changes. Rf was similar to R2 at 12 months, with the exception of one subject who had a stenosis of the trachea (Figure 3B).

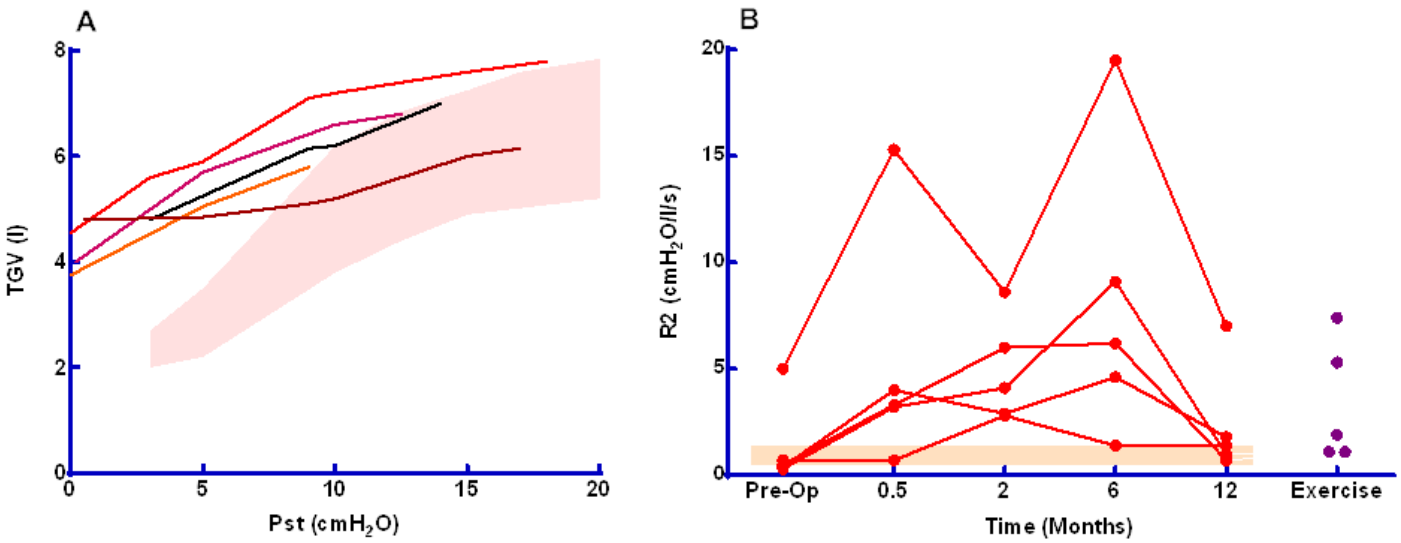

Figure 3. A) The elastic recoil pressure of the lungs in 5 patients compared to the normal range (shaded pink area) showing the Thoracic Gas Volume (TGV) plotted against recoil pressure (Pst). B) Variation in the resistance (R2) from pleura to trachea pre-operatively and then at 2 weeks (0.5 month) 2, 6 and 12 months. The resistance (Rf) is shown as the functional resistance during exercise. Shaded area is the normal range. Redrawn from data in reference 15 with permission.

Exercise performance using an incremental protocol at 12 months was normal or better than normal. Blood gases at rest and during exercise were all within normal limits. Breathing patterns, which may be variable are easily disturbed by emotional factors at rest [10]. During exercise, emotional factors are less of a problem, and it was noted that breathing patterns in this group of patients were essentially normal. One of the key findings from this study was that there is a clear period of adaptation of lung function, during which time patients do suffer from pulmonary symptoms.

Wozniak [16] assessed the dynamic compliance and work of breathing in 29 patients before and after laryngectomy and tracheostomy. Perhaps, not surprising, after surgically removing the malignant tumours causing airway narrowing, the total work of breathing as well as the elastic and non-elastic components of the work of breathing are all decreased. Again, this is perhaps not surprising as the "opened" airway now has a greater radius and hence airflow is increased.

Usui [17] assessed 13 post laryngectomy patients and compared their data to 10 normal subjects using dynamic lung volumes and flows, respiratory resistance and the closing volume (CV) by the single -breath N_2 washout method. The respiratory resistance was greater in the laryngectomised patients as were all of the standard indices from the expiratory flow-volume curve. The flow volume curves showed similar shapes to those observed in patients with chronic bronchitis. The observed effects on the flow-volume curve were generally reversed following inhalation of Orciprenaline - a moderately selective β_2-adrenergic receptor agonist, the exception being the $MEF_{25\%}FVC$, which showed no significant change. The measurement of CV added nothing to the understanding of the effects of laryngectomy on lung function.

Klos [18] studied 60 patients undergoing total laryngectomy, assessing static and dynamic lung volumes and arterial blood gases. They observed that lung function and arterial blood gases were affected by laryngectomy, although no formal data were given.

Togawa et al [19] studied dynamic and static lung volumes and revealed typical obstructive patterns with raised RV and FRC and a decreased FEV_1. The shape of the MEFV curve showed greater convexity at lower lung volumes indicating small airway

dysfunction. As previously observed [15 – 17] pulmonary resistance was lower than normal because of the absence of the upper airway resistance following surgery. Combining the pulmonary and upper airway resistance the total resistance would have been normal or raised. Measured by a mask over the tracheostoma, dynamic compliance remained generally within the normal range. Whilst this was not a long-term study, the authors recommended that laryngectomised patients have regular check-ups to monitor the long-term effects of changes in airway function in this group of patients.

Todisco et al [20] followed up 31 heavy smokers before and up to 12 months post laryngectomy. The main presenting consistent symptom was hoarseness. In those patients who had had conservative surgery (n = 10) there were no significant changes pre- to post-surgery in static and dynamic lung volumes and flows, with the exception of RV, which significantly decreased (167% to 140% predicted), and significant increases in PEF (85.7% to 106% predicted), $MEF_{25\%}$ (88% to 123% predicted) and $MEF_{50\%}$ (64% to 97.1% predicted). There were no significant changes in inspiratory or expiratory S_{Gaw}.

In patients who had had total laryngectomy, the FEV_1, VC, $MEF_{75\%}$, $MEF_{50\%}$, $MEF_{25\%}$and inspiratory and expiratory S_{Gaw} all showed significant decreases at 12 months compared to baseline pre-surgical values (Figure 4A). In the changes of S_{Gaw} these changes were predominately observed at 5 months (Figure 4B). The RV was generally unchanged. In this group of patients, bacteriology showed the trachea was sterile at the time of opening with bacterial growth increasing rapidly before reaching a raised, stable level it was observed that clinical and respiratory impairment correlated with the severity of the microbial infection in the trachea. The results of this study demonstrated that most subjects (71%) had COPD when referred for laryngeal surgery, and that having survived the risks associated with the tumour, the key prognostic factor is the progressive impairment from bronchial obstruction. Patients referred for total rather than conservative surgery may have a poorer long-term outcome, but this is likely to be dependent on the severity of airway dysfunction. What is noticeable is that the impairment of the large airways, assessed using FEV_1, PEF and S_{Gaw} are likely to precede changes in medium ($MEF_{50\%}$) and more peripheral airways ($MEF_{25\%}$). This links in with the earlier observations of Brunetti [21] in laryngectomised

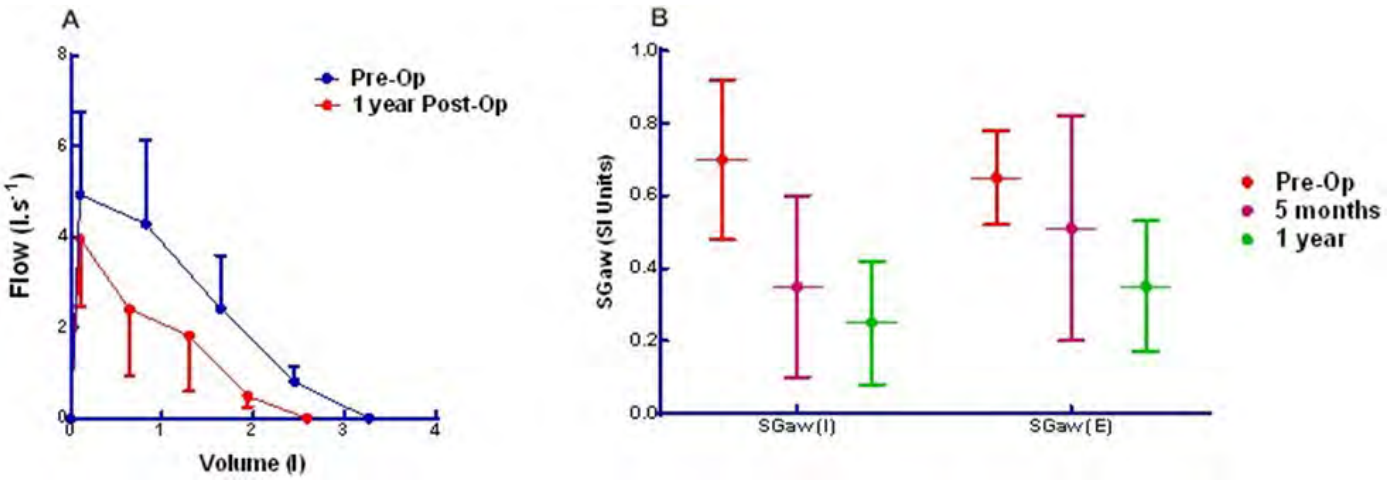

Figure 4. A) The expiratory flow-volume in 21 total laryngectomy patients with an "obstructive pattern" pre-operatively and at 1 year post surgery. B) Changes in SGaw (I) and SGaw (E) before, at 5 months and at 1 year post surgery in 10 "obstructive patients". Data from summary tables within reference 20.

patients that increases in central and peripheral resistances are probably due to the effects of bacterial infection and this ties in with the observations of Todisco et al, that the most frequent post-operative complaints are cough, sputum production and dyspnoea. The authors conclude that careful pre- and post-operative monitoring of lung function, airway dynamics, mucociliary function and tracheal bacteriology may provide a reliable approach for long-term prognosis of these patients especially since the majority of patients have airways dysfunction pre-surgery due in part to the long-term effects of smoking.

