Non-invasive weaning from ventilation reduces mortality, ventilator-associated pneumonia, and length of stay in intubated adults

Synopsis


Objective: To review the evidence as to whether early extubation with immediate application of non-invasive ventilation reduces mortality and ventilator-associated pneumonia and improves other outcomes in critically-ill adults receiving invasive ventilation. Data sources: Medline, Embase, CENTRAL, searched up to April, 2008. This search was supplemented by hand-searching of conference proceeding and citation tracking. Study selection: Randomised and quasi-randomised controlled trials involving adults with respiratory failure who required invasive ventilation for at least 24 hours in which extubation with immediate application of non-invasive ventilation was compared to continued invasive weaning. Outcome measures were mortality, ventilator-associated pneumonia, weaning failure, length of stay in intensive care or hospital, total duration of ventilation (invasive and non-invasive), duration of ventilation related to weaning (after randomisation), duration of invasive-only ventilation, adverse events (arrhythmia, reintubation, tracheostomy), and quality of life. Data extraction: Two reviewers extracted data and discrepancies were resolved by consensus and arbitration. Methodological quality was assessed. Data synthesis: Of 1368 studies identified by the initial search, 12 studies with a total of 530 patients met the selection criteria and were included in the review. All included studies were of moderate to high quality according to the reviewers’ criteria. Based on the quantitative pooling of the available data from these trials, there was a statistically significant difference in mortality in favour of non-invasive weaning, relative risk 0.55 (95% CI 0.38 to 0.79). Non-invasive weaning also significantly reduced ventilator-associated pneumonia (relative risk 0.29, 95% CI 0.19 to 0.45), length of stay in the intensive care unit (by 6 days, 95% CI 4 to 9) and in the hospital (by 7 days, 95% CI 4 to 11), total duration of ventilation (by 6 days, 95% CI 2 to 9), duration of invasive ventilation (by 8 days, 95% CI 4 to 11), and tracheostomy (relative risk 0.16, 95% CI 0.04 to 0.75). The remaining secondary outcomes did not differ significantly. None of the included studies measured quality of life.

Conclusion: Non-invasive ventilation facilitates weaning and has substantial clinical benefits in adults with respiratory failure who require invasive ventilation.

Commentary

This review identifies impressive effects of non-invasive ventilation versus invasive weaning. Some results may have been biased by infrequent use of blinding or influenced by variation in definitions and practices between institutions. Nevertheless, the data concerning mortality are particularly compelling and undoubtedly clinically worthwhile, with one death prevented for every seven patients treated (95% CI 5 to 13).

Despite its impressive findings, the review does not provide the clinician with a definitive picture of a patient who is ready to make the transition to non-invasive ventilation. This is an issue that lacks consensus amongst those experienced with non-invasive ventilation and thereby limits their willingness to act on evidence for ‘early extubation’ (Epstein et al 2009).

The findings are particularly significant in patients with chronic obstructive pulmonary disease (COPD). In centres with an effective non-invasive ventilation program, however, only a minority of patients with COPD exacerbation would be expected to be intubated. The benefits of the intervention are less certain in those with other causes of respiratory failure, and therefore it should be applied with caution in this population.

Another cause for caution is that the review addresses a very specific scenario: ‘early extubation’ of ventilated patients. This differs from patients experiencing post-extubation respiratory failure, in whom non-invasive ventilation increased mortality in one study (Estaban et al 2004) and made no difference in the other (Keenan et al 2002). Notably both these studies included only a small proportion of COPD patients (< 12%). This review’s ‘early extubation’ scenario also differs from patients ready for extubation but at high risk of post-extubation failure, in whom non-invasive ventilation when implemented immediately reduces the risk of reintubation (Ferrer et al 2006, Nava et al 2005) – something not observed in this review’s cohort.

The data in this review arise primarily from centres with considerable expertise with non-invasive ventilation. Clinicians intending to implement the findings of this review should do so in highly monitored settings with suitably trained staff.

