PROCEEDINGS

Australian Physiotherapy Association

8th National Cardiothoracic Special Group Conference

“Inspiring Innovation, Expiring Tradition”

4th – 6th September 2003
Hilton Hotel – Brisbane Australia

Introduction

The 8th National Cardiothoracic Special Group Conference was held in Brisbane from September 4th to 6th 2003. In recent years, the Cardiothoracic Group conferences have explored themes such as "Illness to Wellness", "Challenging the Future" and "State of the Art" to reflect on the ongoing progression and evolution of the speciality of cardiothoracic physiotherapy. Continuing the advancement of the cardiothoracic sphere of physiotherapy practice, the theme for the 2003 Conference, "Inspiring Innovation, Expiring Tradition", challenged physiotherapists to continue the quest for evidence-based practice and to seek and develop new niches to showcase our skills and talents to provide tangible benefits to those receiving our interventions.

More than 150 registrants participated in the conference, travelling from all corners of Australia and New Zealand. The Scientific Committee created a vibrant and diverse program which ensures that this conference remains at the forefront of promoting debate, discussion and development in the specialty that is cardiothoracic physiotherapy. The International Keynote Speaker was renowned physiotherapist Professor Rik Gosselink, who has widespread clinical and research interests in chronic obstructive pulmonary disease, pulmonary rehabilitation and exercise prescription. Also providing a strong blend of Australian invited speakers such as Dr Robyn Box, Dr Brenda Button, Mark Elkins and Associate Professor Jenny Paratz ensured that the diversity of practice was well represented and promoted within the scientific program. Supplementing the plenary sessions and workshops were some 48 oral presentations and 14 posters incorporated into the program. The peer reviewed abstracts of these original works are presented in the following pages.

Shane Patman

Chairperson 2003, National Cardiothoracic Group
Australian Physiotherapy Association

ORAL PRESENTATIONS

Correlation between pulmonary function tests, breathlessness scores and exercise tolerance in paediatric cystic fibrosis subjects

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The relationship between outcomes of functional exercise tests, breathlessness scores and pulmonary function tests (PFTs) are inconsistent in paediatric clients with chronic lung disease. Predictable relationships between outcome measures may assist clinicians to monitor the progress of patients through the use of easily administered clinical tests. The aim of this observational correlational study was to determine the relationship between PFTs, breathlessness scores and an exercise tolerance test in paediatric subjects with cystic fibrosis (CF). Cystic fibrosis subjects were invited to participate if they were between the ages 8 to 18 years, $FEV_1 \geq 40\%$ predicted and were undergoing review at the Women's and Children's Hospital Cystic Fibrosis Clinic, Adelaide. All subjects completed PFTs (FEV_1, FVC, FEV_1/FVC). Modified Borg Perceived Rate of Exertion scales and the 15-count breathlessness score were assessed before and after a six minute walk test (6MWT). Data were analysed using correlation analysis. Thirty subjects completed this study (20 males, age 11.8 (± 2.9 years). Preliminary analysis demonstrated no strong correlations for the whole group or subjects with mild pulmonary impairment between PFT parameters, breathlessness scores and 6MWT (range -0.41 to 0.13). While the sample size is small (n = 3), for subjects with moderate pulmonary impairment (FEV_1 40% to 60% predicted), stronger correlations were found between PFT parameters and 6MWT (range -1.0 to 0.96), PFTs and breathlessness scores (range -0.64 to 0.84) and breathlessness scores and 6MWT (range -0.27 to -0.84). Associations between outcome measures for subjects with mild pulmonary impairment were not evident. Stronger correlations for subjects with moderate pulmonary impairment suggest further study is warranted.

Physiotherapy assessment and management of chronic hyperventilation syndromes/breathing pattern disorders: A review

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Hyperventilation is defined as breathing in excess of metabolic requirements with a resultant hypocapnea and respiratory alkalosis. Hyperventilation syndrome, a term first used in 1938 to describe a series of symptoms caused by chronic hyperventilation, has remained a concept difficult to define. Although considerable research has been published validating the relationship between disordered breathing patterns and fatigue, stress and anxiety, there is little specific research on the effectiveness of physiotherapy management in hyperventilation syndrome. The aim of this review was to determine the value of conventional physiotherapy assessment of dysfunction and breathing retraining in managing hyperventilation syndrome. A critical review of the electronic databases CINAHL, Cochrane Library, PEDro, hand searches and reference lists, limited to English language, and using the terms breathing retraining, breathing exercises, breathing re-education, physiotherapy and physical therapy, resulted in seven papers. Applying the Sackett level of evidence rating scale identified two papers as randomised controlled trials. The remaining papers were descriptive or case controlled studies, an audit, or based on expert opinion. Most studies use small sample sizes and convenience samples. Despite no definitive clinically reliable conclusions being drawn from the review because of the small number of trials and participants and varied outcome measures, convincing evidence of physiotherapeutic effectiveness is revealed. Further larger randomised controlled studies are required to confirm effectiveness and clarify mechanisms of benefit if found.

Asymptomatic (silent) gastro-oesophageal reflux in adults with cystic fibrosis: Implications for cardiorespiratory physiotherapists

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Symptomatic gastro-oesophageal reflux (GOR) has been described in adults with cystic fibrosis (CF). There is no data to indicate whether adults with CF have asymptomatic (silent) GOR. This study aimed to establish: 1) whether adults with CF experience silent GOR; and 2) the usefulness of a valid structured symptom questionnaire (Qx) in CF to identify GOR using 24 hour oesophageal pH monitoring (OPM). Adults with CF with and without symptoms of GOR were studied. Each subject completed the symptom Qx followed by dual probe 24 hour proximal and distal OPM. Mean, SD, range and normal values from 29 subjects are reported, including age: 28.6 ± 4 (19 to 45.5) years; FEV_1: 50.4 ± 21.4 (21 to 87) % predicted; and FVC: 64.4 ± 16.3% (44 to 93.9). Respective results of proximal and distal OPM include: number of reflux episodes, 50.8 ± 44.3 (4 to 147) [normal < 4]; 182.2 ± 90.7 (28 to 404) [normal < 50]. reflux index, 2.11 ± 2.1 (0.1 to 6.8) [normal < 0.1%]; 7.9 ± 5.3 (0.7 to 21.8) [normal < 4.5%]. DeMeester Score (DMS) [weighted computation all indices], 35.7 ± 20.9 (4 to 89.2) [normal < 14.72]. Symptom score, 8.8 ± 5.5 (0 to 18) [normal < 4/18]. Silent GOR was identified in six (21%) subjects with DMS of 53.7, 53.1, 46.7, 37.6, 31.2 and 28.4 respectively. Results to date suggest that symptomatic GOR is common in adults with CF, however symptom scores do not correlate with DMS (n = 29; $r^2 = 0.015$; $p = 0.53$) when silent GOR is present. Patients with high DMS had significantly lower FEV_1 ($p = 0.03$). It is concluded that silent GOR occurs in adults with CF. The symptom Qx is useful in diagnosing GOR in symptomatic patients, but not in asymptomatic patients. Therefore patients with declining lung function without symptoms of GOR should undergo 24 h OPM to establish whether GOR is present. Silent GOR has implications for cardiorespiratory physiotherapy techniques and positioning.

Issues, duty of care and guidelines related to health care workers with cystic fibrosis and their patients in the clinical setting

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There are increasing numbers of health care workers with cystic fibrosis (HCWCF). The University of Melbourne inquired about duty of care to student HCWCF and their patients during clinical placements. The aims of this study were: 1) to research the international experience with HCWCF; 2) to determine issues relating to duty of care to HCWCF and patients; and 3) to develop guidelines. A university working party (UWP) was formed. The physiotherapist (PT) developed a customised fact-finding questionnaire (Qx) related to professions chosen, cross-infection risks/precautions, medico-legal issues, confidentiality and protocols to distribute at international conferences in 2001-2002. One hundred healthy PTs working in CF clinics were approached for information. Twenty PTs were able to complete the Qx. The balance had no knowledge about HCWCF at their clinic. Health care workers with cystic fibrosis trained and worked in most areas of health care. Cross-infection and medico-legal issues have arisen in 5/20 clinics. The UWP recommended that individuals with CF should not be excluded from health care professions but HCWCF should avoid working with other CF patients. Early/ongoing education should be given about demands, stresses and risks. Disclosure by HCWCF to employers and respect for confidentiality are necessary. Education regarding infection control, sputum surveillance, awareness of organisms carried and appropriate actions should be provided. Health care workers with CF with chronic P. aeruginosa or MRSA should not attend patients at risk of infection with these bacteria. Decisions should be made on a case-by-case basis. Guidelines have been formulated that respect the right of adults with CF to work in the health care field while minimising risks of adverse outcomes.

Incontinence in healthy women compared with chronic lung disease including cystic fibrosis and COPD: Prevalence and risk factors

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Women with lung disease report urinary incontinence (UI). The aim of this study was to estimate prevalence and severity of urinary and bowel problems in women with cystic fibrosis (CF) and COPD compared with normal. With ethics approval, 125 women (37 with CF, 22 with COPD and 66 controls) completed a fact-finding survey based on International Continence Society recommendations regarding bladder and bowel problems in the last 12 months, one month and two weeks. Mean, range, OR and *p* value are reported respectively for normal women (aged 41 years) [19 to 81], CF (31) [19 to 61] and COPD (62) [48 to 77] women. Urge incontinence: OR 1, 0.286, 0.187; $p = 0.067$ (CF); 0.732 (COPD). Stress urinary incontinence: 1, 5.768, 2.764; $p = 0.001$ (CF), 0.099 (COPD). Faecal incontinence: 1, 1.879, 4.593; $p = 0.455$ (CF), 0.60 (COPD). Faecal urgency: 1, 1.069, 4.617; $p = 0.929$ (CF), 0.24 (COPD). The prevalence of stress UI was 31% for normal, 69% for CF, 60% for COPD groups while urge UI was 38% for normal, 11% for CF, 43% for COPD. Women with COPD were more likely to have nocturia than CF or normal ($p < 0.001$) women. Of those with incontinence, 18% in normal, 57% in CF and 43% in COPD group were not bothered by their symptoms. Bowel symptoms occurred more frequently in CF than COPD (40% vs 28.6%), COPD women had more prolapse symptoms than CF (24% vs 3%) and voiding difficulties (24% vs 8%). It was concluded that there is a higher prevalence of urinary tract and bowel symptoms in women with lung disease than normal who are symptom tolerant. Defaecation difficulty is prevalent in young nulliparous CF women, possibly because of CF gastro-intestinal pathology.

Standing with assistance of a tilt table in intensive care: A survey of Australian physiotherapy practice

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Although tilt tables are used by physiotherapists to reintroduce patients to the vertical position, no quantitative evidence is available regarding its use in the intensive care units (ICUs) of Australian hospitals. The purpose of this study was to document the use of tilt tables in physiotherapy management of patients in ICUs across Australia. Ninety-nine physiotherapists working in Australian public ICUs were contacted via mail. Participating physiotherapists were asked to complete a questionnaire regarding their tilt table practice. Reasons for the use or non-use of the tilt table, contraindications, commonly used adjuncts, monitoring and outcome measures were also investigated. Seventy-five questionnaires were returned. The tilt table was used by 47 physiotherapists (63%). The most common reasons for inclusion of tilt table treatment were: to facilitate weight bearing (98% of respondents); prevent muscle contractures (87%); improve vestibular stimulation (76%); and increase arousal (72%). Improving ventilation (83%) and improving gas exchange (60%) were also reported. The tilt table was most frequently applied to patients with neurological conditions (66%) and during long-term ICU stay (47%). Techniques often combined with the tilt table treatment included upper limb exercises (96%), balance (87%) and breathing exercises (85%). It is clear that standing with assistance of the tilt table is used by a majority of physiotherapists working in Australian ICUs. A moderate level of agreement is demonstrated by physiotherapists regarding indications to commence tilt table treatment and adjunct modalities combined with standing with assistance of the tilt table.