Gregor and Hassman [22] focused their study on the relationship of stoma size and its effects on lung function measurement. This had previously been highlighted by Torjussen [12]. They studied patients who had had a tracheostomy between 6 months and 18 years previously. Basic spirometry was undertaken and compared to then currently available reference values. The spirometry values were compared to the diameter of the stoma and the cross-sectional area of the stoma. There was no significant correlation between stoma size and spirometric indices. It was noted that FEV_1, FVC and PEF were all reduced, with PEF being at a mean of 50% predicted. The FEV_1/FVC ratio was 0.82 for the group. Similarly there was no relationship between arterial blood gases and stoma size. The observations regarding lung function were similar to those of previous studies highlighted above and was regarded as being more related to changes in the lower airway and pulmonary impairment.

Davidson et al [23] studied 9 subjects and 9 matched controls. Measurements of basic spirometry, and respiratory impedance (R_{os}) using forced oscillation. Lung function in the patients showed wide variation from 33% predicted to 132 % predicted for FEV_1, and is similar to previous studies. Of note was that there was a greater decrease in PEF than FEV_1 which may reflect the presence of the tracheostomy. In some patients significant changes were observed in the shape of the flow-volume curve pre and post-surgery (Figure 5). R_{os} was not significantly different between patients and control over the normal tidal range.

Hentona et al [24] studied 17 laryngectomies before and after surgery and compared the data to 15

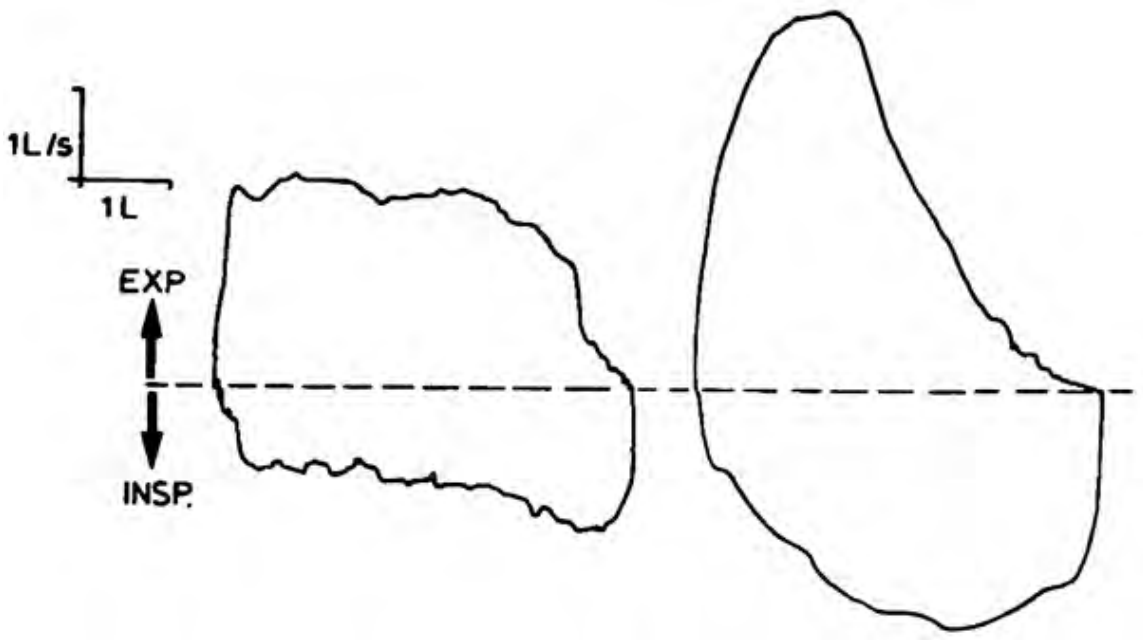

Figure 5. Flow-volume from a single patient pre and post laryngectomy, where pre-operatively the larynx was severely stenosed by carcinoma. The shape of the flow-volume curve is typical of a fixed extrathoracic obstruction. Post operatively, the flow-volume curve has been transformed into an almost normal flow contour. It was noted that Raw decreased from 5.0 $cmH2O.l^{-1}.s$ to 0.7 $cmH2O.l^{-1}$. Reproduced from reference 23 with permission.

control subjects. Measurements of static and dynamic lung volumes and flows, and closing volume were not significantly different pre- and post-surgery, with the majority of patients and of matched control. The only index to demonstrate a change was the PEF for the group, increasing from $4.2 \pm 1.7\ l.s^{-1}$ to $5.4 \pm 1.7\ l.s^{-1}$, but review of the individual data shows changes in both directions. The post-surgical values become closer to the control group values $6.2 \pm 1.3\ l.s^{-1}$. Review of the shapes of the MEFV illustrate the importance of reviewing the actual shape of the curves (Figure 6). All but one of the patients were smokers, and all but one had a reduced FEV_1%predicted. As with previous studies the lung function showed more changes in relation to lower airway function and pulmonary impairment.

Duran Cantolla et al [25] studied 30 patients using spirometry, and as with previous authors noted the issues of associated lung disease in this group of patients. They also noted that there was a poor correlation between the clinical-functional status of the patients, but there was a good correlation between the radiological-functional status.

Gardner & Meah in 1989 [26] studied, in 7 patients, the effects of laryngectomy on the role of the upper airways in the control of respiration by assessing the responses of expiratory flow and respiratory patterns during steady-state exercise at submaximal workloads (Figure 7).

The studies, in both laryngectomised patients and normal controls showed functionally insignificant differences between $P_{ET}CO_2$, mean inspiratory flow,

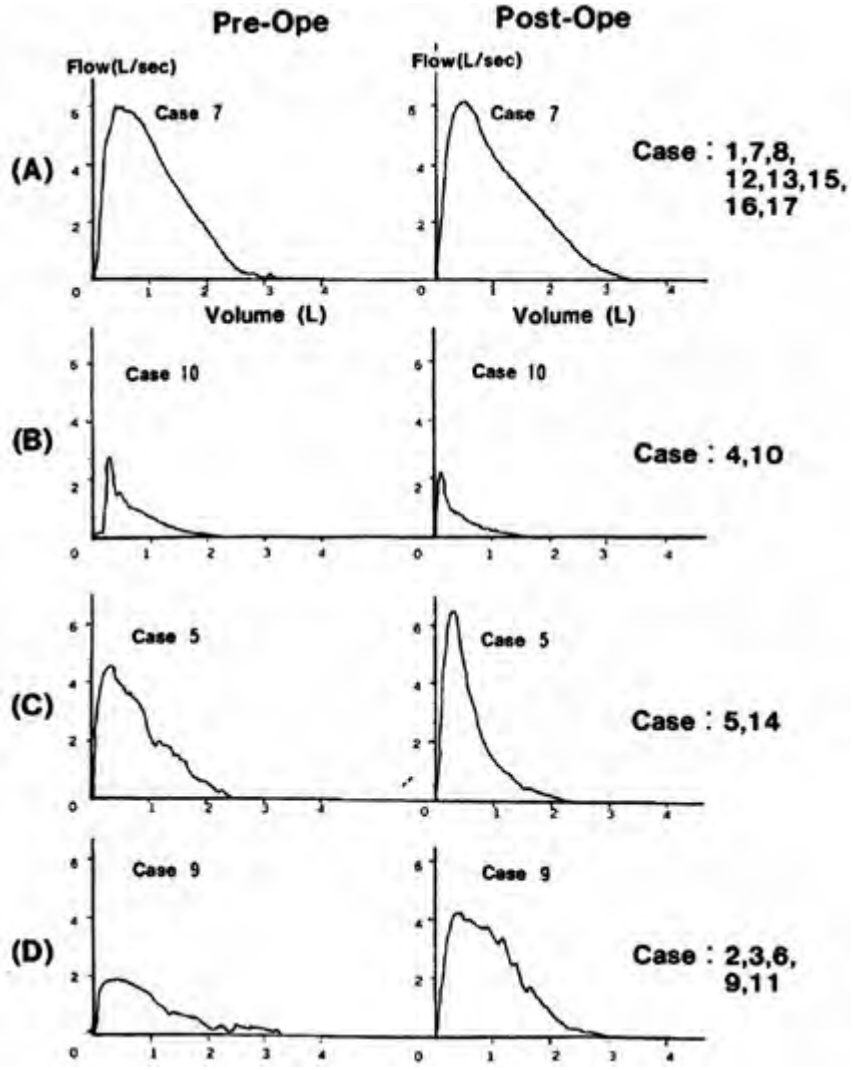

Figure 6. Flow-volume curves pre- and post-operatively in 17 patients, shown by case groups, with examples of curve shapes from within each grouping. Reproduced from reference 24 with permission.

