Intrapulmonary percussive ventilation improves the outcomes of helmet ventilation

Synopsis


Questions: In adults with an acute exacerbation of chronic obstructive pulmonary disease (COPD) receiving non-invasive positive pressure ventilation (NIV), is intrapulmonary percussive ventilation (IPV) feasible? Does IPV improve outcomes compared to manual airway clearance techniques? Design: Randomised, controlled trial with concealed allocation. Setting: Intensive care unit of a tertiary hospital in Italy. Participants: Forty adults with an acute exacerbation of COPD ventilated with NIV via a helmet interface. Inclusion criteria included tachypnoea and respiratory acidosis. Interventions: Participants were randomly allocated on admission to the unit to receive twice-daily IPV or manual airway clearance techniques, commencing on the second day of NIV. Periods of 3–4 hours of ventilation were alternated with 2–3 hours of spontaneous breathing with controlled oxygen therapy. The IPV consisted of breathing through a mouthpiece that delivered high-flow minibursts at rates of 225 cycles per minute. IPV was applied during spontaneous inspiration with a peak delivery pressure < 40 cmH\textsubscript{2}O pressure. Manual airway clearance techniques included chest clapping, mobilisation, and postural drainage. Formal criteria were used to guide decisions regarding intubation, discontinuation of NIV, and discharge from the unit. Outcomes: Feasibility was the primary outcome. Other important outcomes included need for intubation, days requiring ventilatory assistance, length of stay in the intensive care unit, and complications.

Results: IPV was feasible for all participants. Seven participants in each treatment group required intubation for ventilatory support. The median (interquartile range) total time for which NIV was required by the IPV group was 61 (60–71) hours, significantly less than the manual techniques group at 89 (82–96) hours, difference in medians 28 hours. Similarly, the length of stay in the intensive care unit was 7 (6–8) days in the IPV group, significantly less than the manual techniques group at 9 (7.75–9.5) days, difference in medians 2 days. Complications did not differ significantly between the groups. Conclusion: In patients receiving NIV for acute exacerbation of COPD, twice-daily IPV reduces the duration of ventilatory assistance and stay in the intensive care unit more than manual airway clearance techniques.

Commentary

Helmet NIV is less effective than face-mask NIV for the management of acute exacerbations of COPD (Navalesi et al 2007). However, Antonaglia and colleagues (2006) demonstrated in a prospective, randomised, controlled trial that the addition of twice-daily IPV improved the effectiveness of helmet NIV by reducing the duration of NIV and the length of stay in the intensive care unit, when compared to the use of manual chest physiotherapy techniques.

The authors proposed that IPV increased secretion clearance which, unfortunately, was not measured in this study (Antonaglia et al 2006). If secretions were the issue, the fact that IPV and chest physiotherapy were commenced after at least 24 hours of near continuous helmet NIV, may have not be optimal for either therapy. IPV combines conventional positive pressure ventilation, high frequency oscillation, and external positive end-expiratory pressure (Antonaglia et al 2006, Fig. 1). This may enhance expiratory flow and secretion clearance in patient groups with collapsible airways. Positive expiratory pressure (PEP) and active cycle of breathing techniques (ACBT) can enhance secretion clearance during face-mask NIV and may also reduce the time on NIV and in the intensive care unit (Bellone et al 2002, Inal-Ince et al 2004). Helmet NIV in patients with COPD has been shown to increase patient/ventilator dys-synchrony, delay trigger times (Moerer et al 2006) and increase wasted respiratory efforts (Navalesi et al 2007). Antonaglia and colleagues (2006) argue (with tenuous support of an historical control group using face-mask NIV) that the helmet is a more effective interface than face-mask for NIV in COPD. This conclusion is contrary to the current body of higher quality evidence comparing helmet and face-mask NIV.

IPV, PEP, ACBT and chest physiotherapy may all provide some improvement in secretion clearance when using helmet or face-mask NIV. Further investigation of these modalities with secretion clearance as an outcome is warranted. However, NIV via face-mask should be the first choice of interface for COPD.

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References

Patients with rheumatoid arthritis feel better after exercises in warm water than after similar exercises on land