Standing with the assistance of a tilt table improves minute ventilation in long-term critically ill patients

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Physiotherapists in intensive care commonly use a tilt table to reintroduce patients to the vertical position following prolonged mechanical ventilation and immobilisation to improve ventilation. The purpose of this prospective, repeated measures study was to investigate the effect of standing with assistance of the tilt table on ventilatory parameters and arterial blood gases in long-term intensive care patients. Arterial oxygen (P_aO_2) and carbon dioxide concentrations (P_aCO_2) were recorded from blood gas samples of 15 adult patients intubated and mechanically ventilated for $\geq$ 5 days. A flow sensor was attached via the subject's airway or facemask and connected to a respiratory mechanics monitor to record tidal volume (V_T), minute ventilation (V_E) and respiratory rate (f). Subjects were tilted to 70 degrees from the horizontal for five minutes using a tilt table. The tilted position for five minutes produced significant increases in V_E ($p < 0.001$), produced by increases in both f ($p < 0.001$) and V_T ($p = 0.016$) compared with initial levels. These changes were maintained during the tilt intervention and immediately post-tilt. Twenty minutes following the tilt, there were no significant changes in ventilatory measures of V_E or V_T, nor of arterial blood gases P_aO_2 and P_aCO_2 compared with initial values. The study showed that standing with assistance of a tilt table for five minutes significantly increases ventilation in critical care patients during and immediately after the intervention. No deterioration in gas exchange post-tilt was seen. Using a tilt table provides an effective method to increase ventilation in the short term.

Airway clearance techniques as part of the sputum induction procedure

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Some centres have reported using physical airway clearance techniques as part of their sputum induction procedure. The aim of this descriptive study was to determine the diversity of clinical practice with respect to sputum induction for the purpose of microbiological identification of respiratory infections in Australia and New Zealand. In October 2001, a questionnaire was sent to all major teaching hospitals throughout Australia and New Zealand, on the procedure used for sputum induction. Information was collected about which patients were considered suitable candidates, the induction procedure used, which staff performed the procedure, and adverse events. Questions about the procedure related to the induction agent, the delivery circuit, pre-medications, additional physical secretion clearance techniques and infection control. The completion rate was 92%. There was little consistency among the responses. The mean ± SD (range) concentration of hypertonic saline used as the induction agent was 6 ± 4.5% (3 to 20). The estimated time to production of an adequate sample was 15 ± 10 min (5 to 60). The staff responsible for conducting the procedure were most commonly physiotherapists. Physiotherapists frequently included additional secretion clearance techniques in the procedure. There was, however, considerable variation in the selection of techniques, even within individual centres. The procedure for sputum induction varies greatly across Australasia, possibly due to a lack of definitive evidence as to the optimum protocol for this procedure. This study has led to a randomised trial of the effect of physiotherapy techniques on the sputum induction procedure.

Motivational factors that influence exercise habits of people who have chronic obstructive pulmonary disease post pulmonary rehabilitation

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This study sought to understand what motivates people who have chronic obstructive pulmonary disease (COPD) to exercise after completing pulmonary rehabilitation (PR). All participants who completed a 10 week PR program at Waikato Hospital (WH) more than 12 months prior were included (n = 168). An initial survey was sent to determine who was continuing to exercise. All responders to the survey were then put into a ballot to select two focus groups, one made up of exercisers (n = 10) the other of non-exercisers (n = 8). The purpose of these was to determine themes around why people chose to continue or discontinue exercising. The response rate of the initial survey was 92%. Eighty-two per cent stated they were exercisers, with 79% completing home exercise, 70% walking and 54% doing gym exercises. The focus groups were recorded and transcribed. Through content analysis, 11 themes were identified as factors that motivate people to continue exercising: personal expectations, maintaining independence, fear of deteriorating, fear of dying, fear of being caught not exercising, verbal encouragement, social support, group cohesion, role models, self-discipline and goals. Additionally, 10 themes were identified as factors that discouraged people from continuing to exercise: personal expectations, unpleasant physical sensations, unpleasant exercising conditions, travelling costs, lack of time, other physical problems, lack of COPD-related social support and certain personality traits. The PR program at WH is successful in encouraging a majority of its participants to continue with regular exercise. The themes identified should be considered by those providing PR to ensure post-program exercise compliance remains high.

Randomised controlled trial of a post pulmonary rehabilitation maintenance program for patients with chronic lung disease

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This randomised controlled trial investigated the effects of a community maintenance program following pulmonary rehabilitation (PR) on exercise tolerance and health related quality of life (HRQOL). Sixty-one patients with chronic lung disease following six weeks of outpatient PR were referred to a community maintenance program where they were randomly allocated to weekly supervised exercise for 12 weeks (n = 31) or a control group (n = 30). Six minute

walk test (6MWT) and HRQOL (Chronic Respiratory Questionnaire - CRQ) were measured at three and 12 months following completion of PR by staff blinded to allocation. The number of patients achieving a minimum clinically important difference (MCID) in CRQ and 6MWT were compared using chi squared tests. Data for 6MWT were compared using ANOVA, significance set at $p \leq 0.05$. At baseline and following PR, groups were equivalent. Twenty-two control (73%) and 25 maintenance (81%) patients completed 12 month assessments. Six minute walk distance was significantly greater at three months (384 ± 100m, mean ± SD) and 12 months (370 ± 103m) than baseline (306 ± 91m) in the maintenance group. There were no significant improvements in the control group at three or 12 months. A significantly greater number of patients in the maintenance group achieved a MCID in 6MWT (31%, $\chi^2 = 4.871$) and fatigue (CRQ) (38%, $\chi^2 = 8.992$) at three months than the control group. The results showed that a 12 week community-based maintenance program may lead to benefits in exercise tolerance up to 12 months after PR. The effect on HRQOL was inconclusive.

Non-invasive ventilation preserves inspiratory muscle strength and prevents oxygen desaturation during airway clearance in adults with exacerbations of cystic fibrosis

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Airway clearance techniques are essential to cystic fibrosis (CF) management. However, adverse effects such as respiratory muscle fatigue and oxygen desaturation have been reported. To determine the effects of non-invasive ventilation (NIV) during airway clearance in adults during CF exacerbations, 26 subjects aged 27 ± 6 years (mean ± SD) with FEV_1 34 ± 12% were enrolled in a single-blinded, randomised crossover trial on Days 3 and 4 of hospital admission. The active cycle of breathing technique (ACBT) was compared with ACBT + NIV. Inspiratory and expiratory muscle strength (PI_{max} at residual volume, PE_{max} at total lung capacity) and spirometry were measured before and after each treatment. Pulse oximetry (S_pO_2) was recorded. Treatment, period and carryover effects were examined with cross-over two-sample *t*-tests. Relationships between variables were assessed with correlations. PI_{max} fell following ACBT ($p < 0.05$), with the greatest reductions in those with the lowest baseline PI_{max} ($r = 0.73$, $p < 0.001$). PI_{max} was maintained with NIV (mean difference from ACBT 9.04 cmH_2O, $p = 0.006$). There was no change in PE_{max} with treatment. Oxygen desaturation during ACBT was greatest in those with lowest FEV_1 ($r = -0.65$, $p < 0.001$). Addition of NIV improved mean S_pO_2 ($p < 0.001$). FEV_1 and FVC did not change with either treatment, however an increased FEF_{25-75} was evident following NIV ($p < 0.01$). No period or carryover effects were seen for any variable but the trial showed that reduction in inspiratory muscle strength and oxygen saturation during airway clearance are associated with baseline inspiratory muscle weakness and severe lung disease. Addition of NIV preserves inspiratory muscle strength and improves oxygen saturation and small airway function.

Randomised double-blind controlled trial of unsupported upper limb exercise in chronic obstructive pulmonary disease

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Many patients with chronic obstructive pulmonary disease (COPD) report dyspnoea and fatigue when performing upper limb (UL) activities. Unsupported UL training has been shown to improve UL endurance but its effects on symptoms and quality of life have not been examined. To compare the effects of UL and lower limb (LL) training with LL training alone on endurance, symptoms and quality of life in patients with COPD, 38 subjects aged 67 ± 8 years (mean ± SD) with moderate to severe COPD (FEV_1 37 ± 14% predicted) were recruited. The subjects were randomly allocated to unsupported UL endurance training or to a sham training task. All underwent LL endurance training. The six minute walk test (6MWT), incremental unsupported upper limb exercise test and Chronic Respiratory Questionnaire (CRQ) were completed before and after six weeks of training. Subjects and assessors were blinded to allocation. Changes were compared with independent-samples *t*-tests or Mann-Whitney U test. Ninety-five per cent of subjects reported symptoms associated with upper limb activities on the initial CRQ. Both groups showed significant improvements on all domains of the CRQ and on 6MWT following training. Only the UL training group showed improvement in UL endurance time (57 ± 75 vs 2 ± 58 s, $p = 0.02$). There were no differences between groups for 6MWT or CRQ. It was concluded that unsupported UL training in COPD improves UL endurance but has no additional effect on symptoms or quality of life compared with LL training alone. This type of UL training may not adequately address the complex interaction between respiratory mechanics and UL function.

Metabolic alkalosis contributes to acute hypercapnic respiratory failure in adult cystic fibrosis

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Patients with endstage cystic fibrosis (CF) develop respiratory failure and hypercapnia. In contrast with chronic obstructive pulmonary disease (COPD), systemic factors such as altered electrolyte transport and malnutrition may predispose CF patients to metabolic alkalosis. The ensuing respiratory compensation could contribute to hypercapnia. To determine the prevalence of metabolic alkalosis in adults with hypercapnic respiratory failure in the setting of acute exacerbations of CF compared with COPD, arterial blood gases (ABGs), plasma electrolytes and serum albumin from 14 consecutive hypercapnic CF patients admitted to hospital with a respiratory exacerbation were compared with 49 consecutive hypercapnic patients with exacerbations of COPD admitted during the same period. Hypercapnia was defined as $P_aCO_2 \geq 45$mmHg. Differences between groups were examined using unpaired *t*-tests for parametric data and chi-squared test for non-parametric data. Despite

similar P_aCO_2 values, the CF group were significantly more alkalotic than the COPD group (pH 7.43 ± 03 vs 7.37 ± 0.05, $p < 0.01$). A mixed respiratory acidosis and metabolic alkalosis was evident in 71% of CF patients and 22% of COPD patients ($p < 0.01$). Plasma chloride (95.1 ± 4.9 vs 99.8 ± 5.2 mmol/L, $p < 0.01$) and sodium (136.5 ± 2.8 vs 140.4 ± 4.5 mmol/L, $p < 0.01$) were lower in the CF group and serum albumin was reduced (27.4 ± 5.8 vs 33.7 ± 4.8 g/L, $p < 0.01$). The results showed that metabolic alkalosis contributes to hypercapnic respiratory failure in adults with exacerbations of CF. This occurs in conjunction with reduced total body salt and hypoalbuminemia. The contribution of metabolic alkalosis should be considered prior to initiation of non-invasive ventilation in patients with exacerbations of CF.