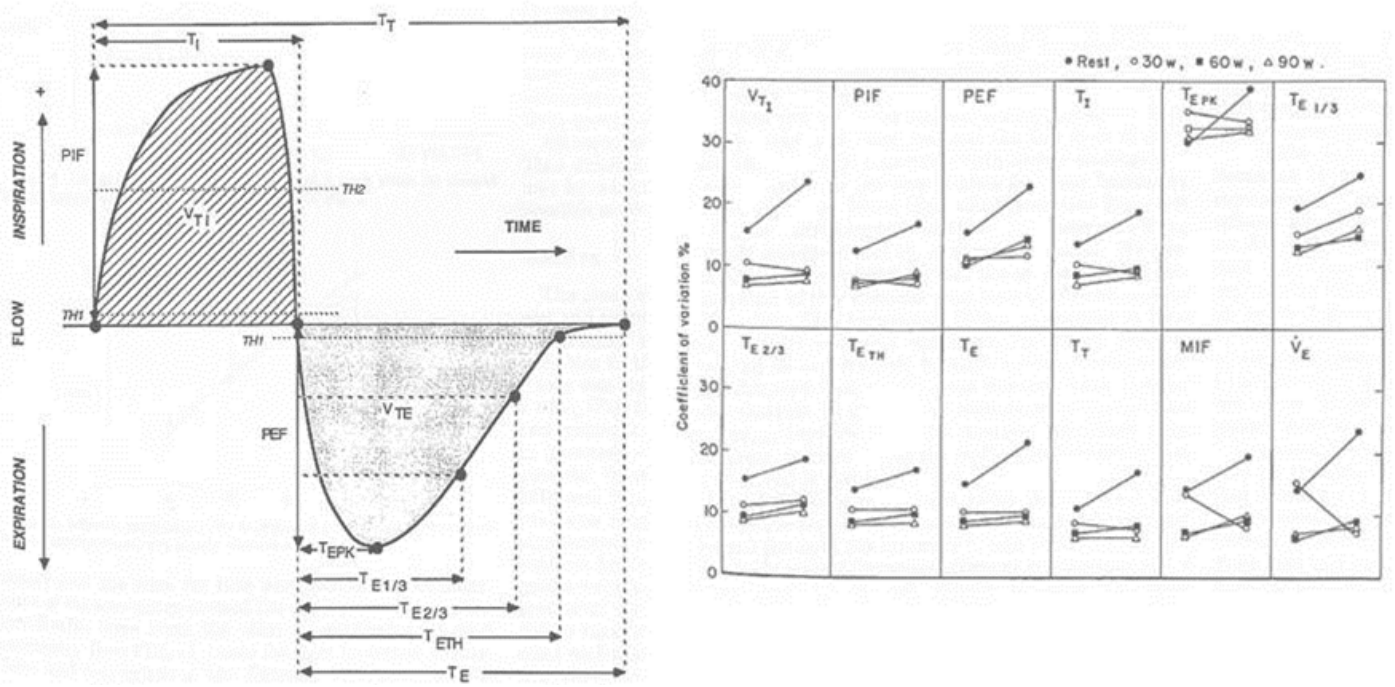

Figure 7. Diagrammatic representation of airflow for a single respiratory cycle showing the range of variables measured. T_I – time of inspiration, T_E – time of expiration. Derived from this data analysis are a number of variables measured at rest and at 30, 60 and 90 watts of exercise between control (points on left of each box) and laryngectomy groups (point on right of each box). From reference 26 with permission.

minute ventilation and the relationships of T_I and T_E to tidal volume over each level of exercise, although there was some suggestion that at higher workloads, some limitations in performance may occur in the laryngectomised patients. It was hypothesized that these changes may be due, in part, to a reduction in drive caused by a number of possible mechanisms which include a) loss of stimulation to CO_2, b) cold and pressure receptors in the upper airways, c) loss of CO_2 loading due to a reduced dead-space, d) modification of the lower airway or lung receptors by the changed pressure profile in the airways or e) a change in FRC. The findings of this study are similar to those of Heyden [10].

Misiolek et al [27] attempted to classify flow-volume curves in a group of 39 patients having partial laryngectomies, into one of three groups as previously described by Miller & Hyatt [28]. These three types are –

1. Fixed upper airway obstruction where both inspiratory and expiratory indices are diminished
2. Variable extrathoracic, where only the inspiratory portion of the curve is affected
3. Intrathoracic where only the expiratory portion of the curve is affected.

The purpose was to assess whether different procedures – cordectomy, hemilaryngectomy and enlarged hemilaryngectomy had an effect on the flow volume curves. Overall, whilst those patients who had a more extensive surgical procedure had greater impact on the flow-volume indices, all procedures affected the flow-volume curves. Furthermore, when comparing the flow-volume indices to those obtained in patients with known chronic bronchitis (n = 10), all indices in the partial laryngectomy groups were lower.

Matsuura et al [29] studied 8 patients pre- and post-laryngectomy. Assessments of arterial blood gases and dynamic lung volumes and flows were made. The FEV_1%predicted was reduced overall to 77.8% (61.5% to 89.2%) and decreased slightly after surgery to 75.7% (61.6% to 85.3%) which was not

significantly different. VC and VC %predicted did decrease significantly after surgery. The most dramatic change was in the $MEF_{25\%}$/height which reflects small airway closure of the lung. In all patients this index was below the LLN and decreased significantly post-surgery (Figure 8)

Ackerstaff et al in 1995 [30] observed in a group of 58 laryngectomised patients that overall lung function, assessed using static and dynamic lung volumes and flows were significantly reduced compared to predicted values, and that in the older patients (> 65 years) there seemed to be much worse lung function. The reasons for this remain unclear.

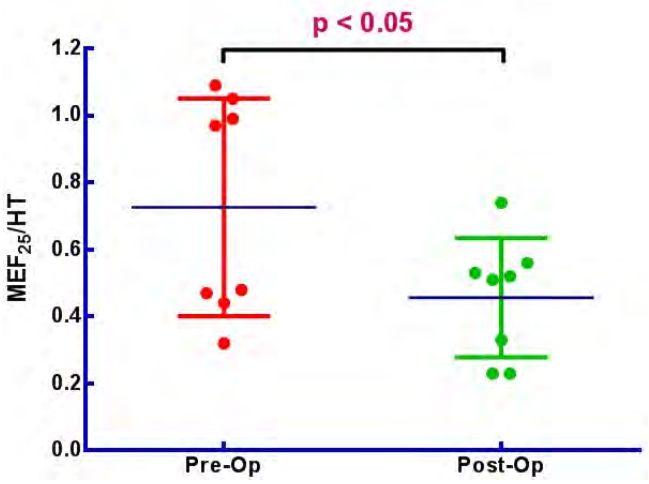

Figure 8. Pre and post laryngectomy showing the effects of the procedure on the MEF_{25}/HT index which is a marker of peripheral airways disease, where HT is height. The differences were significant ($p < 0.05$). Data from reference 29.

When re-assessed with salbutamol, a subgroup of 18/58 patients showed significant improvements in lung function as measured. Suboptimal lung function was noted, as in previous studies. Interestingly the patients main subjective complaints were excessive sputum production (98%), cough (64%), forced expiration to clear the airway (57%) and dyspnoea (32%), and that these subjective complaints did not correlate with objective measures of lung function.

Hess et al [31] assessed 59 patients with total laryngectomy were assessed using static and dynamic lung volumes and flows and total resistance and inspiratory resistance. In a subgroup of patients with ventilatory obstruction, 400 mg of aerosolised salbutamol was given to distinguish between those patients with bronchoconstriction and those without, but both of whom have airflow obstruction. The results are summarized in Figure 9. One observation noted in some patients was a spike-like enhancement of PEF in some flow-

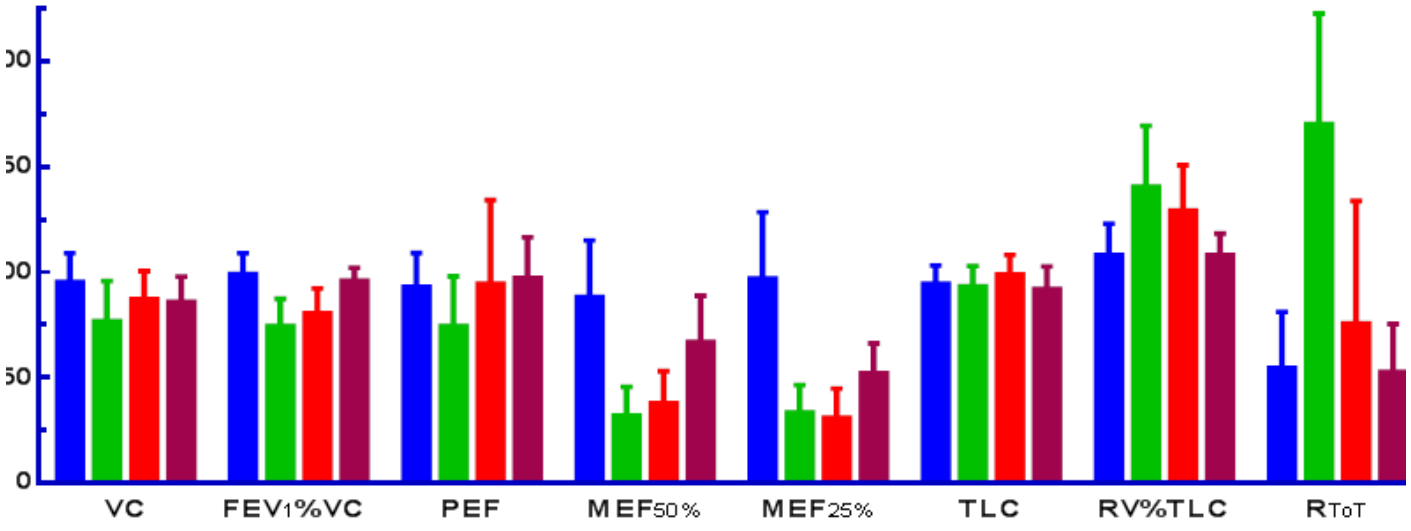

Figure 9. Summary of lung function data from 59 laryngectomized patients showing the state of lung function (as %predicted values) and subdivided in normal airways (blue), large airway obstruction (green), peripheral airway obstruction (red) and small airways disease (purple). Data from reference 31.

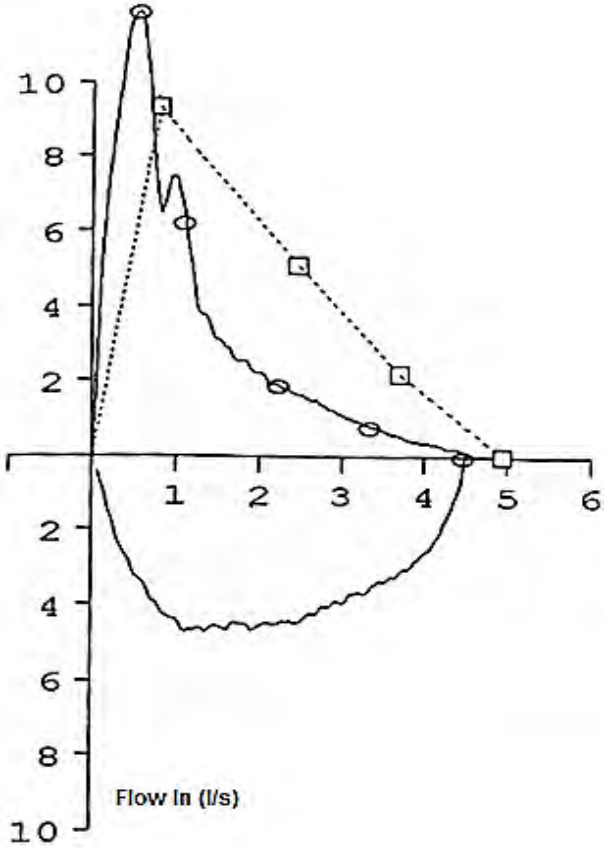

Figure 10. Spike-like enhancement on a flow-volume curve observed in some laryngectomies. The overshoot in the flow is assumed to reflect physiological compressive airway volume effects due to the loss of oropharyngeal resistance. Reproduced from reference 31 with permission.

volume curves (Figure 10). This was explained as reflecting a physiological compressive airway volume effect exaggerated by the loss of the oropharyngeal downstream resistance. In 12 patients, a positive bronchodilator response was observed (Figure 11) with 4/12 having a > 15% improvement in FEV_1 and a further 6/12 having a greater than 10% improvement, which may be regarded as a useful increase.