Synopsis


Question: To compare the effects of individualised exercises in a heated pool to similar exercises on land in people with rheumatoid arthritis (RA). Design: Randomised controlled trial with concealed allocation and assessor blinding. Setting: Hospital rheumatology clinic in Birmingham, UK. Participants: 115 adult patients with RA meeting American College of Rheumatology criteria, invited to participate on referral for physiotherapy, by invitation in clinics, or by mail. Fifty-seven patients were randomised to water-based exercises and 58 to land-based exercises. Interventions: Water-based exercises were performed in 35°C water in sessions with up to four patients. Land-based exercises were performed in sessions with up to six patients. Both groups performed joint mobility, muscle strength, and functional activities, tailored to each individual's ability. Both exercise programs consisted of weekly 30-min sessions for six weeks. Patients were not required to do exercises between treatment sessions but could do so if they chose. Outcomes: The primary outcome was self-rated overall effect of treatment, measured on the day treatment was completed on a 7-point scale ranging from 1 (very much worse) to 7 (very much better). Secondary outcomes included a visual analogue scale of pain, the health assessment questionnaire (HAQ), ten metre walk speed, and the EuroQol-5D questionnaire. Secondary outcomes were also collected at 3 months post treatment. Results: At end of treatment 87% (40/46) of the patients treated with water-based exercise felt much better or very much better. This proportion of patients was significantly greater than the 47.5% (19/40) of patients in the land-based group with the same ratings (relative risk = 1.8, 95% confidence interval 1.3 to 2.6). Sensitivity analyses showed that this result was robust to different assumptions. There were no significant differences between groups in the change in pain, HAQ, ten metre walk speed, or EuroQol-5D after the day treatment was completed or at 3 months follow-up. Conclusion: Patients with RA are more likely to report feeling much better or very much better immediately after treatment if they are treated with exercises in a heated pool compared to similar exercises on land. The duration of this perceived benefit is unclear. (Relative risk calculated by the CAP Editors).

Commentary

Beneficial effects of regular exercise programs for patients with RA are well documented, and strengthening and aerobic conditioning regimes are recommended in the management of RA. However, studies have shown that patients with RA tend to be less physically active than the general population (Eurenius et al 2005, Hootman et al 2003). Hydrotherapy is valued by people with RA and may be an exercise option for enhancing physical activity. Previous randomised controlled trials evaluating effects of exercising in warm water have generally had low methodological quality, and comparisons of similar land-based and water-based exercise programs are lacking (Verhagen et al 1999). Thus, the current study focuses on a highly relevant issue.

The methodological quality of the study is good. However, a significant concern is that the evaluated exercise programs consisted of only one weekly 30-min session for six weeks. This low frequency may have limited the physiological or cardiovascular benefits that could be expected from this intervention.

Another concern is that the primary outcome (self-rated overall effect of treatment) was measured immediately after completing treatment, but was not re-evaluated 3 months post treatment. Further, the patients' report of a superior beneficial effect of water-based exercise compared to land exercise was not reflected in any of the secondary outcome measures, which included measures of health status and physical performance. This study shows conclusively that patients with RA feel better immediately after a water-based exercise program than they do after an exercise program on land. However, it remains unclear whether water-based exercise provides any other additional effects compared to land exercises, and further, for how long the perceived benefit of warm water exercise lasts.

The fact that patients feel better with water-based rather than with land-based exercises might improve their motivation for and compliance with training programs, which is a very important aspect. However, in order to justify provision of hydrotherapy facilities, further information about the real effect of exercising in water compared with a similar land-based exercise program is needed.

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References

Eccentric exercise and shock-wave therapy benefit patients with chronic Achilles tendinopathy

Synopsis


Question: Is eccentric exercise or shock-wave therapy more effective than wait-and-see in the management of chronic Achilles tendinopathy? Design: Pragmatic randomised controlled trial. Setting: Primary health care clinics in Germany. Participants: Seventy-five patients with a diagnosis of chronic midportion Achilles tendinopathy (duration > 6 months), aged 18 to 70 years. All patients had received previous treatment for at least 3 months, without success. Interventions: Subjects were randomly allocated to one of 3 groups: eccentric loading, shock-wave therapy, or wait-and-see. The eccentric loading group performed twice-daily, eccentric, calf muscle exercises, gradually progressed over 12 weeks. The shock-wave wave therapy intervention consisted of 3 sessions at weekly intervals of repetitive, low-energy shock-wave therapy. Patients in the wait-and-see group visited their physician once and were encouraged to await spontaneous improvement. Outcomes: Outcomes were assessed at 4 months from baseline. The Victorian Institute of Sport Assessment (VISA-A) questionnaire was used to measure pain, function and activity (0–100 scale, 100 = asymptomatic). Recovery was measured on a 6-point Likert scale (1 = completely recovered, 6 = much worse). Pain was assessed on an 11-point Numeric Rating Scale. Results: Compared with the wait-and-see group, both eccentric exercise and shock-wave therapy resulted in improved VISA-A scores (21, 95% CI 12 to 29; and 15, 95% CI 8 to 23 respectively). Sixty percent of patients in the eccentric loading group reported complete recovery or much improved (scores of 1 or 2 on the Likert scale), compared with 53% in the shock-wave therapy group and 24% in the wait-and-see group. Between-group differences in pain were 2.4 (95% CI 1.3 to 3.5) for eccentric loading and 2.0 (95% CI 1.0 to 3.0) for shock-wave therapy, compared with wait-and-see. No serious complications were reported.

Conclusion: This study provides evidence that both eccentric exercise and shock-wave therapy produce worthwhile improvements for patients with chronic Achilles tendinopathy.