The effect of nonbronchoscopic bronchoalveolar lavage on respiratory mechanics in ventilated children

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The effect of nonbronchoscopic bronchoalveolar lavage (NBBAL) on respiratory mechanics is unknown, therefore this study sought to determine whether NBBAL causes a deterioration in respiratory mechanics. All patients prescribed a NBBAL were eligible for inclusion. They were excluded if they had a bleeding disorder, were on high frequency oscillation, or had an endotracheal tube leak. CO_2smO data were collected on 19 patients (aged between four weeks and 14 years). Four were excluded because of ventilatory changes following NBBAL. The CO_2smO Plus! Respiratory Monitor (Novametrix Medical Systems Inc.) was used to measure respiratory compliance (C_{rs}), resistance (R_{rs}) and tidal volume (V_{TE}) for 15 minutes prior to and for one hour post-NBBAL. Arterial blood gases (ABGs) were taken prior to and at 30 and 60 minutes following the NBBAL. The NBBAL, performed by a physiotherapist, consisted of saline instillation, manual hyperinflation, chest wall vibrations, and suction. *T*-test analysis showed deterioration in C_{rs} (-0.03 mL/kg, $p = 0.02$), an increase in R_{rs} (10.23 $cmH_20/L/s$, $p = 0.09$) and a decrease in V_{TE} (-0.28 ml/kg, $p = 0.09$) 15 minutes after the procedure. One hour following NBBAL, mean values of C_{rs}, R_{rs} and V_{TE} values had returned to baseline and there was no significant difference ($p > 0.7$) compared with 15 minutes prior to NBBAL. There were no significant changes in pH, P_aCO_2 or P_aO_2. While there was short-term deterioration in respiratory mechanics following NBBAL, measurements returned to baseline within one hour and were not accompanied by changes in ABG values. Clinically, this implies that a NBBAL does not cause a prolonged deterioration in respiratory function.

A survey of physiotherapy practice in the treatment of cystic fibrosis and bronchiectasis in children throughout Queensland

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Historically there is a broad spectrum of airway clearance techniques used in the treatment of children with cystic fibrosis (CF) and bronchiectasis. The objective of this survey was to establish the breadth of physiotherapy practice in the treatment of children with CF and bronchiectasis throughout many centres in Queensland. A survey was developed to review physiotherapy practice and clinical reasoning involved in the selection of airway clearance techniques (ACTs) for children with CF and bronchiectasis. The survey was piloted within the Royal Children's Hospital physiotherapy department and then distributed by post to physiotherapists at 19 rural and provincial hospitals within Queensland. Descriptive analysis was used to collate responses to the survey. The response rate to the survey was 63%. Most respondents reported that their treatment of choice for airway clearance was positive expiratory pressure, active cycle of breathing technique and modified postural drainage with percussion and vibrations. Changes in cough quality and breath sounds were most commonly used by respondents as indicators to increase the use of ACTs for this population of children. This survey highlighted a variance in physiotherapists' views on when a particular ACT, eg head down tilt, is perceived as a contraindication or a precaution. The results showed that a variety of ACTs are employed by physiotherapists in the management of children with CF and bronchiectasis throughout Queensland.

Distribution of ventilation in upright sitting and right sidelying in older normal subjects

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The effects of positioning on the distribution of ventilation in the lungs of younger subjects have been previously studied. Age-associated alterations in distribution of ventilation during tidal breathing in the lungs of older people have been proposed but not investigated. The aim of this within-subjects study was therefore to determine the effects of positioning on the distribution of ventilation in the lungs of older normal subjects during tidal breathing. Ten healthy subjects aged 65 and older were studied. The distribution of ventilation during tidal breathing in the upright sitting and right sidelying positions was quantified using Tc-99 m Technegas lung ventilation scans. Statistical analysis was performed using the Wilcoxen signed-ranks test. In the upright position, ventilation was preferentially distributed to the dependent compared with the non-dependent lung regions ($p = 0.005$), and in the right sidelying position, ventilation was preferentially distributed to the right (dependent) lung compared with the left (non-dependent) lung ($p = 0.005$). Results showed that in older normal subjects, the distribution of ventilation is to the dependent lung regions. This is a similar pattern of distribution to that reported in younger subjects. This suggests that age-associated changes in the respiratory system do not substantially alter distribution of ventilation.

Further research is required to determine the effects of positioning on distribution of ventilation in older subjects with cardiopulmonary dysfunction to enable clinical implications to be made.

The safety of mobilisation, in particular its effect on the haemodynamic and respiratory status of intensive care patients

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The physiotherapy management of patients in an intensive care unit (ICU) often incorporates mobilisation. To date, there is no research assessing the overall safety of mobilising acutely ill patients, nor the effect of mobilisation on haemodynamic and respiratory status. This prospective study evaluated the safety of mobilisation, in particular its effect on the haemodynamic and respiratory status of ICU patients, in all ICU patients where mobilisation formed part of their physiotherapy management. Haemodynamic and respiratory variables were recorded prior to, during and after mobilisation. Additionally, any intervention required to stabilise haemodynamic or respiratory status during mobilisation was noted. Paired *t*-tests were used to compare haemodynamic and respiratory data observed prior to and during mobilisation. Thirty-one ICU patients received a total of 69 mobilisation treatments during the study period. Sixty-three of the treatments (91.3%) were performed with patients who had marginal cardiac and/or respiratory reserve at rest. Mobilisation resulted in significant increases in heart rate, systolic and diastolic blood pressure ($p < 0.01$) and a significant fall in percutaneous oxygen saturation ($p < 0.01$). There were three episodes (4.3%) of desaturation during mobilisation, involving different patients, where a temporary increase in inspired oxygen was required to stabilise respiratory status. Mobilisation resulted in significant haemodynamic and respiratory changes for this sample of ICU patients and this study therefore indicates that if appropriate screening procedures and precautions are taken prior to and during mobilisation, the majority of ICU patients deemed suitable for mobilisation can be safely mobilised without further compromising their haemodynamic and respiratory status.

Who uses vibration and why?

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Vibration has been recommended in many physiotherapy textbooks as a method of clearing secretions in patients with respiratory disorders and has been widely investigated in multimodal treatment regimens in this patient group. However the degree to which vibration is used has not previously been adequately investigated. To investigate the use of vibration by physiotherapists within Australian public hospitals, physiotherapists from 95 randomly selected hospitals throughout Australia (13% of all Australian public hospitals) who treated patients with respiratory disorders were surveyed. A previously piloted, purpose designed questionnaire was distributed by an administrator within each of the hospitals, which were stratified according to hospital size and state. Two follow-up letters with additional survey forms were sent to the administrator to distribute, to ensure an adequate response rate. Logistic regression was used to determine whether there was an association between the background profile of the respondents and their use of vibration. Two hundred and fifty-three surveys were distributed, with 204 physiotherapists (81%) responding. The majority (96%) of the responding physiotherapists used vibration, with one third (33%) having used vibration on the day that they filled in the survey. Most (81%) of the physiotherapists used vibration to remove secretions and 17% used vibration to directly improve ventilation. This indicates that vibration is widely used by physiotherapists within Australian public hospitals.

The effects of chest wall vibration

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Although vibration is frequently used by physiotherapists throughout Australia, the forces applied during vibration and the effects of vibration on respiratory parameters have not been described. The aim of this within-subjects repeated measures study was to quantify physiotherapists' application of vibration on a normal subject's chest wall and to measure the effects of vibration on respiratory parameters. Sixteen physiotherapists who were currently treating patients with either respiratory disorders or cardiopulmonary educators volunteered. The physiotherapists randomly applied the following interventions: vibration, cough, huff from total lung capacity (TLC) ($huff_{TLC}$), relaxed expiration from TLC (TLC_{relax}), tidal breathing, sham treatment and the two individual components of vibration, ie oscillation alone and compression alone to a normal subject's chest wall. The net forces and frequencies of vibration, oscillation and compression were measured by an instrumented bed with seven load cells. Flow rates and volumes were measured during all interventions. A one-way ANOVA with repeated measures analysis was used. Significance was set at $p < 0.05$. The physiotherapists applied a mean (± SD) vertical force of 64 (± 25) N. The frequency of vibration was 5.5 (± 0.8) Hz. Cough and $huff_{TLC}$ had significantly higher expiratory flow rates (EFR) than all other interventions ($p < 0.05$). Vibration, oscillation, compression and TLC_{relax} had significantly higher EFR than tidal breathing and sham treatment ($p < 0.05$). The study shows that cough and $huff_{TLC}$ are the optimal treatment choices to increase EFR. If the above results are replicated in patients, vibration may be useful in increasing EFR in those patients who cannot cough or $huff_{TLC}$.

Evaluation of lung volume reduction surgery on arm exercise capacity, arm strength and resting energy expenditure

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The objective of this study was to evaluate the short-term effect of lung volume reduction surgery (LVRS) on supported and unsupported arm exercise capacity, arm strength and resting energy expenditure (REE). Nine subjects with COPD (mean age ± SD = 60.0 ± 5.2 years;

% predicted FEV_1 ± SD = 27.1 ± 7.1%) were recruited. At baseline and four months after LVRS (combined with pulmonary rehabilitation) each subject had tests of lung function, REE, quality of life (QoL), six minute walk test and also performed three exercise tests to peak work capacity: 1) incremental unsupported arm exercise (UAE) which consisted of lifting a bar at a constant rate using an incremental protocol; 2) incremental supported arm exercise (SAE) using an arm ergometer; and 3) incremental leg exercise (LE) using a leg ergometer. Work capacity, oxygen consumption (VO_2) and minute ventilation (V_E) were measured each minute during these tests. Arm strength was measured in five subjects using a hand-held dynamometer. A repeated measures ANOVA was used to compare the effect of LVRS on all parameters. Following LVRS, lung volumes, QoL and 6MWT significantly improved (all $p < 0.05$). Work capacity, VO_2 and V_E significantly increased for LE, SAE and UAE (all $p < 0.05$). A significant reduction in mean arm muscle strength occurred ($p = 0.001$). Resting energy expenditure was significantly reduced from 1515 ± 154 kcal/day to 1431 ± 172 kcal/day ($p = 0.04$). It can thus be shown that improvement in SAE and UAE capacity, and REE occurs following LVRS. The reduction in arm muscle strength following LVRS suggests that this should be assessed after surgery and appropriate strength training implemented.

Improvement in skeletal muscle metabolism following pulmonary rehabilitation in subjects with chronic obstructive pulmonary disease

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The objective of this study was to determine the effect of an 8 week pulmonary rehabilitation program on quadriceps muscle metabolism in subjects with chronic obstructive pulmonary disease (COPD). Magnetic resonance spectroscopy (^{31}P-MRS) and magnetic resonance imaging (MRI) were performed on the quadriceps muscles of five subjects with COPD (mean age ± SD = 71.2 ± 3.9 years; % predicted FEV_1 ± SD = 41.4 ± 18.1%) before and after an 8 week pulmonary rehabilitation program. Incremental leg exercise using a cycle ergometer to peak work capacity and a six minute walk test were also performed. Quality of life (QoL) was measured using the St George's Respiratory Questionnaire. All values were analysed using a repeated measures ANOVA. The maximum rate of oxidative ATP synthesis (Q_{MAX}) was used a measure of mitochondrial function. After exercise training, there was a significant increase in Q_{MAX} from 24.49 ± 13.9 mmol/L/min to 69.07 ± 30.41 mmol/L/min ($p = 0.05$) and an increase in quadriceps muscle volume from 32836 ± 5326 mm^2 to 33938 ± 6556 mm^2 ($p = 0.3$). Peak work capacity also increased from 42 ± 14 watts to 50 ± 8 watts ($p = 0.08$). There was a significant increase in six minute walk distance from 376 ± 15m to 440 ± 17m ($p < 0.001$) after exercise training. The total QoL score significantly decreased from 54 ± 20% to 37 ± 18% after rehabilitation ($p < 0.05$). As expected, an improvement in exercise capacity and QoL occurred after pulmonary rehabilitation. Furthermore, some subjects with COPD showed an improvement in skeletal muscle oxidative capacity and muscle volume following pulmonary rehabilitation.