As with other studies, a significant number of patients (48/59; 81%) had marked airflow obstruction and a number benefitted from further medical intervention. The authors recommend a more proactive follow-up assessment program than was applied at the time of the study to ensure all patients post laryngectomy are fully assessed and monitored to ensure their quality of life and lung function status is optimal.

Matyja [32] studied 72 patients undergoing partial laryngectomy using the flow-volume curve and deriving a range of indices from each patient's curve. Some of the indices were reduced before surgery, with surgery having a more negative effect on most indices (Figure 12). What was observed was that over a period of follow-up, the flow-

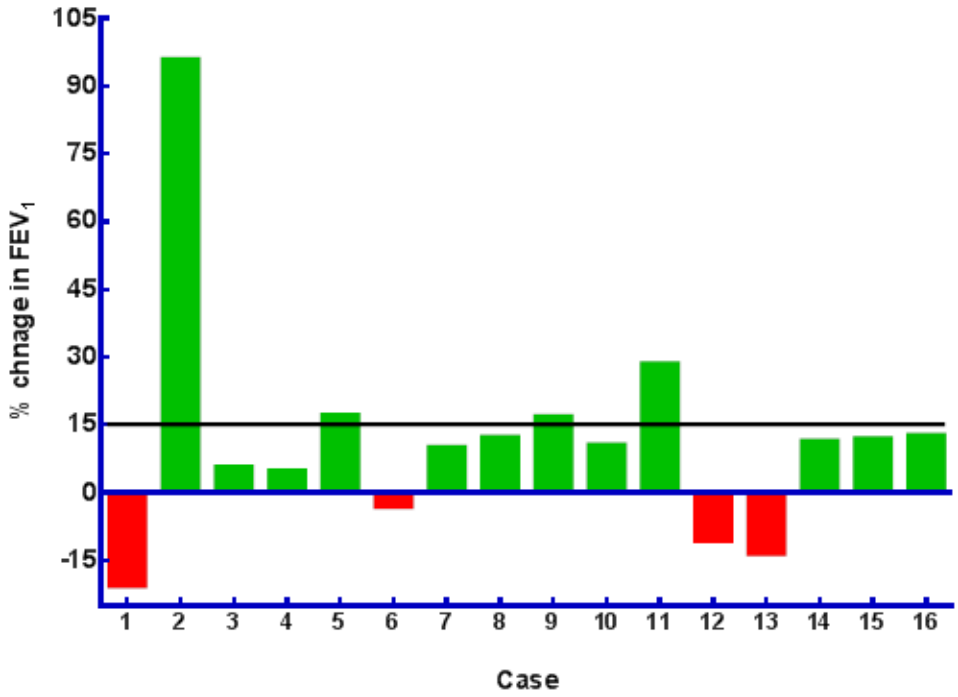

Figure 11. Percentage change in FEV_1 after inhalation of a bronchodilator. Green is a positive response and red a negative response. The horizontal black line is the +15% response line. Data is shown for each case. Data from reference 31.

volume shape changed dynamically during the healing process of the larynx until normalisation was observed (Figure 13).

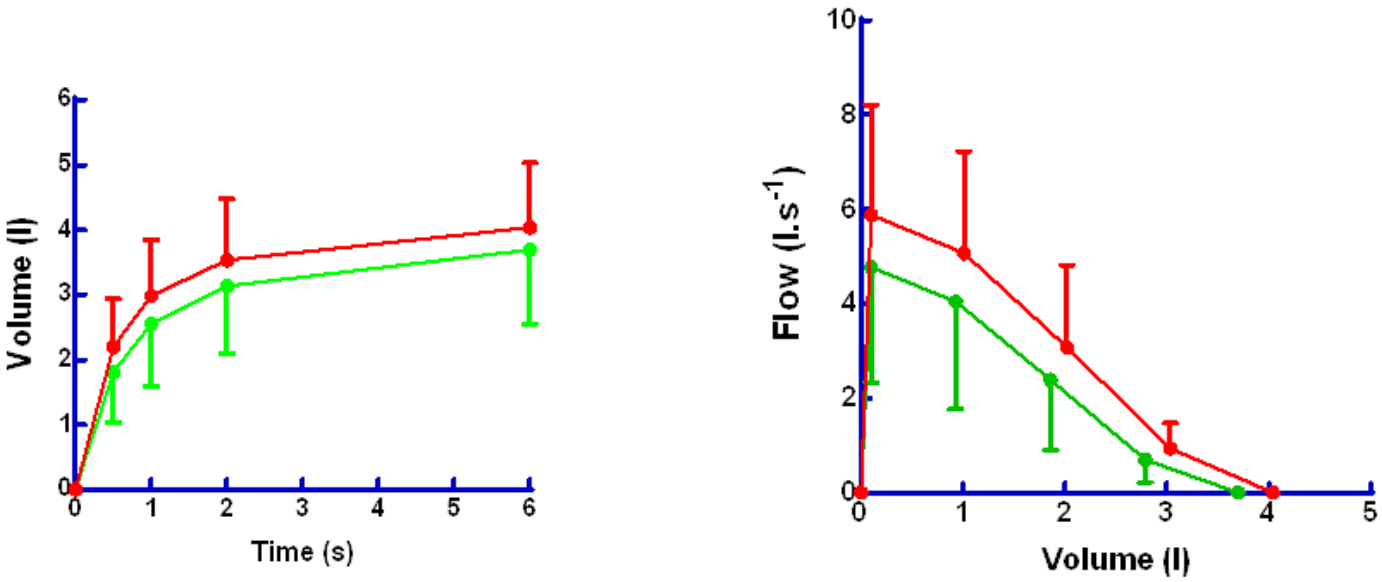

Figure 12. Volume-time and flow-volume curves before and after partial laryngectomy summarized for 72 patients. The key data points are $FEV_{0.5}$, FEV_1, FEV_2, FVC for the volume-time curve and PEF, MEF_{75}, MEF_{50} and MEF_{25} for the flow-volume curve. The red curve is for pre-operative data and the green curve for post-operative data. Curves created from tabulated summary data from reference 32.

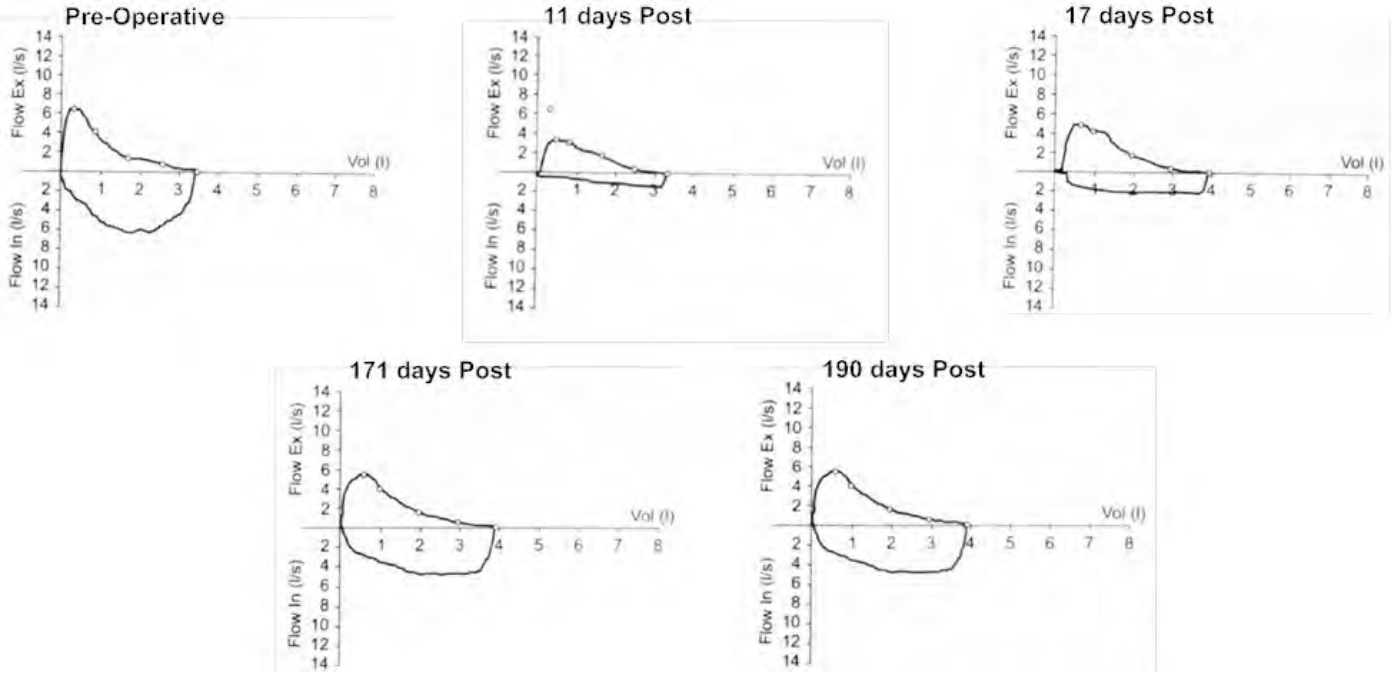

Figure 13. Changes in flow-volume curve in a single patient, comparing the pre-operative to that obtained 11 days, 17 days, 171 days and 190 days post-operatively. The patient had a glottic laryngectomy. Even after 190 days, the PEF had not returned to the pre-operative value. MEF_{50} and MEF_{25} were similar at these two time points. Reproduced from reference 32 with permission.