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References

Combined pain self-management and antidepressant therapy are effective in patients with chronic musculoskeletal pain with depression

Synopsis


Question: Does a combination of pain self-management and antidepressant therapy improve pain and depression in people with musculoskeletal pain and depression? Design: Randomised, controlled trial with concealed allocation and blinded outcome assessment. Setting: Six primary care clinics and five tertiary outpatient clinics in the USA. Participants: Primary care patients were eligible if they had at least moderate pain in the low back, hip, or knee, present for at least 3 months despite analgesic medication, and depression of at least moderate severity. People taking antidepressants but who still met the inclusion criteria were eligible. Severe cognitive impairment, major psychoses, and current pain-related disability claims were exclusion criteria. Randomisation of 250 participants allotted 123 to an intervention group and 127 to a control group. Interventions: The intervention group participated in the Stepped Care for Affective Disorders and Musculoskeletal Pain (SCAMP) program. During the initial 3 months (Step 1), this group optimised their antidepressant medication according to an algorithm based on clinical response, with a potential increased dose at 3 weeks and change of medication at 6 weeks for those who had not improved. During the following 3 months (Step 2), fortnightly pain self-management sessions were conducted by a nurse care manager, modelled on the Stanford self-management program. Participants were taught to modify their behaviour through behavioural plans and problem-solving techniques. During the final 6 months (Step 3), two telephone calls from the nurse care manager were used to assess symptoms and adherence, and to adjust management if required. The control group were informed that they had depressive symptoms and that they should seek advice about treatment, but received no other intervention unless a psychiatric emergency arose. Outcome measures: The primary outcome was a combined improvement in both depression and pain. Depression was assessed using the 20-item Hopkins Symptom Checklist and pain severity using the Brief Pain Inventory. Global improvement in pain was also assessed. Results: 205 (82%) participants completed the final assessment. At 12 months, 26% of the intervention group achieved the primary outcome, compared with 8% of the control group (RR 3.3, 95% CI 1.8 to 5.4). For depression specifically, 37% of the intervention group had a 50% or greater reduction in depression severity from baseline compared with 16% of the control group (RR 2.3, 95% CI 1.5 to 3.2). When expressed in terms of major depression, 41% of the intervention group had major depression at 12 months compared to 68% of the control group (RR 0.6, 95% CI 0.4 to 0.8). A reduction in pain of at least 30% was more likely in the intervention group (41%) than the control group (17%) (RR 2.4, 95% CI 1.6 to 3.2). Global improvement in pain also significantly improved. Conclusion: Combined pain self-management and antidepressant medication result in substantial improvement in depression as well as moderate reductions in pain severity and disability.

Commentary

Over 6 000 000 Australians suffer from musculoskeletal conditions such as low back pain, knee, and hip pain (ABS 2006). Over twice that number report some level of psychological distress, the most commonly reported problems being mood disorders such as depression (ABS 2006). Musculoskeletal pain and depression frequently coexist, impacting on health outcomes, disability, and quality of life (Bair et al 2003). For primary care practitioners, treatment of patients with co-morbid pain and depression presents a challenge and treatments do not always result in clinically worthwhile benefits for patients.

This clinical trial represents a significant step forward to address this dilemma. The authors investigated the long-term outcomes of a combination of pharmacological and behavioural interventions in primary care patients with musculoskeletal pain and co-morbid depression. The evaluation of the synergistic effects of these two treatments in this patient group is novel. The design, conduct, and analysis of the trial were robust. The investigators found that optimised antidepressant therapy followed by a self-management program resulted in substantial reductions in the severity of depression. The combined intervention also produced clinically significant improvements in pain, which is impressive in this patient group with musculoskeletal pain of long duration (up to 20 years).

The Stepped Care for Affective Disorders and Musculoskeletal Pain (SCAMP) program was evaluated in North America and implemented by a nurse care manager, under the supervision of a physician depression specialist. It would be valuable to trial this inter-disciplinary primary care program in Australia, in which physiotherapists with expertise in cognitive-behavioural approaches to pain management could play a prominent role. If found to be equally effective in the Australian health care setting, the establishment of this program for co-morbid musculoskeletal pain and depression has the potential to substantially reduce the burden on primary care practitioners and enhance long term patient outcomes.