Randomised trial of coached lateral basal expansion, secretion clearance techniques and early mobilisation versus mobilisation alone, in upper abdominal surgery

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The objective of this prospective single-blinded randomised clinical trial was to determine if coached breathing exercises and sputum clearance (DBandC) improve outcomes when added to a physiotherapy program of mobilisation in high risk patients after open abdominal surgery (OAS). Fifty-eight subjects (mean age 65 years, SD 14) at Westmead Hospital, assessed as high risk for pulmonary complications (PPC) (aged > 59 years or co-morbidities such as smoking, obesity and respiratory disease) undergoing elective OAS via a midline incision were randomly allocated to two groups. The 23 subjects in Group A participated in a mobilisation program only. The 29 subjects in Group B received DBandC, three times daily for the first two post-operative days, twice daily for Days 3 and 4 and daily until symptom free for two consecutive days, in addition to the mobilisation program. All subjects were assessed at least daily for PPC. Outcomes were assessed by the researcher who was blinded to allocation, using a standardised outcomes measurement audit tool previously published. Statistical analyses on an intention-to-treat basis included student *t*-tests and *z*-tests using SPSS Version 6.1.2. Complete data were available for 52 subjects (90%). Dropouts were due to procedure cancellation (2) or change in incision (4). There was no significant difference between Groups A and B in age, anaesthetic time, peri-operative morbidity or post-operative mobility. Overall incidence of PPC was 15% (A:13%, B:17%, $p = 0.68$), with no significant difference in mean PPC score between groups (A: 2.7 ± 1.8 SD, 95% CI 1.9 to 3.5; B: 3.0 ± 1.7 SD, 95% CI 2.3 to 3.7), physiotherapist time ($p = 0.76$) or number of treatments ($p = 0.34$). The trial demonstrated that addition of DBandC to a physiotherapy program of mobilisation confers no significant improvement in PPC incidence in high risk OAS patients.

The effect of circuit type and "rapid release" on flow profiles during manual hyperinflation

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Manual hyperinflation (MHI) is used for the purpose of moving secretions to the large airways where they can be removed by suction. Traditionally it was thought that expiratory flow rate was the primary factor in promoting secretion movement and this was achieved by the technique of "rapid release" of the bag. This randomised 3 x 2 x 2 within-subjects repeated measures trial measured flow rates during MHI using "rapid release" for three different bagging circuits. Fifteen physiotherapists with experience in using MHI were recruited from the School of Physiotherapy at The University of Sydney, and principal referral and major metropolitan hospitals in New South Wales. The therapists performed MHI in a test lung model using Air Viva, Mapleson-C and Mapleson-F circuits in random order, with and without "rapid release". Inspiratory time was controlled using a metronome. Flows were

measured with a heated pneumotachometer and data acquired and analysed with custom designed programs. Results were analysed using a repeated measures ANOVA with planned contrasts and reported as means (SEs). "Rapid release" increased peak expiratory flow for all three circuits (0.14 L/s, $p = 0.003$). Inspiratory flow rate was faster (1.15 (0.05) vs 0.99 (0.03) L/s, $p = 0.006$) and expiratory flow rate was slower (1.65 (0.03) vs 1.90 (0.05) L/s, $p < 0.001$) comparing the Air Viva with the Mapleson circuits. "Rapid release" produced less of an increase in expiratory flow in the Air Viva circuit (0.09 vs 0.17, $p = 0.05$). This study shows that both technique and circuit type influence the flow rates generated during MHI in a test lung model. The reproducibility and relevance of these differences needs to be confirmed in clinical trials.

The effect of maintaining bag compression during expiration on expiratory flow rate during manual hyperinflation with a Mapleson-C circuit

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Operator performance during the expiratory phase of manual hyperinflation (MHI) appears to vary between physiotherapists in Australia for Mapleson-B or C circuits. Some physiotherapists release the valve but maintain compression of the black bag during expiration, whereas others release both the valve and the bag. The effect of this difference on peak expiratory flow rate (PEFR) has not been reported. The aim of this within-subjects repeated measures study was, therefore, to document the effect of maintaining bag compression on PEFR during MHI. A sub-group of six physiotherapists with experience inusing MHI, recruited from principle referral and major metropolitan hospitals in New South Wales for a larger study, participated. The subjects performed MHI using a Mapleson-C circuit, with "rapid release", firstly releasing the bag and secondly maintaining bag compression during expiration. Inspiratory time was controlled using a metronome. Flows were measured with a heated pneumotachometer and data acquired and analysed with custom designed programs. Results were analysed using a repeated measures ANOVA with planned contrasts and reported as mean (SE). Maintaining bag compression significantly reduced PEFR for the Mapleson-C circuit at a 1.4 L target volume from 2.00 (0.07) to 1.54 (0.08) L/s ($p = 0.008$). There was no significant difference in PEFR between the two techniques at a 2 L target volume (2.02 (0.14) with bag compression vs 2.29 (0.08) L/s without bag compression, $p = 0.112$). This study showed that maintaining bag compression during expiration reduces PEFR at a volume of 1.4 litres in a test lung model but the effect needs to be confirmed in the clinical setting.

Intermittent exercise results in a decreased breathlessness and dynamic hyperinflation in COPD patients

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Recent studies have suggested that intermittent exercise (IEx) may be better tolerated than continuous exercise (CEx) in COPD patients. We hypothesised that IEx may result in a lower rating of breathlessness and dynamic hyperinflation when compared with continuous exercise (CEx) at the same intensity. We examined the changes in breathlessness and inspiratory capacity during an acute bout of IEx and CEx in 10 individuals (5 male and 5 female) aged 68 ± 8 yr (mean ± SD) with moderate COPD (FEV_1 = 52 ± 15 % predicted). Each subject completed an incremental exercise test to exhaustion prior to commencing the study. Subjects completed an IEx and CEx test at 70% of peak power in random order on separate days. Intermittent exercise was performed using a 60 s exercise, 60 s rest protocol. Oxygen uptake (VO_2), ventilation (V_E), heart rate (HR), ratings of breathlessness (0 to10 scale) and inspiratory capacity were recorded during the exercise tests. Intermittent exercise was associated with a significantly lower ($p < 0.01$) VO_2, V_E and HR compared with CEx. Subjects also reported a significantly lower rating of breathlessness (IEx 3 ± 2 and CEx 7 ± 2, $p < 0.01$) during IEx compared with CEx. Moreover, IEx was associated with a lower degree of dynamic hyperinflation when compared with CEx. This study clearly demonstrates that IEx is associated with a lower breathlessness and dynamic hyperinflation and that IEx should be considered as an alternative exercise training mode for patients with COPD.

The effects of water versus land-based exercise for patients with chronic obstructive pulmonary disease – a pilot study

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Few studies have considered the impact of aquatic exercise on COPD patients in terms of exercise capacity and quality of life. An AB/BA, single blinded, randomised design was used to determine if a course of aquatic exercise is as beneficial as land-based exercise for patients with COPD. People referred to pulmonary rehabilitation at Flinders Medical Centre were invited to participate. Subjects were excluded if they had a recent hospital admission or contraindications to hydrotherapy. Outcome measures were six minute walk test (6MWT), pulmonary function (FEV_1, FVC) and St George's Respiratory Questionnaire (SGRQ). Concealed allocation was used to randomise subjects into two groups undertaking either six weeks of land (L) or water (W) based exercise. Subjects were reassessed and commenced the alternate intervention for a further six weeks followed by reassessment. Crossover *t*-tests were used to determine differences between exercise interventions ($p < 0.05$). Twelve subjects completed baseline assessment (age: 67 ± 17.5 yrs, FEV_1: 1.5 ± 0.5 L), 11 subjects completed both rotations (L/W = 6, W/L = 5). Preliminary analysis indicates no significant differences between groups for any outcome measure or demographic at baseline (p range 0.20-0.97). Exercise on land was associated with significant improvement in SGRQ (impacts, $p = 0.02$, activity, $p = 0.04$, total score, $p = 0.03$). No significant differences were found for 6MWT and pulmonary function. Given the sample size, the results suggest that outcomes for exercise on land or water are comparable but land-based exercise may be more effective in improving quality of life. A larger controlled trial is warranted.

Peripheral muscle strength training for people with chronic obstructive pulmonary disease: A systematic review

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Skeletal muscle weakness and the associated impact on exercise tolerance provide a strong theoretical rationale for strength training intervention for people with chronic obstructive pulmonary disease (COPD). The purpose of this systematic review was to examine the effects of peripheral strength training, with regard to impairment, activity and participation measures, for people with COPD. Empirical trials and reviews were obtained by searching electronic databases (MEDLINE, pre-MEDLINE, EMBASE, CINAHL, PubMed, PEDro, Cochrane, AMED, AMI, Expanded Academic Index, SPORTSDiscus, Ausport medical) and citation tracking, using COPD with strength/resistance training and skeletal muscle as keywords. Two reviewers completed data extraction and quality assessment independently, using the PEDro scale and a checklist developed for review articles. Effect sizes and 95% confidence intervals were determined for empirical trials and meta-analysis used where appropriate. The search strategy yielded 13 papers (nine empirical, four reviews). Strength training was found to have strong evidence for improving upper body ($\delta = 0.70$, 95% CI: 0.28 to 1.11, $z = 3.30$, $p < 0.001$) and lower limb strength ($\delta = 0.90$, 95% CI: 0.42 to 1.38, $z = 3.65$, $p < 0.001$). However, no strong evidence was found for other outcome measures including respiratory function, aerobic capacity and walking endurance. Further research is required to investigate the effects of strength training on functional activities such as balance, upper limb function and self-care, and participation in daily life.

Manual hyperinflation improves recruitment in extrapulmonary lung disease

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Increasing evidence suggests dissimilar pathologies in acute lung disease (ALI) of intrapulmonary (ALI_{ip}) and extrapulmonary (ALI_{exp}) origin. This prospective within-subjects study aimed to compare gas exchange and respiratory mechanics following manual hyperinflation (MHI) in subjects with acute lung injury of ALI_{ip} and ALI_{exp} origin. Sixteen ventilated subjects (65 ± 13.9 years) post-septic shock with ALI were included in the study. Manual hyperinflation was performed once for three minutes with a Mapleson-C circuit, 2l reservoir bag, peak inspiratory pressure standardised to 30 cmH_2O, positive end expiratory pressure to 5 cmH_2O and an inspiratory:expiratory ratio of 2:1. Arterial blood gases were recorded immediately before and after MHI and P_aO_2/FiO_2 ratio calculated. Tidal volume (V_T) and dynamic compliance (C_{dyn}) were recorded on a Ventrak respiratory mechanics monitor. All subjects completed the study providing data from 100% of measured outcomes. A repeated measures analysis of variance demonstrated significant increases in C_{dyn} both in ALI_{ip} ($p < 0.05$) and ALI_{exp} ($p < 0.01$) sustained at 30 minutes post MHI in ALI_{exp} only (pre 49.2 ± 9.4, post 57. ± 7.87, post 30 minutes 56.9 ± 7.7 ml/cmH_2O). A paired *t*-test indicated that P_aO_2/FiO_2 ratio decreased post MHI (pre 259 ± 75.5, post 197.5 ± 78.2) in ALI_{ip} ($p < 0.001$) and significantly increased in ALI_{exp} ($p < 0.01$), (pre 226.5 ± 28.6, post 305 ± 40.9). Tidal volume increased significantly post MHI in ALI_{exp} ($p < 0.001$ 947 ± 287.7 to 1050.1 ± 251.1ml). Lung recruitment appeared more successful in ALI_{exp}, which supports the view of differing pathologies in acute lung injury. This study should assist in patient selection for MHI.