Observations and Conclusions

These 23 studies have shown a number of key points about the assessment of lung function in patients with tracheostomy and laryngectomy –

1. Lung function measurements including flow-volume curves ± bronchodilator, airways resistance, static lung volumes, breathing patterns, lung compliance using oesophageal pressure monitoring and the effects of lung function on arterial blood gases have been relatively easily assessed both pre-surgery and to a limited extent post-surgery.
2. Studies can be undertaken both at rest and during exercise with relative ease.
3. Many patients show abnormalities of lung function pre-surgery and this may reflect more about the peripheral airway function and the prior effects of smoking history on lung function than the effects of the upper airway issues on the patients.
4. A proportion of patients appear to have reversible airways obstruction, more consistent with an asthmatic component to their airway dysfunction than irreversible airways obstruction, and this should be assessed where appropriate.
5. Stomal size, although logically presenting an issue in terms of flow dynamics – based on the application of Poiseuille's equation, may or may not have an influence on actual lung function, particularly flow rates.
6. The choice of attachment between the tracheostomy site and the testing equipment may have an influence on the lung function data. This will be discussed further in part 2..
7. Visualisation of the flow-volume curves both before and at follow-up present some interesting changes in shape and can be used to characterize the effects of both healing, but also the effects of stenosis of the stoma site over time.
8. The type of surgery, may or may not influence the outcome of lung function measurements, although this is not clear from the current literature.
9. A variety of indices from the flow-curve have been assessed, and probably the key ones are FEV_1, VC, PEF and $MEF_{25\%}$, allowing assessment of both large and small airway function. Airways resistance appears to add little and static lung volumes are only useful in characterising the degree of hyperinflation and gas trapping or the potential of a restrictive ventilatory defect.
10. The changes in upper airway physiology - humidification, reduced dead-space etc., probably have some effect on lung function measurements, but these are probably less than that of the known airway disease in these patients.
11. Upper airway bacteriology may be an important contributor to abnormal lung function, with increased sputum production, airway inflammation and the resultant decrease in airway radius (Poiseuille's equation again!).
12. No studies reported to date have attempted to use CO Diffusion measurements to assess gas exchange defects at alveolar level, although technically this measurement should be possible, with a few minor adjustments to

the calculations. This may reflect the difficulties in obtaining a really good seal, but also with the older bag-in-the-box system presenting added limitations in terms of increased "fixed" dead space. With modern flow heads and rapid gas analysis, these technical issues should be less problematic.

13. No studies have reported the use of MIPs or MEPs, to assess changes in lung mechanics. Again, with care, these measurements can be made, and from personal experience can be made on ventilated ITU patients. This will be discussed further in part 2.

14. No studies have reported the use of hypoxic challenge testing where patients wish to fly. Again, with adaptation, these assessments can easily be made and will be discussed further in part 2.

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A student experience in a Paediatric Laboratory

Saptieu Mahdi

I am a student from St George's University of London who is currently undertaking my second year in BSc Healthcare science (Physiological Science). During the first year of my course I was introduced to both Cardiac and respiratory and sleep physiology, and after 8 weeks of placement I decided to specialise in Respiratory and sleep physiology. I was also asked my preference of placement site and was luckily given my first choice, therefore, for the remainder of my Course, I am going to spend my time in the respiratory and sleep laboratories in Great Ormond Street Hospital.

This year I spent a total of 15 weeks in these two paediatric laboratories: 12 weeks in the Respiratory Laboratory and 3 weeks in the Sleep Laboratory respectively. Here I was able to learn how to carry out different diagnostic tests some of which I had yet to try. The tests that I performed included Spirometry, a test that requires a patient to forcedly expire after a full inspiration and tests how well air can move in and out of your large airways and Gas transfer, a test that requires the patient to inhale a mixture of gases and hold their breath for ten seconds before expiring, which shows how well oxygen can move from the lungs into the blood stream. I also performed field tests, where heart rate and oxygen saturation is measured during exercise to test their tolerance, and limited sleep studies where we use various bands and sensors to monitor the cardiorespiratory status of the patients during sleep, which can indicate the presence of a sleep disorder. Along with this I was able to set up a patient on CPAP (Continuous Positive Airway Pressure), where room air at pressure is used to stent the airway open during sleep to treat obstructive sleep apnoea.

I was also given the opportunity to witness and experience for myself testing both within and beyond the scope of my course, including trying out CPAP and BiPAP (bi-level Positive Airway Pressure), which is similar to CPAP but uses two pressures to aid ventilation, on myself, as well as watching Multiple Breath Washout, a test that measures ventilation and airway obstruction in your small airways. I was also able to carry out different procedures on myself as a biological control to monitor the quality of the equipment along with the log I kept of daily callibrations.

The opportunity to try out the tests on myself helped me to put into perspective what and why a patient might find distressing during the test. This in turn helped me when I began explaining to the patient what to expect,...

The opportunity to try out the tests on myself helped me to put into perspective what and why a patient might find distressing during the test. This in turn helped me when I began explaining to the patient what to expect, and gave me a better idea of what to focus on, for instance, the sensation of not being able to breathe during the occlusion in Plethysmography, a test that allows the indirect calculation of static lung volumes. This also helped to get rid of my initial concern of how much detail to tell the patient and how best to reassure them.

These points for concern were also partly caused by the fact that I was dealing with children of different ages. I was able to test many children from the age of eighteen to as young as three years old. Having this opportunity to test this wide range, coupled with being in a paediatric laboratory in general is exciting as I was able to witness and try the skills involved in paediatrics. However, this was a situation that I hadn't been exposed to before, which at first was a little intimidating.

However, being able to observe many different members of staff in both Lung Function and sleep departments helped me to understand how to approach the situation. Also, gaining the experience myself, along with the support and constructive criticism of everyone that I worked with, helped me to acquire and continue to improve on the skills needed when working with children. This in turn aided a growth in confidence to apply them.

Also, in contrast to the adult labs that I have been to, the turnover of patients is less, which generally allowed me to spend slightly more time with each patient. This meant that I didn't feel too rushed, especially in light of the fact that it can be harder to coach paediatric patients into performing the correct technique. This also meant that I could have a go trying to coach a new patient or have a go in a slightly more challenging situation, with the support of other members of staff who were there to step in if I was having trouble or assure that what I have done is of an acceptable standard. This extra time also meant that there was time to talk me through test procedure and the criteria for an acceptable test, whilst also letting me practice on available staff. This was especially important in the sleep department as I had even less experience in this field from my placements in my first year and no experience of inpatient overnight studies.

Moreover, this extra time meant that I could spend time asking questions and carrying out my own research to help consolidate my knowledge. It also gave me a chance to listen to lectures by Senior Staff, including Prof. Janet Stocks, which allowed me to gain knowledge beyond the scope

... I could have a go trying to coach a new patient or have a go in a slightly more challenging situation, with the support of other members of staff who were there to step in if I was having trouble or assure that what I have done is of an acceptable standard.

of my course. Also this privilege is extended outside of my placement blocks, as I am allowed to come in and attend these lectures whenever I am able.

However, even though this smaller turnover of patients provided some great advantages, it also meant that it took longer for me to become confident in the skills needed in a paediatric laboratory. It also meant that it was harder for me to gain experience in less commonly carried out procedures in the department, like Plethysmography and Bronchodilator Response tests where you perform spirometry before and after administering a Bronchodilator to test if the patient has a significant positive response to it. Nevertheless, because of the staff allowing me to practise on them and insuring that I either sat in for or carried out testing of these patients I was able to gain some good experience.

Nonetheless, the patients that I did see meant that I was able to see many different diseases and disabilities that I may not have been able to see in other centres and certainly not on such a regular basis. As I was able to see Cystic Fibrosis, Neuromuscular and scoliosis patients weekly at their respective clinics, whilst also seeing Bone Marrow transplant patients, tracheostomy patients and also various different craniofacial patients. This was not only interesting for my general knowledge, but it forced me to use and apply the physiology that I had already learnt and am still learning.

These diverse patients were also present in the Sleep department where I had a total of 3 night shifts, which I was excited to attend. This was my first experience of a night shift and I found the first night a bit difficult towards the end, but by my last night shift I had started to develop my own way of handling them. However, I really enjoyed my night shifts and learned a lot about setting up, troubleshooting and monitoring patients during a limited sleep study. This really aided the development of my knowledge on sleep and gave me a more well-rounded view of test procedure that I wouldn't have been able to get from day shifts alone.

To conclude, I have thoroughly enjoyed my time in the Respiratory and Sleep Paediatric Laboratories and have learned a great deal. In the future, I would like to start trying to gain experience in the less commonly carried out procedures in my first placement block, so that I can acquire more experience overall. I will also continue to learn from everyone in these departments, work on the skills that I am gaining and my confidence in applying them.

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From Adults to Paediatrics

Paul Burns, Higher Specialist Respiratory Physiologist, Respiratory Laboratory, Yorkhill RHSC, Glasgow

"Are children just small adults?"

Spirometry. Body plethysmography. CO gas transfer. Reversibility testing.

These were just some of the words used in the job description for the Trainee Physiologist post I applied for in a Glasgow adult hospital. Coming from a Sports Science background, I vaguely remembered hearing of spirometry; from 1st year chemistry. I knew that CO stood for carbon monoxide and I was very familiar with VO_2 max, but the rest was lost on me.

After being successful in my interview, I spent three and a half happy years at Gartnavel General Hospital (GGH) and completed my Part 1 & 2 exams in the process. When the opportunity appeared for a senior post at Glasgow Children's Hospital, I decided to try my hand at paediatrics and progress my career. After all, how different could it be? The job description sounded similar, albeit with a few extra tests. I quickly realised, however, that the job had many similarities. But there were notable differences….

As Professor Janet Stocks once titled her ERS talk, "Are children just small adults?" I would like to answer this through my personal experience and give people an insight into working in both adults and paediatrics.

I instantly enjoyed being a Respiratory Physiologist; the regular patient contact, the science behind it all, the feeling that you were helping people, and the camaraderie in the lab all made it an enjoyable job. GGH is situated in the West End of Glasgow City Centre and the respiratory lab encompasses another two hospitals: the Western Infirmary (approximately one mile away) and the Golden Jubilee in Clydebank (three miles further West). The keen historians among you will know the town of Clydebank as synonymous with "The Clydebank Blitz", coming under attack during the Second World War. This was a formerly private hospital but was taken over by the NHS in 2009. It was then opened as the National Heart and Lung Centre of Scotland and Gartnavel was asked to take on the management of the Respiratory lab.