Commentary

Achilles tendinopathy is a common presentation to health care practitioners and a proportion of these patients have long term symptoms and pain. This group is difficult to manage clinically and this trial provides evidence that will improve clinical decision making and outcomes for sufferers of the condition. It would seem from this trial that active conservative management offers a reasonable chance of success and that, economically, eccentric exercise should be the primary treatment. If eccentric exercise is inappropriate, shock wave therapy can offer similar benefits.

Eccentric exercise has been reported previously to be successful in 90% of active individuals (Fahlstrom et al 2003), but less so in a more sedentary population (Sayana and Maffulli 2007). Approximately one-third of the participants in this trial were not athletic (although this was undefined) which may be the reason for the lower success rate (60%) in this study. Clinicians should account for this when making decisions about treatment. What is indicated from this study is that a wait-and-see approach to treatment may not be successful for Achilles tendinopathy (24% improved), an approach that can be successful in other tendinopathies (Smidt et al 2002). However it is important to note that the follow-up period in this study is relatively short, and may not fully describe the outcomes over the longer term. It is also worth noting that there was no change in the ultrasound tendon dimensions in any group, regardless of change in pain, confirming that clinical management of tendinopathy should be based on pain.

Clinicians should be heartened that chronic Achilles pain remains responsive to appropriate conservative interventions, and actively prescribe the treatments shown to be effective in this study.

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References

Constraint-induced movement therapy improves upper extremity motor function after stroke

Synopsis


**Question:** What is the effect of constraint-induced movement therapy (CIMT) on upper limb function in patients 3 to 9 months after stroke? **Design:** Randomised controlled trial with concealed allocation and assessor blinding. **Setting:** Seven universities in the USA, recruiting participants from 247 medical facilities. **Participants:** 222 adults 3 to 9 months after their first ischaemic or haemorrhagic stroke with at least 10° of active extension at the wrist and at the thumb and two fingers. Participants also had to demonstrate adequate balance, transfer, sit-to-stand, and standing ability while wearing the mitt used to apply CIMT. One hundred and six patients were randomised to CIMT and 116 to usual care. **Interventions:** CIMT involved wearing a restraining mitt on the less-affected hand for 90% of their waking hours over a 2-week period. On weekdays during this period, repetitive task practice and behavioural shaping with the hemiplegic hand were performed for up to 6 hours per day, with 30 minutes of additional practice of the tasks at home. Usual care ranged from no treatment after concluding formal rehabilitation to the application of orthotics or occupational/physical therapy on a domiciliary or outpatient basis. **Outcomes:** The primary outcomes were the Wolf Motor Function Test (WMFT), which includes measures of speed and strength of upper extremity motor function, and the Motor Activity Log (MAL), an interview-derived measure on a 0–5 scale of the amount and quality of performance of 30 common daily activities. The Stroke Impact Scale (SIS) health status interview was a secondary outcome measure. All outcomes were measured after treatment and at 4, 8, and 12 months post-treatment. **Results:** From baseline to 12 months, the CIMT group showed greater improvements than the usual care group in: the WMFT Performance Time by 34% (95% confidence interval (CI) 12 to 51); the MAL Amount of Use by 0.43 (95% CI 0.05 to 0.80); and the MAL Quality of Movement by 0.48 (95% CI 0.13 to 0.84). The CIMT group also had a significantly greater decrease in self-perceived hand function difficulty on the SIS hand domain, by 9% (95% CI 0.3 to 19). **Conclusion:** Among patients who have had a stroke in the past 3 to 9 months, CIMT produces improvements in arm motor function that persist for at least one year.

Commentary

CIMT is gradually becoming the most effective, evidence-based intervention strategy for improving upper extremity function in patients with stroke. In line with findings from a recent systematic review involving 14 randomised, controlled trials (Hakkennes and Keating 2005), the EXCITE study showed that constraining the upper non-paretic limb combined with task-oriented practice improves functional outcome of the upper paretic limb and reduces self-perceived hand function difficulty for up to 12 months. The results further indicate that both intensity and task-specificity are the main drivers to overcome learned non-use in patients with stroke. However, it is important to note that patients were selected only if they had some minimal amount of voluntary control of the paretic hand, resulting in a low (6%) inclusion rate. The most important question is: exactly what did patients learn when overcoming learned non-use with CIMT? Are these CIMT-induced improvements related to more efficient, compensatory movement strategies, such as proximal trunk-shoulder movements, or do they reflect true repair in the sense of regaining neurological functions reflected in more distally oriented hand function? These findings stress the need for kinematic analysis in which changes in motor co-ordination of the upper paretic limb are investigated longitudinally. Besides a better understanding of what patients learn when they show significant functional improvement, future studies should investigate how these CIMT-induced improvements are associated with dynamics in cortical-neuroplasticity of the ipsi- and contralesional hemispheres. For example, a preliminary report showed in serial functional neuroimaging that improvements in precision of a grip task on WMFT were accompanied by a reduction in contralesional activation with more focused activity towards ipsilesional primary motor cortex M1 (Dong et al 2006). Finally, future studies should focus on the cost-effectiveness as well as the minimum dose needed to induce these clinically meaningful changes.

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References