Intensive care readmission - analysis of patients returning to ICU

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This quality project was a prospective survey of patients who were readmitted to a 22 bed tertiary level intensive care unit (ICU) within a 12 month period. Aims were to: 1) identify factors in the physiotherapy management (level of intervention of ward management) which could be improved to prevent readmission to ICU; and 2) identify factors that could predict which patients were at high risk of readmission. Data were kept on every patient readmitted to ICU, including standard demographic data, initial admission diagnosis, co-morbidities, readmission diagnosis, mobility on discharge, respiratory pattern, secretions, airway, handover, P_aCO_2, PaO_2/FiO_2, time of discharge and physiotherapy ward management. Subjects included 59 patients who had been readmitted to ICU in a 12 month period. They were compared for the same factors with a convenience sample of 59 patients who were not readmitted to ICU. A *t*-test was performed for continuous variables and categorical data analysed using a chi squared test for equal proportions. The overall percentage of patients who were readmitted to ICU compared with total admissions was 7.7%. Significant factors for readmission were found to be age > 65 years, colonisation, prior weakness, inability to mobilise, co-morbidities of cardiac and/or respiratory disease and depression. The most significant category potentiating readmission was cardiac or respiratory problems, particularly problems with a tracheostomy. There were no factors pertaining to physiotherapy management. A certain profile of patients who are at increased risk of readmission to ICU has now been established. A controlled study could be established using this information.

The use of non-invasive ventilation as an adjunct to physiotherapy in the treatment of the acute tetraplegic patient – preliminary results

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This randomised clinical trial investigated if out-of-hours physiotherapy using intermittent non-invasive ventilation (NIV) is more beneficial than traditional intermittent positive pressure breathing (IPPB) in maintenance of lung function and prevention of nosocomial pneumonia (NP) in acute tetraplegics, and explored if continuous nocturnal NIV is a viable and effective alternative to intermittent

IPPB or NIV. Patients admitted with acute tetraplegia (involving spinal levels from C5 to T1) were eligible for inclusion. Patients requiring prolonged invasive mechanical ventilation or who had significant head injury requiring neurosurgical involvement were excluded. Randomisation was to: Group 1 receiving historical standard physiotherapy care using IPPB; Group 2 receiving standard physiotherapy but using intermittent NIV as a substitute for IPPB; or Group 3 receiving continuous nocturnal NIV. Ethical constraints prevented the use of a control group. Dependent variables were vital capacity (VC), arterial to inspired oxygen ratio (P_aO_2/FiO_2), NP incidence, length of stay at the acute facility, and utilisation of out-of-hours physiotherapy service. Groups were similar with respect to demographic variables. One-way analysis of variance and chi squared tests performed on the dependent variables of 21 subjects (Group 1 = 7, Group 2 = 8), with an intention-to-treat philosophy, found no significant differences with daily P_aO_2/FiO_2, NP incidence, length of ICU stay (p = 0.403), or out-of-hours physiotherapy requirements. Significant differences with length of acute facility stay [502.2 hours (363.5) vs 163.3 (116.0) vs 228.6 (183.3); p = 0.046], VC on Day 2 [1.30l (0.24) vs 1.58 (0.32) vs 0.85 (0.53); p = 0.021] and Day 3 only [1.011 (0.29) vs 1.60 (0.35) vs 0.88 (0.36); p = 0.009] were evident but the clinical significance of this is unclear.

The effect of chest physiotherapy on prevention and treatment of nosocomial pneumonia for intensive care patients with acquired brain injury – preliminary results

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This randomised controlled trial investigated the effects of respiratory physiotherapy on adult acquired brain injury (ABI) patients admitted to the intensive care unit (ICU). Subjects admitted with a Glasgow Coma Scale of < 9, requiring intracranial pressure monitoring, and invasive ventilatory support for > 24 hours, were randomised to a treatment group receiving six respiratory physiotherapy interventions in 24 hours, or to a control group. The incidence of nosocomial pneumonia (NP), duration of ventilatory support, and length of ICU stay were the dependent variables. Of 141 patients fulfilling inclusion criteria, consent was obtained for 105 subjects, with 53 randomised to the treatment group. Presence of exclusion criteria (eg unstable neurological, cardiac or respiratory status) accounted for 25 of those excluded and consent was declined in four patients. Groups were similar with respect to demographic variables except for age[treatment group 46.5 (19.7) vs control 38.2 (19.2); p = 0.03] and body mass index [28.1 (5.6) vs 24.5 (5.2); p = 0.02]. Thirteen subjects were withdrawn (four from treatment group) - five due to cessation of active management, four because they became medically unstable and four received physiotherapy services outside of those provided by group randomisation. Seven withdrawn subjects died. Using multivariate analysis of variance with intention-to-treat philosophy, there were no significant differences for NP incidence [treatment group 11/53 vs control 15/52; p = 0.365], length of ventilation [190.2 hr (124.9) vs 224.3 (171.6); p = 0.248], or length of ICU stay [240.5 hr (120.9) vs 256.4 (169.4); p = 0.584]. Despite a trend favouring the treatment group, there appears to be no benefit from respiratory physiotherapy in preventing NP or reducing length of ventilation or ICU stay in adult ABI patients.

A survey of physiotherapy emergency on-call services in New Zealand

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Physiotherapists working in hospitals are commonly required to undertake on-call duties. Concerns from within the profession about the quality of on-call services have been expressed. The objective of this survey of on-call practice in New Zealand was to identify variations in service provision and ascertain physiotherapists' concerns in providing these services. A purpose-designed postal questionnaire was distributed to senior physiotherapists in all New Zealand hospitals expected to provide emergency on-call physiotherapy services (n = 38). Data were analysed using the statistical package for the social sciences (SPSS). A response rate of 97.4% (n = 37) was obtained, of which 33 respondents provided on-call physiotherapy. Written on-call protocols were in place in 87.9% (n = 29) of hospitals. Areas covered in written protocols varied widely. The majority of hospitals (n = 29) had an agreed standard of practice in place before commencement of on-call duties with 97% (n = 32) providing some form of training prior to commencement of these duties. Ongoing training was offered in 75.8% (n = 25) of hospitals; in some cases this was compulsory (n = 12). Training varied in length and type. Support for new staff whilst undertaking on-call duties was offered in 90.9% (n = 30) of hospitals. Respondents highlighted their most important concerns regarding on-call provision to be maintenance of competency, service provision, and training and resource issues. This study demonstrates wide variations in the practice and provision of on-call duties by physiotherapists and highlights common concerns in the provision of these services. Strategies to diminish these concerns require further consideration at both national and local levels.

Comparison of the three-dimensional forces and frequencies of the percussion and vibration techniques

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Percussion and vibration techniques are commonly used in chest physiotherapy treatment. The aim of this study was to compare the three-dimensional forces and frequencies of the percussion and vibration techniques. Forces and frequencies were recorded by six force transducers mounted on the treatment plinth. Eighteen physiotherapists working at Concord Repatriation General Hospital at the time of data collection were invited to participate. The chief investigator was the "patient". Therapists applied the techniques in randomised order, using a single layer of towel. Each therapist was allowed to practise the technique without leaning on the plinth. Twenty seconds of recording started when the therapist signalled. Five therapists performed shaking instead of the vibration technique. The mean peak vertical force for percussion was 64.85 N (SD =

26.47, range of 32.93 N to 132.12 N), which was significantly ($p < 0.001$) lower than those of the vibration (mean value of 291.35 N, SD = 96.06, range of 129.29 N to 543.81 N). Similar behaviour was also observed in both the medial-lateral and cephalad-caudad forces. The mean frequency of percussion was 6.4 Hz (SD = 0.97, range of 4.5 to 8.8 Hz) vs 9.7 Hz (SD = 2.9, range of 5 to 15 Hz) in vibration. All participating therapists considered vibration to be a more gentle technique. Results indicated that the applied forces of the vibration technique are much higher than that of percussion and this technique may therefore be dangerous, especially for frail elderly patients. It is recommended that clinicians be made aware of the forces being applied by these chest physiotherapy techniques.

Using mobility indicators to evaluate and benchmark physiotherapy practice post abdominal surgery

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This comparative outcome study attempts to benchmark two physiotherapy clinical indicators after abdominal surgery from four hospitals (CI3 mobilise 30 metres with minimum assistance by Day 3 and CI5 mobilise 100 metres by Day 5 and be discharged from physiotherapy). All subjects underwent upper abdominal surgery over a period of four months in 2002. Group A hospitals used mobilisation as part of the chest treatment while Group B hospital did not mobilise patients routinely. Data was collected on mobility indicators, length and frequency of physiotherapy treatment. Group A had 118 subjects (mean age 65.03 ± 14.35) while Group B had 21 subjects (mean age 60.95 ± 15.07). The average treatment time per visit was 26.17 ± 23.91 minutes for Group A and 21.62 ± 11.74 minutes for Group B. The average physiotherapy visits were 4.57 ± 4.49 for Group A and 5.38 ± 3.19 for Group B. There was no significantly difference between the groups ($p > 0.05$) for age, treatment time or visits. However, while 75.4% of patients in Group A could achieve CI3, only 52.3% in Group B were able to do so. Similar percentages of CI5 were observed, with Group A significantly better ($p = 0.002$) than Group B. Thus CI3 and CI5 appear to be useful clinical indicators for post-abdominal surgery patients. Group B also reported that additional treatment was given to mobilise those patients who were not classified as "chest treatment". Our results suggest that early mobilisation may be more effective.

Elevated sleep posture in the management of obstructive sleep apnoea: A controlled study

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The efficacy of a shoulder and head elevation pillow (SHEP) as a therapy for obstructive sleep apnoea (OSA) was compared with standard therapy, nasal continuous positive airway pressure (nCPAP). Subjects received treatment with SHEP or nCPAP in random order, for one month each. Analysis was performed on an intention-to-treat basis. Ten adults with mild to moderately severe OSA (apnoea hypopnoea index (AHI) 30 ± 12/h recording time, range 13 to 50/h) completed the study. Obstructive sleep apnoea was diagnosed using a portable respiratory-only diagnostic system. Subjects with other pathologies affecting sleep were excluded. The SHEP, designed to reduce gravitational force on anatomical structures in the upper airway and thorax, supported the upper body at an angle sixty degrees above the horizontal. Subjects completed baseline symptom questionnaires, then a daily symptom diary for four weeks during therapy. Questionnaires were repeated prior to home-based sleep monitoring with one or other of the allocated devices in situ. Treatment success (AHI ≤ 10/h) with SHEP was achieved in only 4/10 subjects (mean AHI 21 ± 20/h, 2 to 64). In contrast, treatment success was achieved in nine subjects using nCPAP (mean AHI 4 ± 3/h, 0 to 10) ($p = 0.039$). There were no significant differences in recording times or daytime symptoms. Our results, although negative, provide important evidence that elevation from supine posture is helpful in OSA management in some individuals. However, there were no relationships between subjective reporting and objective findings, thus follow-up monitoring as demonstrated by home-based sleep studies is essential to determine the success of an elevated sleep posture as a therapy for OSA.

The contribution of physiotherapist interest and experience to the availability of pulmonary rehabilitation

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Despite the documented advantages of pulmonary rehabilitation (PR) there is limited access to this intervention for many individuals who have chronic obstructive pulmonary disease. The lack of PR may be related to the limited availability of interested, qualified staff to run PR programs. This study aimed to identify whether there were relationships between the interest and experience of physiotherapists and the provision of PR. Data was collected via a survey completed by 214 physiotherapists (producing a response rate of 71.3%) working in any type of physiotherapy in public hospitals of New South Wales. The results indicated that the type of physiotherapy of most interest to respondents was musculoskeletal outpatients/private practice. The types of physiotherapy of least interest were cardiopulmonary inpatients and/or outpatients. Similarly, the type of physiotherapy in which respondents had most experience was musculoskeletal outpatients/private practice. Where physiotherapists had been involved in PR, this was more often due to job requirements than as a result of interest in PR. The percentage of respondents who indicated that there was no PR program available in their area was 31.3. However, only 44.2% of these respondents stated that they would consider setting up a PR program. Physiotherapists cited factors including lack of funding, staff and time as barriers to implementing PR. Addressing these barriers could result in an increase in the provision of PR. However, the lack of physiotherapist interest in this area of practice raises questions for the future ability to staff PR programs with interested, dedicated physiotherapists.