Covering three hospitals meant that we were performing a wide range of tests. GGH had a large sleep service which covered not only Glasgow but lots of other counties, including the Scottish Isles. Therefore, housing a large sleep centre, the West of Scotland Adult Cystic Fibrosis Unit, the Scottish Pulmonary Vascular Unit and an Asthma Research Unit meant that I was able to gain a wide variety of

experience as a trainee. I certainly noticed the benefit of this when doing my professional exams.

Whilst I worked in GGH, the lab housed thirteen staff, and this has increased further still since I left. It was a great place to work and I learned to hone my trade as a Physiologist there. I found working in adults to be thoroughly rewarding. The face-to-face patient contact was particularly enjoyable. The patients always had interesting stories to share, particularly the older ones. For my 1st year most of my day was spent at the Respiratory Clinics performing spirometry. During this time I saw a wide variety of patients with different diseases, including: cystic fibrosis, COPD, asthma, interstitial lung disease, pulmonary hypertension and lung cancer. This gave me experience in seeing all types of weird and wonderful spirometric patterns. After serving my apprenticeship at the clinics I began to perform full lung function tests, including histamine challenge testing. I also rotated through the sleep service. This involved one week per month of nightshift, monitoring different types of investigations such as: transcutaneous S_pO_2 and CO_2 monitors, limited channel cardio-respiratory, full polysomnography and CPAP trials.

After passing my professional exams, it was my ambition to advance my career and look for a role as a Senior Physiologist. I was keen to stay in GGH as I enjoyed the variety of work and patients and I had a good relationship with the staff. Perhaps more importantly, knowing that many Physiologists in other hospitals do not get the chance to work in both lung function and sleep meant that I was not keen to move elsewhere. Although there is a large children's hospital in Glasgow, I had not really considered a job in paediatrics. Soon after I qualified, however, the opportunity arose for a Senior Physiologist at The Royal Hospital for Sick Children, Glasgow (known as Yorkhill Hospital after the area in which it is situated). I was not immediately convinced about going for this position but after some enquiries I found out it was a very good department which also had the variety of covering lung function and sleep. Although I had no children of my own I come from a big family so had plenty of experience in talking to and caring for children and infants. All of this, along with the idea of a new challenge and the opportunity to forward my career, convinced me to go for the post. And so, I soon started as a paediatric Respiratory Physiologist.

Aware of the challenges but ready for the role, I often pondered how different it really could be. By this stage I had nearly four years experience working in adults, had my professional exams, and so surely

presumed that I would take to it like a duck to water. Unfortunately not!

My first couple of weeks were like starting all over again. I had that 'new-start' feeling of being pretty useless. I can imagine most Physiologists who have changed labs in the past experience an element of this: the different equipment, different ways of working, different colleagues. However, I also had to contend with performing tests I had never done, on patients younger than I had ever tested, not to mention the crucial but little-known fact that lots of the points in lung function guidelines for adults pretty much go out the window when dealing with paediatrics. Sweat tests and gastro-oesophageal pH studies were just a couple of the new tests I had to learn. What's more, histamine/ methacholine was the stimulus we used in adults for challenge testing, whereas in paediatrics, physical challenges on the treadmill to test for exercise induced asthma were predominant. Although I knew all about the theory of this, I had no practical experience. I remember walking into the lab on my first day and seeing my colleague perform a cardio-pulmonary exercise test on a five year old. It had not really occurred to me that we would perform these types of volitional tests on children as young as this. This was, indeed, a steep learning curve.

… the crucial but little-known fact that lots of the points in lung function guidelines for adults pretty much go out the window when dealing with paediatrics.

Naturally, my first week did not pass without drama. As I waited with my colleague to travel in the lifts to one of the wards, the lift door opened with a mum shouting for help as her child collapsed. My colleague acted admirably quickly, picking the child up and sprinted round the corner to A&E. The very next day we were performing transcutaneous monitor training on the ward to two new ventilatory support workers. There were two young children in the same bed bay who were on ventilators via tracheostomies, which, in itself, was not something I was used to seeing. As I was observing the training, one of the children decided to pull his full tracheostomy tube out of situ, which immediately had the two support workers performing an emergency tracheostomy change. As this happened I could hear another ventilator alarm sounding behind me as the other child had decided to detach his ventilator tubing from his tracheostomy. After spending four years in adults and not seeing any real medical emergencies, this was certainly not what I was expecting!

Things soon settled down and I started to really get to grips with the paediatric setting. One of the most common questions to a paediatric Lung Function Physiologist is: what type of conditions do your patients have? In reality, this is not too far removed from the adult conditions. Asthma and cystic fibrosis are the big groups. We see children with interstitial lung disease, Primary

Ciliary Diskynesia, neuromuscular disease…we also get referrals from rheumatology, congenital cardiac patients, immunology and pre-operative assessments. This has led to my COPD guideline knowledge deteriorating over the last few years and my asthma guideline knowledge significantly improving!

Another common question is: at what age can you get good lung measurements from a child? Although this does vary from child to child, we can generally get good spirometry from four years and upwards. We will also try for lung volume measurements in children this age if we think they are capable. One thing that surprised me was how good children were at body plethysmography. I simply imagined that you would be unable to get a child to perform shutter breaths since many adults had poor technique. The three to five minutes of tidal breathing required for the dilution techniques does not bode well with the average five year old whose concentration span is much less. So it is best to use the Tardis-like box and get it done quickly. At most paediatric hospitals the patients referred for lung function will range in age from four to eighteen. When testing an older teenager then it is very similar to testing an adult and this is when you can use current ARTP[1] and ERS/ATS[2] guidelines. However, there are many differences when testing younger children and there are many parts of the guidelines that do not apply.

For example, the maximum of eight attempts is ignored, children don't really tire like your sixty year old COPD patient therefore I have seen myself perform fifteen plus attempts to get acceptable spirometry in young children. Another one is that children generally do not have good technique when doing a relaxed vital capacity. This is most likely due to the fact that their airways are larger in size in relation to lung volume therefore empty their lungs much quicker. Even our obstructed patients with asthma are very different from your typical emphysema patient and there is not the same early collapse of the airways that you tend to see in emphysema. Therefore, we rarely perform this measurement on children. One thing that is lacking in paediatric respiratory physiology is established guidelines and hopefully in the future this is something that can be developed. The new Global Lung Initiative reference equations[3] are a massive step forward for both paediatric and adult respiratory physiology and will improve the tracking of patient's lung function as they transition from paediatric to adult hospitals.

As mentioned, the youngest patients we see for spirometry are four years and older, although we are always

By this stage I had nearly four years experience working in adults, had my professional exams, and so surely presumed that I would take to it like a duck to water. Unfortunately not!

trying to push the boundaries and get acceptable technique from younger patients. With the more recent introduction of tidal breathing tests like lung clearance index, it is allowing us to obtain lung function measurements in pre-school children. In our cardio-pulmonary exercise lab we also test from around four years and up. Most of our tests are performed on the cycle ergometer which we can adapt to fit small children, however some of the smaller patients need to be tested on the treadmill. While exercising and testing lung function in the younger patients, you have to be very vocal, enthusiastic and patient. This can be very similar in adults when you are dealing with an elderly patient who is having trouble with understanding the tests. One of the things I enjoy is that the majority of the children will never moan about 'doing another one' or trying harder. (I remember being told many times from an adult patient that they were 'fed up' and 'why do I need to do this anyway?') The kids love a challenge and making the tests into a game or competition for them really spurs them on. I always think you can never be over-enthusiastic when it comes to testing children in the lung function/exercise lab. When I used to test the cystic fibrosis patients in the adult hospital who had transitioned from paediatrics, I always wondered why their lung function technique was so pristine and since moving to Yorkhill. I now know the answer.

One of the things I enjoy is that the majority of the children will never moan about 'doing another one' or trying harder.

In terms of sleep physiology, paediatrics is very different from adults in many respects; I would say even more so than lung function and in my opinion more challenging. From the set-up and monitoring of patients right through to analysis of sleep studies it is an entirely different experience. When I set-up my first paediatric cardio-respiratory sleep study, my patient was a three-month old ex-prem. I initially struggled with the concept of placing so many sensors on such a small body. The size of the respiratory bands would not have fit round the wrist of some of the obese OSA patients I had seen in adults! The set-up itself, and then the task of actually getting the child to keep sensors on, are problematic. When you are trying to set up a full polysomnograph montage on a two year old there is no way of explaining the necessity of the test to the child; how do you explain to a baby that the uncomfortable sticky things are essential to their health? Certainly, you need the parents onside and it often becomes a "stealth operation" once the child has fallen asleep. Maintaining the signals is also problematic: once the child awakes, sensors are usually pulled off. Unsurprisingly, the flow sensors are the least favourite

so often you lose one of your most important signals. So, put simply, there is a lot more work to do performing a nightshift in paediatric sleep studies than in adults. The poorer compliance in children means that we do not give out any multi-channel studies to be performed at home but instead stick to home overnight pulse oximetry.

We see a wide variety of patients in the paediatric sleep lab: from newborn through to eighteen years of age. There are many different craniofacial abnormalities that can cause obstructive breathing in babies therefore a large proportion of our referrals will originate from ENT. Nearly all children who have an adenotonsillectomy will have at least a pre-op overnight pulse oximetry and will usually be studied post-op as well. There is also now a screening programme in place for Down Syndrome patients as many of them have mixed sleep disordered breathing. Other patient groups are: neuromuscular, premature children, endocrine, obese children, and less common conditions like central congenital hypoventilation syndrome (CCHS).

I must admit, I miss having a nice compliant adult patient to set-up, monitor and score. The analysis of paediatric sleep studies can be problematic due to poor signals and strange breathing patterns. When you consider scoring an infant study – with a breath rate of around forty breaths per minute – compared to an adult – with a rate of twelve breaths per minute – it is not surprising to find out that the infant study will take you a lot longer to analyse. It has been long recognised that paediatric sleep physiology can be very different to adults therefore there are separate paediatric scoring guidelines, provided in the American Academy of Sleep Medicine manual[4], which are very helpful.

Finally, NIV/CPAP establishment is not a straightforward process in adults or paediatrics, however, it is much more challenging in children: if your typical adult patient does not want to wear their CPAP and refuses treatment then it is their choice; in children, great efforts have to be made to get them established and in many cases if you fail with non-invasive then the only alternative is invasive ventilation via tracheostomy. Indeed, one of my most rewarding experiences whilst working in paediatrics was being involved with moving a six year CCHS patient off her tracheostomy ventilation and onto NIV. When she told me that she was most looking forward to be able to go swimming it certainly put a smile on my face.