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References


Long-term use of a splint at night reduces pain and disability in people with osteoarthritis at the base of the thumb

Synopsis


Question: Does use of a splint at night improve pain and disability in people with osteoarthritis at the base of the thumb (OABT)? Design: Randomised, controlled trial with concealed allocation. Setting: Two tertiary hospitals in France. Participants: Patients were recruited from tertiary clinics or private practices. Inclusion criteria were pain at the base of the thumb 30 mm or greater on a visual analogue scale (VAS) from 0 (no pain) to 100 mm, age 45–75 years, radiographic evidence of OABT, and either trapeziometacarpal joint enlargement or closure of the first web. Post-traumatic osteoarthritis, inflammatory and crystal arthritis, neurological conditions, trauma, surgery and collagen diseases were exclusion criteria. Randomisation of 112 participants allotted 57 to the intervention group and 55 to a control group. Interventions: Both groups received usual care, at the discretion of the general practitioner or rheumatologist. In addition, a rigid splint was custom made for participants in the intervention group by an occupational therapist. It covered the base of the thumb and the thenar eminence but not the wrist. These participants were advised to wear it at night for one year, and encouraged to contact the therapist if they felt the splint needed adjustment, if pain increased while wearing the splint, or if they had adverse effects, eg, skin erosion. Outcome measures: The primary outcome was the change in pain on the VAS at one month. Secondary outcome measures were disability at one month, and pain and disability at twelve months. Disability was measured with Cochin Hand Functional Scale from 0 (low disability) to 90, and on another VAS (100 mm = high perceived disability). Participants also rated their perceived global improvement and underwent clinical and radiological measures: pinch strength, pain during pinch, thumb mobility, closure of the first web, and blinded assessment of radiological progression of osteoarthritis. Results: 98 (87%) participants completed the study. No significant between-group differences in any outcomes were observed at one month. At 12 months, however, the intervention group showed significantly greater reductions in pain (by 14 mm, 95% CI 5 to 23), in Cochin scores (by 6 points, 95% CI 2 to 11), and in perceived disability (by 13 mm, 95% CI 4 to 22). The groups did not significantly differ on the remaining secondary outcomes. Conclusion: For patients with OABT, night splinting had no effect on pain and disability at 1 month but both improved at 12 months.

Commentary

Osteoarthritis at the base of the thumb is particularly common in women (Swigart et al 1999), and is associated with symptoms of pain, stiffness, and weakness at the base of the thumb (Wajon et al 2005). Not only do these impairments have the potential to limit task performance, but they also restrict participation in hobbies, sports, and many activities of daily living.

Current conservative intervention aims to assist individuals in managing their symptoms through the use of splints, exercises, and joint protection advice. Initially, patients are encouraged to wear their splints for 12–18 hours per day, but certainly at night and during performance of aggravating activities. As symptoms improve, they are advised to alter their wearing schedule accordingly.

While there have been a number of clinical trials comparing two different splinting techniques for carpometacarpal joint OA (Wajon and Ada 2005, Swigart et al 1999), this study is the first RCT to compare a rigid splint with a control group that has not received a ‘placebo’ splint.

The trial is well designed and reported, satisfying all the validity criteria on the PEDro scale (de Morton 2009), apart from those related to blinding. It is unfortunate that the assessment of pinch strength and web closure was not blinded, as this would have been simple to achieve.

The study found no difference in the improvement in pain between groups at one month. Clinically, this would appear to be surprising, but may be explained by the splint-wearing schedule. Patients were advised to wear their splints only at night, and may have continued to perform potentially aggravating activities, unsupported, during the day. As Rannou suggests, night-time-only use may result in the benefit of splinting taking longer to detect.

Significant improvements in pain and reduction in disability were identified at 12 months in the splinting group. These findings should encourage therapists to advise their patients to persevere with splinting, at least at night, for the long term to achieve ongoing symptom relief.