A method for the study of clinical decision making in cardiopulmonary physiotherapy

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An understanding of how physiotherapists make clinical decisions is important in developing strategies to improve the quality of decision making. Clinical decision making takes place within a context and therefore an understanding of how contextual factors influence physiotherapy decision making is needed. Traditional quantitative methods of studying decision making control the context of decision making and thus fail to reflect the complexity of the real world of physiotherapy practice. The aim of this study was to establish a method for identifying and studying the influence of contextual factors on decision making by cardiopulmonary physiotherapists in the real world of practice. A qualitative research methodology was developed using hermeneutics as a research approach. Three physiotherapists were recruited using purposive sampling. Participants were included if they were practising cardiopulmonary physiotherapy for more than 24 hours per week. The participants were observed over a 6 hour period and data was collected in form of field notes. A semi-structured interview was also conducted and recorded by audiotape. Preliminary data analysis was conducted and the results for each participant summarised in the form of a concept map. This map was returned to the participants for checking of the credibility of the collected data. A subsequent observation and interview session was then conducted. Each of the participants used this follow-up session to make minor modifications to the map and then concluded that the resultant map depicted the factors that affected their decision making. Using this method will produce credible results capturing the factors that affect cardiopulmonary physiotherapists' decision making.

Safety aspects of mobilising acutely ill inpatients

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Mobilisation is frequently used by physiotherapists in the management of acutely ill inpatients. The aims of mobilisation include increasing lung volumes, improving ventilation/perfusion matching, providing a gravitational stimulus to restore normal fluid distribution in the body, reducing the effects of immobility, and maximising function and fitness. This original review provides physiotherapists with guidelines regarding safety issues that should be considered prior to and while mobilising acutely ill inpatients. Information for this review was obtained from textbooks, articles and the authors' clinical experience. For the purposes of this review, acutely ill inpatients are defined as those patients who have, or are at very high risk of developing, cardiac and/or respiratory failure or other potentially life threatening disorders, who are likely to be managed in an intensive care or high dependency unit. Due to the lack of relevant data, analyses were descriptive in nature. It is recommended that the patient's current and past medical history be reviewed, as this may indicate disorders that are likely to affect the ability of an acutely ill inpatient to mobilise. Other safety issues that should be considered include the patient's heart rate (as a percentage of age predicted maximum), blood pressure, cardiac status, oxygenation, haemoglobin, platelet count and subjective factors. This unique review provides information to help physiotherapists maximise the benefits and minimise the risks associated with the mobilisation of acutely ill inpatients.

The effect of lateral body position on oxygenation in mechanically ventilated patients with acute lung injury

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There has been little published on the response of patients with acute respiratory distress syndrome (ARDS) and/or acute lung injury (ALI) to positioning, other than in prone. The aim of this prospective, repeated measures study was to investigate the effect of lateral body position on oxygenation in subjects with ARDS/ALI. Subjects were mechanically ventilated patients with ARDS/ALI. Baseline measurements were taken in supine, then the subjects were randomised to a right or left lateral turn, which was maintained for two hours before returning to supine. The alternate lateral position was then measured. Arterial blood samples were collected in the supine starting position (baseline), then 30 minutes and two hours into the lateral turn and 30 minutes after returning to supine (completion). These were used to calculate the P_aO_2/FiO_2 (P/F) ratio. Overall, there was no difference found between the mean [± SEM] P/F ratios between sides (right lateral = 172.3 [10.1], left lateral 165.2 [10.2], p = 0.77). Lateral positioning to the right did not alter the mean P/F ratio from baseline, but a significant fall occurred when the subjects were turned back to supine (171 to 155 [10.6], p = 0.01). Lateral positioning to the left showed no effect due to position or time (P/F at baseline = 162 [10.6], 30 minutes = 169 [10.9], two hours = 174 [10.5] and completion = 164 [10.6], p = 0.07). Further analysis of respiratory dynamic and haemodynamic data is to be carried out. It is concluded that lateral positioning of ALI/ARDS patients appears to have no clinically significant short-term benefit on P/F ratio.

A comparison of incremental and self-paced workload exercise tests in subjects with moderate to severe chronic obstructive pulmonary disease

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The six minute walk test (6MWT) and incremental shuttle walking test (ISWT) are commonly used to assess exercise capacity in chronic obstructive pulmonary disease (COPD). To date, no studies have compared maximal and submaximal patterns of cardiorespiratory response between the 6MWT, ISWT and a laboratory-based incremental cycle ergometry test (CET) in the same subjects. The aim of this study was to compare heart rate (HR), dyspnea and oxygen saturation (SpO_2) in the 6MWT, ISWT and CET. Twenty COPD subjects (15 male) aged 64 ± 7.5 yrs, FEV_1 0.78 ± 0.25 litres, completed the three tests (≥ 24 hours apart). Strong, standardised encouragement

was given to maximise performance. Heart rate, dyspnea and SpO_2 were measured throughout the tests. Peak oxygen consumption (VO_2) was determined from the CET. Peak HR and dyspnea were not significantly different with the three tests. SpO_2 was lower at the end of both walking tests compared with the CET ($p < 0.001$). Heart rate increased linearly with increasing workload during the ISWT ($r = 0.96$, $p < 0.001$) and CET ($r = 0.98$, $p < 0.001$) but increased in a curvilinear fashion during the 6MWT ($r = 0.90$, $p < 0.001$). Dyspnea increased linearly during the 6MWT ($r = 0.90$, $p < 0.001$) and in a curvilinear fashion during the ISWT ($r = 0.96$, $p < 0.001$) and CET ($r = 0.93$, $p < 0.001$). Distances walked in the ISWT and 6MWT were related to peak VO_2 ($r = 0.73$, $p < 0.001$). The results demonstrate that, in comparison with the CET, the 6MWT and ISWT are valid tests for measuring exercise capacity. Walking tests are more sensitive than a CET when assessing for ambulatory oxygen. Submaximal patterns of response potentially impart useful information about cardiorespiratory performance independent of maximum distance walked or workload achieved.

Outcomes of a tertiary based pulmonary rehabilitation program for patients with chronic lung disease

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Benefits of pulmonary rehabilitation in COPD are well documented. We hypothesised that the Prince Charles Hospital participants had clinically significant changes in exercise tolerance and dyspnoea, and that non-completion was attributable to more severe disease. A longitudinal case-controlled study between 2001 and 2002 was performed on the 7 week course incorporating an education and exercise program. Six minute walk tests (6MWT) and University of California San Diego Shortness of Breath Questionnaires (UCSD SOBQ) were performed. One hundred and thirty-one people (66 males, 65 females) were enrolled, mean age was 66 years ± 10.1 years and mean predicted FEV_1 was 49.2% ± 18.9%. Participants' lung diseases as per ATS/TSANZ criteria were predominantly COPD (72%). Mean improvement in 6MWT was 48 metres ($p < 0.001$). Mean decrease on the UCSD SOBQ was 4/120 ($p = 0.03$). Mild (> 80% FEV_1% predicted) and moderate (30% to < 80% FEV_1% predicted) disease groups had improvement in the 6MWT > 53 metres ($p < 0.005$). The severe (< 30% FEV_1% predicted) group had a small increase on the 6MWT (27metres) but had the largest decrease on the UCSD SOBQ score of 6/120 ($p = 0.5$). Overall completion rate was 61%; with 91% for mild (n = 11), 59% for moderate (n = 102) and 56% for severe (n = 18). Mean FEV_1% was significantly lower ($p < 0.05$) in non-completers (45.4% ± 15.9%) than completers (51.8% ± 20.2%). Non-completers had a lower baseline 6MWT (396 metres compared with 408 metres) and higher UCSD SOBQ (61/120 compared with 57/120), although this is not significant. Our study demonstrated that pulmonary rehabilitation resulted in clinically significant increased exercise tolerance and decreased dyspnoea. Non-completers have a trend towards more severe disease but from our results, this patient group does benefit from pulmonary rehabilitation.

Assignments versus written examinations in cardiothoracic undergraduate curricula – is there a difference in outcome?

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The inclusion of summative written examinations as a measure of student learning has become increasingly unpopular over the past decade. However, the role of formative written examinations scheduled throughout clinical placements may have a role in improving learning outcomes for undergraduate students. The aim of this study was to compare written assignments with written examinations during cardiorespiratory clinical placements in two groups of undergraduate physiotherapy students completing the cardiorespiratory course, "Acute Care", within the third year of a 4 year program. During Semester 1, all students completed an assignment on a topic relevant to the clinical placement. Concerns about cardiorespiratory core knowledge and the possibility of altering the assignment to specific written examinations was a key theme arising from written feedback and focus groups of students and clinical educators. Therefore, during Semester 2, all students undertook two 30 minute written examinations instead of the assignment. Unpaired *t*-tests were used to compare the results for the two learning tasks and final grades for Acute Care. Eighty-four students completed Acute Care in 2002 (43 assignment group, 41 written assessment group). No significant differences were found between results for the two learning tasks ($p = 0.34$) nor between final grades for Acute Care between semesters ($p = 0.86$). Written student feedback and focus group responses in Semester 2 unanimously supported the inclusion of the written examinations as an explicit way of "knowing what I really know and the areas I need to address". It can therefore be concluded that formative written examinations when scheduled within clinical placements can be an effective and useful learning strategy.

Hidden curricula - what levels of evidence are we using to teach cardiothoracic physiotherapy?

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The ability to review and consider literature in terms of the rigour and quality of the source is becoming accepted throughout both clinical and research environments. However, little is known about the quality of source materials used to educate undergraduate physiotherapy students. The aim of this study was to identify the levels of evidence represented within the core cardiothoracic curriculum within the University of South Australia. The core course for cardiothoracic education within the third year of the Bachelor of Physiotherapy is "Acute Care". This course includes specific content in cardiothoracic, acute neurological, orthopaedic and paediatric pathology and physiotherapy management. During 2002, all print materials provided to students throughout this course (lecture notes, manuals, handouts) were reviewed and each reference cited was ranked according to a hierarchy of evidence with systematic reviews regarded as the highest level of evidence and expert opinion/case studies at the lowest level. When considered overall, 188 references were cited within these materials: 3 (1.5%) systematic reviews;

11 (5.8%) randomised controlled trials; 25 (13.2%) non-randomised control trial experimental studies; 8 (4.2%) uncontrolled cause and effect studies; 44 (23.4%) descriptive studies; and 97 (51.5%) opinion/case studies. When cardiothoracic specific content was compared with acute neurological, orthopaedic and paediatric resources, a far greater number of references were cited (147 cardiothoracic versus 41 orthopaedic, neurological, paediatric references combined) and proportionally greater representation of the higher levels of evidence were reported. These results were unexpected and raise a number of implications for development, planning and review of educational resources.