So to conclude, although adult and paediatric physiologists perform the same job and the same tests, the roles are very different. The physiological variations mean interpretation of results can be very different and the

younger patient needs a lot more consideration when testing. Continuing to work in paediatrics now, and having the benefits of working in both settings, I can say wholeheartedly that I enjoy both sectors and find the rewards – and challenges – in both very fulfilling.

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PROFESSIONAL REGISTRATION

Michelle Goodlad - Chair of Workforce Committee

Background

Currently unlike other disciplines such as nurses and physiotherapists, it is not mandatory for clinical physiologists to be regulated. It is of the opinion of many physiologists and professional bodies including the ARTP that the role of the clinical physiologist has evolved and many are now playing a valuable role in patient care by undertaking sensitive and high risk procedures that could pose significant risks to patients' health and safety.

It is believed that that these risks cannot be mitigated fully and only the regulation of clinical physiologists can ensure patient safety to ensure those physiologists who are poorly trained or those with poor work standards cannot practice and put patient safety at risk.

Anne Burge MBE, Chair of the Alliance for Patient Safety.

"It would be unacceptable for unregulated doctors or nurses to treat patients, yet tens of thousands of patients a year are having procedures performed on them by unregulated professionals – and while these professionals are not as instantly recognisable as doctors and nurses, the procedures they perform are complex, sensitive, potentially invasive and can cause serious harm if the highest professional standards are not followed."

What is the difference between voluntary, assured and statutory regulation?

Voluntary	Assured	Statutory
Lowest level of protection afforded by a register. Registration is not compulsory and some practitioners may choose to practise without registration, Not accredited by Professional Standards Authority. Therefore standards for good practice may not be met.	A register that has been accredited by the Professional Standards Authority. This means that the organisation who holds the register meets demanding standards set by the Authority in the following areas: governance, setting standards for registrants, education and training, managing the register. An assured voluntary register is still not mandatory and practitioners are not obliged to be registered in order to practise.	Highest level of protection. Statutory registration is mandatory and professionals cannot practice legally without registering and complying with recognised standards.

Registration Bodies

Registration Council for Clinical Physiologists (RCCP)

The Registration Council for Clinical Physiologists (RCCP) was formed in 2001 by the clinical physiology professional bodies to campaign for statutory regulation for physiologists. The RCCP firmly believes that only statutory regulation can ensure patient safety and the current approach of voluntary registers provides no means of preventing poorly trained physiologists performing procedures on patients.

The RCCP represents physiologists from the disciplines below:

Audiology	British Academy of Audiology
Cardiology	Society for Cardiological Science and Technology
GI Physiology	Association of GI Physiologists
Neurophysiology	Association of Neurophysiological Scientists
Respiratory Physiology	Association for Respiratory Technology and Physiology
Sleep Physiology	The British Sleep Society

In an attempt to highlight the need for statutory regulation the RCCP currently hold the largest voluntary register for clinical physiologists with in excess of 7000 members. Although the RCCP have complied with the Professional Standards Authority's standards concerning governance, education and training and managing the register they have chosen not to have their register accredited as they believe the only way to mitigate risk is to have statutory regulation.

Their objectives as a Registration body are:

- Maintaining and publishing a publicly accessible register of properly qualified members of the professions
- Promoting awareness of the Register and working in partnership with professional bodies
- Upholding high standards of education and training and continuing professional development by working closely with universities to accredit graduate clinical physiology degrees
- Investigating complaints and taking appropriate action

The RCCP have been continually lobbying the Government to change their policy on statutory regulation and a recent House of Commons Health Select Committee's report on the Health and Care Professions Council's work agreed that it is concerning how long it can take for professional groups to gain statutory regulation when there is a clear patient safety case for doing so. The report follows evidence to the Committee from the RCCP on how voluntary registration accredited or

otherwise, cannot achieve the patient safety regime we all want to see. HCPC agreed strongly with RCCP in their evidence session to the Committee and said that they viewed clinical physiologists as a priority group for statutory regulation, given the larger number of people working in the profession.

Currently with RCCP there are 3 main routes for entry to the voluntary register.

- Graduate Entry - A degree from a UK accredited RCCP programme incorporating both academic and professional training
- Standard Entry - Any applicant who began training prior to 2005 in the UK will be considered on a case by case basis
- Equivalence Entry - A minimum of 6 years training and experience within the UK with evidence provided to support competent practice and underpinning knowledge

The RCCP have now opened the Chartered Scientist (CSci) and M Level register in some of the modalities. The M Level register recognises that many experienced Clinical Physiologists are qualified and practising at, or above, NHS Career Framework 6 Specialist Practitioner level. GI Physiologists, Neurophysiologists and Sleep Physiologists can apply to this register but it isn't currently available for Respiratory Physiologists. (See Chartered scientists below for more information).

Academy for Healthcare Science (AHCS)

The Academy of Healthcare Science is the overarching regulatory body for the whole of the Healthcare Science Profession. Launched in September 2012, the aim is to ensure that Healthcare Science is recognised and respected as one of the key clinical professions in the health and care system, including working towards statutory regulation for all staff groups to ensure protection for patients.

This means that, unlike the RCCP who represent only clinical physiologists, they represent a number of wide and diverse disciplines from clinical physiologists through to transplant services and imaging services. AHCS believe that these smaller disciplines working together will have a more powerful, louder voice.

The Academy's functions are to:

- Provide a strong and coherent professional voice for the healthcare science workforce
- Ensure the profession has a high profile sufficient to influence and inform a range of stakeholders on healthcare

science and scientific services in the health and social care systems across the UK

- Provide engagement and support for wider strategic scientific initiatives
- Act as the overarching body for issues related to education, training and development in the UK health system and beyond including standards and quality assurance of education and training

Although the AHCS's ultimate goal is statutory regulation, until there is a change in government policy the AHCS is currently preparing documents and standards to comply with the PSA to obtain accredited voluntary register status.

The AHCS' registers are linked to the Modernising Science Career pathway. Although still in the early stages of setting up registers, the AHCS has been approved by the HCPC to award two certificates that will confer eligibility to apply for registration with HCPC as a clinical scientist. The first is a Certificate of Attainment awarded to individuals who have successfully completed an accredited Scientist Training Programme (STP). The second is a Certificate of Equivalence awarded to individuals who have not undertaken the STP but whose qualifications and experience have been assessed as equivalent to those exiting the STP programme. Late 2013 saw the first clinical physiologists complete the pilot equivalence route and the AHCS are asking other clinical physiologist to express an interest in STP equivalence.

For other clinical physiologists not working at STP level, the AHCS is currently establishing a voluntary register for clinical physiologists who successfully complete an accredited Practitioner Training Programme (PTP), or who obtain a relevant Certificate of Equivalence from the AHCS.

While AHCS apply for accreditation from the Professional Standards Authority (PSA) for their voluntary register, the Academy has opened a shadow register. It has been set up in accordance with the requirements of the Professional Standards Authority (PSA) and will operate in 'shadow' form but once accreditation has been approved, the register will be a PSA Accredited Voluntary Register and registrants will automatically be transferred to the accredited register.

Chartered (CSci) and Registered Scientist (RSci)

Chartered Scientist (CSci) is a well-established award, with over 15,000 scientists having achieved it since its launch in 2004. Candidates will typically be in senior scientific or managerial roles and qualified to at least QCF level 7 or have Masters-level science qualification (or

equivalent) with four years of postgraduate work experience. The CSci register enables practitioners to demonstrate the level at which they are working in relation to scientists across a wide range of disciplines.

Again for those not currently working at the higher Masters-level there is the option in applying for the Registered Scientist (RSci) award. This award provides recognition for those working in scientific and higher technical roles. Candidates will typically be qualified to at least QCF level 5 or post graduate level and will be applying this knowledge to their roles. It provides recognition in its own right but can also be a springboard to recognition as a Chartered Scientist.

At the present time for Respiratory Physiologists to register the ARTP would need to apply to the Science Council to become a licensed professional body. The Science council upholds the standards for CSci and RSci but it delegates responsibility for its award to Professional Bodies which are granted Licensed Body status. While becoming a licensing body would have financial implications for the ARTP, it is felt if there were a number of ARTP members who wanted to apply for CSci or RSci awards then the ARTP Executive Board would consider this.

As you see from above regulation can be a confusing subject with no clear cut answers on which register to join. It really depends on your personal circumstances and the level you are working at but all the registers agree that regulation is the only way to maintain safe working practices not only to improve patient care and safety but to also recognise the role and expertise of the clinical physiologist in healthcare.

I am happy to try and answer any further questions that you may have about registration and will collate number of members that show an interest in Chartered (CSci) and Registered Scientist (RSci). Please feel free to email me on michelle.goodlad@uhcw.nhs.uk.

Further information can be found on the regulatory body websites

Registration Council for Clinical Physiologists (RCCP)

www.rccp.co.uk

Academy for Healthcare Science (AHCS)

www.ahcs.ac.uk

Chartered (CSci) and Registered Scientist (Rsci)

www.charteredscientist.org

ON THE BLOWER

Brendan Cooper,
Nigel Clayton
Alan Moore

In this edition of On the Blower we have the latest news on Windows XP and how the NHS intends to deal with the ticking time bomb, the latest NICE guidelines on FeNO measurements, together with the usual round up of company news and latest products.

The ticking time bomb defused??

Following on from Alan's excellent article in the last edition of Inspire, it would appear that the ticking time bomb has been defused, albeit temporarily.

As Alan warned, Microsoft withdrew updates and technical support for the Windows XP operating system on April 8th this year, potentially affecting 8 out of 10 PCs used in the NHS (according to a research by EHI Intelligence back in September 2013). The good news is that the Government has signed a £5.5m deal with Microsoft to extend Windows XP support across the public sector for 12 months. Whilst this does provide "breathing" space, now is the time for all of us and our equipment providers to consider what impact this might have in our labs come April 2015. If you are not currently running your test systems on Windows 7 you might be interested to know what the upgrade might cost. I received a quotation of £13,000 to upgrade 6 full test systems from Windows XP to Windows 7, so this needs to be considered when drafting your budgets for 2015/16.