The transition from traditional physiotherapy for cystic fibrosis is supported by clinical audit

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Physiotherapy treatment practices for cystic fibrosis (CF) have undergone substantial change in recent decades. This study therefore sought to determine if changes had occurred in physiotherapy provision at Royal Children's Hospital (RCH), according to available evidence regarding airway clearance techniques. A clinical audit was used to evaluate 247 records of inpatient physiotherapy data from two separate whole year periods (1998, 2000). The subjects were inpatients with CF, over two years of age. Repeated measures analysis of variance and *t*-tests were used. Significant differences between 1998 and 2000 were seen in frequency of use of postural drainage without head-down tilt, with tilt, positive expiratory pressure and autogenic drainage as a proportion of the total occasions of service for all modalities. The number of treatment sessions per patient in a single admission did not change significantly between 1998 (mean = 22.6, SD = 9.2) and 2000 (mean = 23.9, SD = 9.9), (p = 0.317). Sputum characteristics, cough quality and respiratory function tests were the most informative aspects of outcome measurement. There was no significant difference in the rate of change of FEV_1, FVC and FEF_{25-75} (% predicted) in 1998 and 2000 (n = 126, p = 0.869; p = 0.514; p = 0.232 respectively). There was no significant difference between 1998 and 2000 in the amount of change in sputum colour (p = 0.455), or cough quality (p = 0.065). The audit showed that physiotherapy provision for CF inpatients at RCH changed significantly in the periods studied, whilst treatment efficacy as measured by cited outcome measures remained unchanged from 1998 to 2000.

Functional respiratory classification of patients with cystic fibrosis

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Physiotherapists frequently working with cystic fibrosis (CF) routinely assess and reassess qualitative and objective signs as a guide to clinical reasoning and technique selection and as tools for patient motivation. This study aimed to develop a clinical tool which defines key assessment items incorporated by experienced therapists. A secondary aim was to provide comparable information for transfer of care of patients between institutions. A seven-item criterion-referenced assessment was developed and piloted on children and adults with CF who were admitted to hospital for seven days or more for respiratory exacerbation. Two paediatric and three adult CF units in Queensland participated in data collection, and 155 complete data sets were obtained. Repeated measures analysis of variance (ANOVA) and *t*-tests were performed. Intra-class correlation revealed strong inter-rater reliability. Statistically significant differences were shown from admission to discharge in all measures used ($p < 0.01$). The most significant differences were observed in auscultation signs ($p < 0.001$) and sputum production or quality of cough ($p < 0.001$). This clinical tool defines key assessment items for paediatric and adult patients with a CF respiratory exacerbation, and can be used to provide comparable information for transfer of care of patients between institutions. The criteria lack sensitivity for physiotherapists experienced in CF respiratory care but physiotherapists not frequently working with cystic fibrosis may find the functional respiratory classification form (FRCF) a useful guide to clinical observation.

The Royal Perth Hospital physiotherapy experience with non-invasive ventilation – a unique service delivery model?

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In 1998, the Royal Perth Hospital (RPH) physiotherapy department, in conjunction with the respiratory medicine department, commenced an acute non-invasive ventilation (NIV) service for patients external to the intensive care unit (ICU). From its foundation year in which nine patients were treated, the service has grown consistently to 180 episodes provided in 2002, with many more patients assessed but NIV deemed inappropriate. The RPH physiotherapy department provides the NIV service within its rostered 24 hour, 7 day cover. The initial service delivery and subsequent growth in NIV has resulted in many challenges within physiotherapy. From the outset, the NIV service has not received dedicated funding or staffing and has subsequently been provided from within existing services. Consequently, the physiotherapy department has pursued a unique service delivery model in which the understanding and application of NIV has been considered and deemed a core element for those physiotherapists working in the medical, surgical or critical care environments, as opposed to being considered an advanced practitioner skill that is the domain of select senior staff. Achieving this NIV service delivery model has required a significant degree of ongoing education, training and support in a department that historically has a significant turnover of staff and six-monthly rotational posts. A significant cultural shift and change to work practices, particularly amongst non-fulltime physiotherapy staff, has been required to enable the implementation of NIV services within current physiotherapy services. The future visions and expectations of the physiotherapy NIV service is presently tempered by the expansion of NIV services provided from the ICU and the possible commencement of a dedicated sleep unit at RPH.

The effect of early mobilisation of the intubated ventilated abdominal surgery patient on respiratory and haemodynamic variables

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This study aimed to investigate the effects of mobilisation on respiratory and haemodynamic variables in the intubated, ventilated abdominal surgical patient. Mobilisation was defined as the progression of activity when moving between all of the following positions: supine; sitting over the edge of the bed; standing; walking on the spot for one minute (WOS); sitting out of bed initially; and sitting out of bed for 20 minutes. Seventeen consecutive intubated, ventilated surgical patients satisfied a range of inclusion/exclusion criteria, and had respiratory and haemodynamic measurements taken in each of these positions. Minute ventilation (V_E) increased significantly from 15.1 ± 3.1 L/min in supine to 21.3 ± 3.6 L/min, p = 0.001 in standing. The increase in V_E was achieved by significant increases in tidal volume (V_T) from 712.7 ± 172.8 ml to 883.4 ± 196.3 ml, p = 0.008 and in respiratory rate (f_R) from 21.4 ± 5.0 breaths/min to 24.9 ± 4.5 breaths/min, p = 0.03 when supine values were compared with standing. No further increases were observed in these parameters beyond standing when activity was progressed to WOS. Mobilisation produced significant increases in inspiratory flow rates (V_T/T_I) from 683 ± 131.8 mls/s in supine to 985.1 ± 162.3 mls/s, p = 0.001 with WOS. Significant increases were observed in rib cage displacement (maximum increase 0.23 ± 0.28 cm, p = 0.001) with no significant increases in abdominal displacement (p = 0.23) when WOS was compared with supine. No improvements were observed in arterial blood gases following mobilisation. Mobilisation could be performed safely. However, it encouraged an upper chest pattern of breathing with significant increases in V_T/T_I, which may favour regional ventilation to the non-dependent regions of the upright lung.

POSTER PRESENTATIONS

The effect of two breathing manoeuvres on diaphragm movement and regional ventilation: A single case report

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Previous studies of diaphragmatic movement have proposed that when transdiaphragmatic pressure (P_{di}) was used as feedback for diaphragmatic control, subjects were able to relax their diaphragm during upper chest inspiration (indicated by P_{di} = 0). In these studies, abdominal breathing was found to preferentially increase ventilation to the lung bases. Our case study aimed to determine whether one subject could vary diaphragmatic movement when inspiratory flow rate and volume were controlled and whether controlled variation in diaphragm movement effected the distribution of lung ventilation. The subject was a physiotherapist experienced in the use of breathing exercises. Cephalo-caudal diaphragm movement was measured with m-mode sonography and the distribution of ventilation was measured with Technegas. The subject was tested twice, with one week between tests. During the inhalation of Technegas, the inspiratory flow rate was maintained at < 0.5 L/s while the volume was maintained at 20% of the subject's vital capacity. During diaphragmatic breathing, the leading edge of the right hemi-diaphragm moved 4.34 ± 0.05 centimetres and during an upper chest pattern of breathing, the diaphragm moved 2.02 ± 0.09 centimetres. However, there was less than 5% difference in the distribution of ventilation to any zone. In this study, a twofold increase in cephalo-caudal diaphragm movement during abdominal breathing compared with upper chest breathing did not result in a difference in the distribution of ventilation to any lung zone. The use of an abdominal pattern of breathing to increase ventilation to the lung bases in this normal subject was therefore not supported.

A four week cardiac rehabilitation program – is it really "fast tracking"?

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The research presented on this poster aims to demonstrate high attendance and completion rates, and comparable six and 12 month outcomes, for clients attending a 4 week Phase 2 cardiac rehabilitation program. Cardiac rehabilitation programs traditionally have been six to eight weeks in duration, with 2 to 4 week programs defined as "fast tracking". In 1999, Princess Alexandra Hospital commenced a Phase 2 cardiac rehabilitation program of four weeks duration. This length of program was developed due to budget constraints and high patient numbers. Clients' assessments are commenced while they are inpatients, and completed within two to three weeks of their cardiac event. Their entry into the program is generally within three weeks of their inpatient stay, and communication with employers (for those returning to work quickly, eg angioplasty clients) maximises availability to attend. Clients attend an exercise and education program twice weekly for four weeks. Attendance rates for patients commencing cardiac rehabilitation in 1999 to 2003 were, on average, 87% for education and 86% for exercise. Sixty-eight per cent of participants have continued to exercise for longer than 30 minutes at six months, and 69% at 12 months. Ninety-one per cent were continuing to not smoke at six months and 90% at 12 months. Eighty per cent of participants who were in fulltime employment prior to their cardiac event had returned to fulltime employment at their 6 month review and 86% by 12 months. Thus it can be concluded that a 4 week Phase 2 cardiac rehabilitation program can produce positive outcomes.

Vascular rehabilitation – where do you start?

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Evidence has shown the benefits of exercise for patients with peripheral arterial disease although the optimal exercise program has yet to be established. The aim of this pilot study is to investigate the effect of an exercise training

program on pain free walking distance. Patients (with peripheral arterial disease, claudication pain and no previous surgery) referred by vascular physicians attend once a week for 12 weeks. Education is provided on peripheral arterial disease, exercise, smoking cessation, hypertension, diet and foot care from the multidisciplinary team. Exercise consists of warm up/cool down and stretches, and 30 minutes exercising on the treadmill, bike, rowing machine, upper limb weights, step and mini-trampoline. Assessment is by progressive treadmill walking test, comprising five stages of five minutes. Each stage has an increase in gradient and/or walking speed. The test is completed when the patient cannot continue due to intolerable claudication pain. In the first nine months of this study, 17 patients commenced the program and seven completed the full 12 weeks. On initial treadmill assessment, patients walked an average of 7.44 minutes (range 1.30 to 15 minutes). On final treadmill assessment, patients walked an average of 13.88 minutes (range 8 to 24 minutes). The dropout rate of 58% was due to transport difficulties, lack of motivation by patients and patients' unwillingness to exercise with claudication pain. Patients improved in walking distance without claudication pain. Early results are encouraging but larger number of patients need to attend the program.

Effects of pulmonary rehabilitation on exercise tolerance, quality of life, depression, anxiety and spirometry

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The aim of this study was to determine the effects of pulmonary rehabilitation at Sutherland Hospital on exercise tolerance, quality of life, depression, anxiety and spirometry. Fifty-two subjects (39 male, 15 female) with a diagnosis of chronic lung disease participated. Clients were assessed at the beginning and on completion of the pulmonary rehabilitation program, which required attendance over eight weeks (twice/weekly for two hours each session). The program consisted of a 1_ hour exercise component followed by _ hour education component. Clients were assessed by the same physiotherapist for both pre- and post- assessments. The same physiotherapist performed exercise prescription and progression. Exercise options in the program included upper limb exercises, arm crank, multigym, boxing circuit, stationary bicycle, stepper, walking, treadmill, hill training and weighted leg exercises. Assessment included spirometry and one six minute walk test (6MWT) on an outdoor, flat 40 m circuit. The self-administered St George's Respiratory Questionnaire (SGRQ), and hospital anxiety and depression scale were completed. Paired *t*-tests were performed on the data. A 17% increase in 6MWT distance was shown ($p = 0.001$). Quality of life improved by 8% but this was not statistically significant ($p = 0.064$). A 22% reduction in depression was shown ($p = 0.001$) and anxiety reduced by 21%, though not statistically significant ($p = 0.293$). No change in spirometry (FEV_1/FVC%) was seen. It was concluded that pulmonary rehabilitation at Sutherland Hospital improves exercise tolerance, quality of life, depression and anxiety but not lung function. Sutherland Hospital's pulmonary rehabilitation program is achieving results similar to other researched programs and is meeting the standards of the Australian Lung Foundation.

Cough machine: The Flinders Medical Centre experience

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Recently, a "cough machine" (mechanical in-exsufflator/cough assist) has been incorporated into the management of patients with ineffective sputum clearance, including those with neuromuscular diseases, critical illness polyneuropathy, long term ventilation and post-surgery in the critical care unit of Flinders Medical Centre. Anecdotal reports support its role in preventing admissions and/or intubations in these patients. Three outpatients (ages 5 to 35), each with a neuromuscular disease, also use the machine regularly at home to prevent admissions. The cough machine is a non-invasive device which increases expiratory air flow, assisting secretion clearance. This poster describes a tour of the Jerry Lewis Muscular Dystrophy Association Clinic at the University of Medicine and Dentistry, New Jersey, USA, where non-invasive methods of respiratory management in neuromuscular disease have been developed, and also includes experiences at Flinders Medical Centre with the cough machine. The aim of the tour was to observe respiratory evaluation and management in patients with neuromuscular diseases, with a view to improving skills and knowledge in using assisted coughing techniques. Observation occurred in both inpatient and outpatient settings for two weeks in 2002. As a result, extensive information sharing has occurred across the critical care unit and physiotherapy department, to improve knowledge, skills and confidence in using the cough machine and non-invasive ventilation. It has also strengthened our role as a resource for other centres. The tour has enhanced the inpatient and outpatient management of those with ineffective sputum clearance and/or neuromuscular diseases, preventing admissions and intubations. It has stimulated ideas for research, data collection for evaluation and establishing a network of users.

Effects of a rollator on exercise capacity, gas exchange and ventilation in COPD patients

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Although some COPD patients benefit from the use of rollators, the mechanisms to explain the benefits are not well studied. To analyse the effects of a rollator on distance covered, pulmonary gas exchange and ventilation during the six minute walk test (6MWT) and on maximal voluntary ventilation (MVV) in COPD, 15 patients (age: 69 ± 8 yrs, BMI: 24 ± 3, FEV_1: 51 ± 23% predicted) were studied. Two 6MWTs were performed with a portable gas analysis system (VmaxST 1.0 Sensormedics) with rollator (R) and without rollator (NR) in random order. Maximal voluntary ventilation was measured with and without arm support on the rollator, randomly. Walking distance improved significantly (NR: 73 ± 17% predicted vs R: 80 ± 14% predicted; $p = 0.03$). Oxygen volume ($VO_{2)}$ and

walking efficiency (VO_2/6MWT) were unaltered in the rollator. V_E and MVV increased significantly with the rollator (1.3 ±0.01 L/min and 3.4 ± 2 L/min, respectively ($p < 0.04$). Consequently, V_E/MVV was unaltered (NR: 69 ± 19 and R: 67 ± 17, $p = 0.36$). Borg dyspnea was lower during the walk test with the rollator (NR: 6 ± 2 vs R: 5 ± 1; $p = 0.04$). The variation in the 6MWT was explained by individual changes in VO_2 and VO_2/6MWT ($R^2 = 0.97$; $p = 0.001$). It was concluded that the use of a rollator increases ventilatory capacity, improves walking distance and reduces dyspnea in patients with COPD.

Characteristics and determinants of activities of daily living in patients with COPD

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People with chronic obstructive pulmonary disease (COPD) frequently report symptoms of dyspnea during activities of daily living (ADL). However, objective and detailed assessment of ADL has not been performed previously. The objective of this study was to assess walking time, standing time and other activities for 16 hours per day using triaxial accelerometers in 20 COPD patients (FEV_1 38 ± 16% predicted). Walking and standing time were grouped as active time. Active time pattern throughout the day was analysed using 4 hour blocks from 8:00 am. In addition, age, body mass index, pulmonary function, six minute walk test (6MWT), maximal exercise capacity, respiratory and peripheral muscle force were assessed as potential determinants of ADL. Walking time corresponded to only 4 ± 2% of the measurement time, whereas standing time corresponded to 22 ± 12%. Active time between 20 and 24 hours was lower than the other parts of the day ($p < 0.01$). Active time was significantly related to 6MWT and maximal workload ($r = 0.70$, $p < 0.001$ and $r = 0.60$, $p < 0.005$, respectively), but not to FEV_1, muscle force and maximal oxygen uptake. Multiple regression analysis revealed 6MWT, age and diffusion capacity as significant determinants of active time (model $R^2 = 0.65$; $p < 0.10$). It was concluded that COPD patients spend only a short time in walking or standing activities and that 6MWT is a valid estimate of ADL such as walking and standing at home.

Efficacy of a heated humidifier during bilevel positive airway pressure: A bench study

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Bilevel positive airway pressure (BiPAP) delivers inspired air at high flow rates, which has been associated with airway mucosal drying and impaired airway function. The aims of this study were to: 1) examine the effects of ventilatory parameters on relative humidity (rH) and absolute humidity (AH) during BiPAP; and 2) evaluate the effect of a heated passover humidifier on rH, AH and ventilator performance during BiPAP. The effects of inspiratory pressure (IPAP 10, 15 and 20), respiratory rate (RR 12 and 24) and I:E ratio (1:2 and 1:3) on rH and AH were studied. Measurements were obtained on room air (RA) and with a heated humidifier at medium (H5) and maximum (H9) heater settings. A manometer was used to measure delivered pressure. Relationships between variables were assessed with non-parametric correlations. Relative humidity was significantly lower than ambient rH at all ventilatory settings on RA. Increasing IPAP was associated with decreasing rH ($r = 0.67$, $p < 0.001$). There was no effect of RR or I:E ratio. Addition of the humidifier was associated with progressively increasing rH ($p < 0.001$) and AH ($p < 0.001$), however air was fully saturated only at H9. Delivered IPAP was reduced by 0.5 to 1 cmH_20 when using the humidifier. It was concluded that BiPAP delivers air at a low rH, especially at high inspiratory pressures. Addition of a heated humidifier increases rH and AH to levels acceptable for non-intubated patients but results in a small reduction in delivered pressure. Consideration should be given to heated humidification during BiPAP, especially when airway drying and secretion retention are of concern.

The Bali bombings – the Royal Perth Hospital Intensive Care Unit physiotherapy experiences

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The events of October 12, 2002 in Bali had significant implications for the intensive care unit (ICU) and burns unit (BU) at Royal Perth Hospital (RPH), with 28 casualties transferred to RPH, 11 of whom required intensive care. Significant implications and repercussions for ICU physiotherapy services resulted. Historically, the RPH ICU averages approximately 10 major burns patients per year. Traditionally at RPH, the multidisciplinary philosophy is that rehabilitation commences at the time of injury. Individual ICU burns admissions are very labour intensive from a physiotherapy perspective, with customised splinting, positioning, stretching and rehabilitation programs in conjunction with any specific respiratory physiotherapy interventions provided. From the outset, the focus of physiotherapy services was to provide this same individualised and holistic care to each Bali bombing patient. In contrast, literature suggests that the traditional response in a major trauma situation by medical services is one of "best for the most". Apart from obvious challenges in these 11 patients being admitted within a 48 hour timeframe was the scope of traumas and management complexity encountered. From October 14 until December 9, 2002, 707 occasions of service and 28,485 minutes of physiotherapy treatment were provided to 11 Bali victims in ICU, representing 64.5% of their total inpatient physiotherapy services. This was achieved successfully with unheralded degrees of co-operation, communication, dedication and commitment not just from the ICU and BU physiotherapy and nursing teams but also in conjunction with all members of the health care team. Three Bali bombing patients died in ICU, but all others were discharged home, the last one on January 6, 2003.

Beyond the Bali bombings – the Royal Perth Hospital Intensive Care Unit physiotherapy 2002 burns experiences

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Historically, the Royal Perth Hospital (RPH) intensive care unit (ICU) averages approximately 10 major adult burns patients per year. Following the multidisciplinary philosophy that rehabilitation commences at the time of injury, individual ICU burns admissions are very labour intensive from a physiotherapy perspective, with customised splinting, positioning, stretching and rehabilitation programs provided in conjunction with any specific respiratory physiotherapy interventions. Prior to October 12, ICU burns admissions for 2002 numbered 13 and required 215 occasions of service and 1,458 minutes of physiotherapy, representing 15.6% of their total inpatient physiotherapy services. The October 12 Bali bombings resulted in 11 ICU admissions within a 48 hour timeframe, necessitating unique management and co-ordination strategies for ICU physiotherapy services. From October 14 until December 9, 707 occasions of service and 28,485 minutes of physiotherapy were provided to 11 Bali bombing victims in ICU, representing 64.5% of their total inpatient physiotherapy services. Many lessons and skills were developed from strategies instigated to manage ICU physiotherapy services during the treatment of Bali victims. Post-Bali, RPH ICU received 10 further major burns patients with 550 occasions of service and 23570 minutes of physiotherapy treatment provided in ICU, representing 63% of their total inpatient physiotherapy services. Interestingly, these data mirror the workload data from ICU Bali bombing patients and underline the success of providing an individual treatment focus with Bali bombing patients, which has been sustained and repeated with subsequent admissions. In summary, 34 burns patients received 1,472 occasions of service and 53513 minutes of physiotherapy treatment in ICU during 2002, which represents an unheralded and unrivalled period of RPH ICU physiotherapy experiences in the field of burns management.

A different approach to respiratory physiotherapy in children with neuromuscular disease – a case study

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The aim of this study was to provide a rationale for use of positive pressure via a Laerdel bag in conjunction with traditional chest physiotherapy in the treatment of children with neuromuscular weakness and tracheostomy. Children with neuromuscular weakness are predisposed to respiratory problems. The intensity of physiotherapy required daily and during acute illnesses prompts the identification of optimal interventions to recruit lung volume and mobilise secretions. A Laerdel bag with a pressure release valve (< 20 cmH_2O) was used, together with other physiotherapy techniques including positioning and expiratory vibrations. A theoretical framework to support this clinical practice is provided, and supported by case study evidence. A two-year-old boy with nemaline rod myopathy, tracheostomy and nocturnal ventilation was admitted to hospital with a chest infection. The described treatment was implemented during his admission, and continued after discharge from hospital. Treatment efficacy was monitored through regular clinical assessment and repeat chest radiography (CXR). During the boy's admission, physiotherapy assessment demonstrated improvements in treatment tolerance, auscultation, chest expansion and secretion clearance, in addition to improved CXR appearance. After discharge, the patient's family confirmed this technique to be more time efficient, more effective for secretion clearance and better tolerated than traditional techniques. Since its introduction at home, the patient has had only one respiratory admission. Although this technique has not been described before, it proved to be a safe, effective and useful management strategy in this patient. Application to the wider neuromuscular weakness population is being considered.

Pulmonary rehabilitation component of priority health care program for patients with chronic obstructive pulmonary disease

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Pulmonary rehabilitation is a major component in the management of patients with COPD enrolled in the Priority Health Care Program in Central Sydney Area Health Service (CSAHS). This review covered the response to the pulmonary rehabilitation component of this program through data on patient referrals to, enrolment in, and completion of, the pulmonary rehabilitation program within CSAHS. Six minute walk test (6MWT) and quality of life (QOL), measured by St George's Respiratory Questionnaire (SGRQ), were assessed at the start and completion of the program. Statistical analysis used paired *t*-tests, where appropriate, with significance set at $p < 0.05$. Two hundred and twenty-four patients were referred to pulmonary rehabilitation in the period from August 2001 to September 2002. Of these, only 129 patients (58%) attended initial assessment for an 8 week pulmonary rehabilitation program. Baseline data on the 129 patients was: 6MWT (mean ± SD) = 324 ± 109m, SGRQ = 51 ± 19%. Fifty-two patients (40%) were regarded as "drop-outs". Of the 77 patients who completed the 8 week rehabilitation program, there was a significant increase in 6MWT from 364 ± 90m at baseline to 405 ± 87m at eight weeks ($p < 0.001$). There was also a significant improvement in SGRQ score. Total QOL score improved from 47 ± 18% at baseline to 41 ± 18% at eight weeks ($p = 0.001$). Strategies to enhance initial attendance to, and retention within, the pulmonary rehabilitation program need addressing.