This neatly leads into our next piece of news……

MicroMedical Updates for Windows 7

If you have an older Micro Medical spirometer with Spida5 software, then it is possible to update this to Windows 7. Williams medical has agreed to provide the upgrade at a discounted rate. **NC**

New Look for Vitalograph Pneumotrac

The Vitalograph Pneumotrac pc-based spirometer has been given a new look to complement the increased functionality of the latest Spirotrac Software. Pneumotrac and Spirotrac now deliver spirometry, 12-lead ECG, pulse oximetry, COPD assessment, blood pressure measurement, challenge testing and medical weighing scales. All versions of Spirotrac V are now Windows 7-compatible and the latest version compatible with Windows 8. Users of older Spirotrac versions and older serial-type Pneumotracs updating from Windows XP should contact Vitalograph customer services for upgrade advice and support. **NC**

Ndd EasyOn PC and EasyOne ProLab

The Ndd EasyOn PC and EasyOne ProLab are now HL7 compatible which will allow you to integrate the patients test results into the hospital record. Still with Integration, the EasyOn PC is probably the first spirometer which allows integration with all three primary care clinical systems - Emis, SystmOne and Vision VES. As always, Ndd is one of the few companies to provide all software upgrades free of charge.

NICE recommend 3 Nitric Oxide analysers for use in diagnosing asthma

NICE guidelines published in April 2014 recommended FeNO testing to help diagnose asthma in adults and children when diagnosis is unclear. It has also recommended FeNO testing to help manage asthma in people who have symptoms despite using inhaled corticosteroids. The 3 devices recommended are NIOX MINO (Aerocrine), NIOX VERO (Aerocrine), and NObreath (Bedfont Scientific Ltd).

When comparing the analysers the conclusion from the NICE committee stated that:

"Although some differences were observed in test results, there was generally a good correlation with results from other chemiluminescence devices. The Committee noted that there appeared to be poorer equivalence between devices in some circumstances, such as at higher FeNO levels, and that the direction of disagreement varied between studies and devices. However, the Committee acknowledged that there is no commonly accepted definition of clinically acceptable differences in FeNO measurements. The Committee concluded that, based on the available evidence, the 3 devices could, on balance, be considered to be broadly equivalent. The Committee also thought that standardisation of FeNO devices should be encouraged."

The NICE report also goes on to say:

"Overall, the Committee accepted the External Assessment Group's observation that the ranges of specificity were generally narrower than those for sensitivity, and that FeNO testing appeared to have a higher specificity than sensitivity. It heard from the clinical specialists that higher specificity would indicate that testing would be of greater use as a rule -in test; that is, patients testing positive are assumed to have asthma and patients testing negative have further tests for asthma. The Committee considered that the absence of a meta-analysis of accuracy meant that there was a greater uncertainty about the accuracy of FeNO devices in this assessment. Nevertheless, it was satisfied that the specificity of the devices was acceptable if they are used in a rule -in scenario."

So the conclusion appears to be that more research is required to determine the accuracy of these devices and not to rely on a low FeNO measurement ruling out inflammation and asthma. To read more go to http://www.nice.org.uk/Guidance/dg12

Following on from this article you might like to know that the Bedfont NObreath is on special offer while stocks last at £1,365, including 300 mouthpieces. You may also be able to negotiate a deal with the NIOX Vero. Incidentally, Aerocrine sales, support and distribution in the UK is now provided by Healthcare 21, Unit 1 West Bank, Berryhill Industrial Estate, Droitwich Spa, Worcestershire WR9 9AX. Tel 0845 6055521.

NC

Big Brother is Watching

The Dynaport www.mcroberts.nl is essentially an activity monitor for assessing respiratory interventions. The DynaPort consists of a small, light case containing a tri-axial accelerometer, a rechargeable battery, a USB connection, and raw data storage (204 hours) on a MicroSD card. It is worn on the lower back where the accelerometer responds to the Earth's gravitational field and uses a seismic sensor which responds to both slow and fast changes in acceleration. These features enable posture and motion detection of the patient. Its application for pulmonary rehabilitation (PR) and patient activity monitoring adds a new dimension to monitoring and understanding patient's habitual activity, thus aiding the impact of therapeutic interventions such as PR, ambulatory oxygen or new medication. It has good reproducibility (<3.1%) and has been clinically validated (see references below). It could be useful for monitoring COPD and other severe patients and be part of a pulmonary rehabilitation programme.

REFERENCES

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3. Dijkstra, Kamsma, Zijlstra. This tri-axial monitor system is a practical and valuable tool for objective, continuous evaluation of walking and postures in patients with mild to moderate PD. Arch Phys Med Rehabil Vol 91, August 2010.

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Philips Respironics announces the Nuance and Amara CPAP interfaces

Nuance Gel Pillows

Philips Respironics have turned to jelly – sorry gel, in its latest award winning range of masks and nasal pillows. The Nuance gel nasal pillows interface is designed to help your patient succeed with CPAP with the comfort of a gel nasal seal which comes with a choice of either fabric or a gel padded frame.

The gel theme has also been extended to the Amara range of face masks. These masks have been simplified such that a single click is all that is required to disassemble and reassemble the cushion and the mask frame for quick cleaning and replacement.

Amara Gel Mask

Web based patient management

Also new from Philips Respironics is EncoreAnywere, a new web-based patient management system for sleep therapy and home ventilation patients. Data from CPAP and BiPAP devices is uploaded to a secure server, which is then accessible by the healthcare team from any internet-enabled location. An optional GSM wireless modem also enables pressure changes to be made remotely from the hospital, saving patient visits and valuable clinic time. NC

EasyFit Lite nasal CPAP mask from DeVilbiss Healthcare

EasyFit Lite

The EasyFit Lite silicone cushion design has been created by utilising computer analyses of facial characteristics from 50,000 individuals globally to achieve the optimum comfort and seal. The exhalation valve has also been designed to be 'whisper-quiet' and the exclusion of a forehead pad also eliminates pressure points on the skin. The mask also features a ball and socket swivel to allow freedom of movement during sleep. NC

ResMed's new AirFit range of Masks and new Astral ventilators

AirFit Gel Mask

Not to be outdone by Philips Respironics, ResMed announced its latest range of masks in May. The AirFit brand has also won awards and provides three lightweight interfaces, including full face, nasal or pillow. The new AirFit pillows mask is claimed to be up to 50% quieter with its woven mesh venting design. The advantage of nasal pillows from a patients point of view is literally quite clear, as the design allows the patient to wear spectacles during treatment

Astral 150 Ventilator

Just released as I write, ResMed has announced the release of their latest ventilator range. The Astral 100 and 150 ventilators are two portable lightweight user friendly life support ventilators. Both machines offer a low battery-to-weight ratio with an eight-hour internal battery and a weight of only 3.2 kilograms. Two optional eight-hour external batteries can be added to provide a total battery run-time of 24 hours. **NC**

Walking on Air?

For those of you who are involved in NIV and LTOT assessments, here is an interesting development – portable NIV. The Non-invasive Open Ventilation System (NIOV) www.breathetechnologies.com is a new portable non-invasive ventilator which is the NIV equivalent of ambulatory oxygen and enables the patient to have portable supportive ventilation. NIOV can be set to 3 activity levels: resting (low), moderate activity (medium), and exercise (high). It requires an oxygen cylinder or other pressurized oxygen sources to deliver the pressure so is an adjunct to portable oxygen. It too has been clinically validated.

It may be run either while plugged into the mains (when sitting) or in portable mode where its rechargeable internal battery lasts approximately 4 hours. It is connected to a pillows-style nasal interface that just covers the nostrils, leaving

the mouth unobstructed for speaking while device is in use. I suspect it will start a trend in such devices,(and I think this has been tried before) but this certainly has potential.

REFERENCES

1. Porszasz J, Cao R, Morishige R et al Physiologic Effects of an Ambulatory Ventilation System in Chronic Obstructive Pulmonary Disease", Am J Respir Crit Care Med 188:3 (2013), 334-342

Finally, the Dynaport and NIOV will feature in the September 2014 issue of the ERS Buyer's Guide which brings you lots of information about advances in diagnostics and therapeutics. It should be available on line around the time of the Munich Congress.

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COMPLAINTS

Don't forget, if you have any problems regarding equipment malfunction, quality control / calibration, service response times, software issues etc. please feel free to voice your opinions off the forum by contacting the Manufacturers Liaison Committee direct at Watchdog@artp.org.uk. We will then be able to collate this information, including verification of accuracy, before commencing on an appropriate course of action.

Finally, to all the manufacturers who may be reading this article, please remember to keep us posted with details of any new products you are about to release on the market. Details should be sent to nigel.clayton@uhsm.nhs.uk.

STOP PRESS. New European Legislation. ROHS- Restriction of Hazardous Substances

ROHS- Restriction of Hazardous Substances came into force on July 22nd 2014. The implications for ARTP members are that certain devices can no longer be sold in Europe and this will obviously have implications on the devices that departments can purchase.

All manufacturers will presumably been working to meet this legislation but in some cases compliance may not be possible.

Your Biomedical Engineering/EBME departments should be aware of this and be asking manufacturers to provide evidence of compliance to the legislation but it is worth checking with the manufacturers before ordering diagnostic/treatment devices (even those you may have ordered before) to check that they comply with this legislation.

We shall ask manufacturers to provide us with a list of their compliant devices so watch this space!

RoHS definition:

The European directive 2002/95/EC RoHS 1, revised by directive 2011/65/EU RoHS 2, aims to limit the use of six hazardous substances and applies to medical devices (in Category 8), which need to comply by July 22, 2014. RoHS stands for: Restriction of the use of Hazardous Substances in electrical and electronic equipment.

This Directive is applicable to all new products placed on the European Union market, whether imported or manufactured in the EU. Non-compliant products will no longer be CE-marked.

The article 4 of RoHS Directive defines the substances involved:

Hazardous substances	Maximum concentration
Lead	0,1%
Mercury	0,1%
Cadmium	0,01%
Chromium VI	0,1%
Polybrominated biphenyls (PBB)	0,1%
Polybrominated diphenyl ethers (PBDE)	0,1%

The RoHS 2 directive is applicable to medical devices in all European markets. From 22nd of July 2014, all newly manufactured devices shipped and placed on the market for the first time within Europe shall be RoHS compliant.