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References

Interruption of sedation for early rehabilitation improves outcomes in ventilated, critically ill adults

Synopsis


Question: Does early provision of rehabilitation improve the likelihood of functional independence at discharge in ventilated, critically ill patients? Design: Randomised, controlled trial with concealed allocation and blinded assessment of some outcomes. Setting: Two tertiary medical centres in the USA. Participants: Adults in a medical intensive care unit (ICU) who had been on mechanical ventilation for less than 72 hours and were expected to continue for at least another 24 hours, and who had been functionally independent two weeks before admission. Exclusion criteria included: rapid onset neuromuscular disease, cardiopulmonary arrest, irreversible disorders with high mortality, and raised intracranial pressure. Randomisation of 104 participants allotted 49 to receive the early intervention and 55 to a control group. Interventions: Both groups received sedation guided by the Richmond Agitation Sedation Scale and underwent daily interruption of sedatives or narcotics or both, unless contraindicated. Weaning from mechanical ventilation and insulin for glycaemic control were also protocol-directed. During the daily interruption of sedation, the intervention group commenced rehabilitation as appropriate to their clinical status: passive movements for those who were unresponsive, and active assisted or active movements in supine for those who were responsive. If well tolerated, these exercises were progressed to sitting balance activities, activities of daily living, transfer training, pre-gait exercises, and walking. Extensive physiological stability criteria guided whether the intervention could be initiated or continued. Overall progression of the intervention was continued until the participant regained functional independence or was discharged from hospital. Outcome measures: The primary outcome was return to functional independence by discharge from hospital (ie, able to walk, bathe, dress, groom, transfer, and toilet independently). Secondary outcome measures included the number of hospital days with delirium, the duration of mechanical ventilation, lengths of stay in the ICU and in hospital, and adverse events. Results: All participants were followed up. Functional independence at discharge was more likely in the intervention group (59% vs 35%, p = 0.02). The intervention group also had fewer days of delirium in hospital (median 2 vs 4 days, p = 0.02), and shorter duration of mechanical ventilation (median 3.4 vs 6.1 days, p = 0.02). Adverse events were rare and discontinuation of the intervention (most commonly, due to perceived patient-ventilator asynchrony) occurred in only 4% of all intervention sessions. Conclusion: Early rehabilitation during daily interruption of sedation was safe and well tolerated. It reduced the duration of delirium and mechanical ventilation, and improved functional status at hospital discharge.

Commentary

Early rehabilitation of mechanically ventilated patients in the ICU has historical precedent and an emerging body of research supporting its safety, feasibility, and short-term benefits (Needham 2008). This paper represents the highest level of evidence supporting early rehabilitation. Rehabilitation therapy was started within the first 72 hours of mechanical ventilation, was delivered daily during periods of sedation interruption, and (unlike in previous studies) was continued on the ward after discharge from the ICU. Sedation interruption has been demonstrated as a beneficial ICU intervention (Kress et al 2000) and has also been paired with a ventilator weaning protocol to improve patient outcomes (Girard et al 2008).

Consistent with prior literature, this study demonstrates the benefits of early rehabilitation on patients’ physical function. Moreover, there may be additional benefits related to reducing short-term cognitive impairment frequently experienced by mechanically ventilated patients (Fan et al 2008) and to decreasing health care resource utilisation (Morris et al 2008).

Additional early rehabilitation trials performing economic analyses and evaluating longer-term patient outcomes, including quality of life, are currently under way (eg. Denehy et al 2008 and grant #1R01NR011186-01 at http://crisp.nih.gov/). These ongoing trials will help build a larger foundation of evidence regarding early rehabilitation.

Given that neuromuscular sequelae of critical illness are common, and can be severe and long-lasting in some patients (Fan et al 2009), ICUs that do not routinely provide early rehabilitation should begin the necessary processes, including interdisciplinary collaboration and ‘culture change’ (Hopkins et al 2007), to introduce this efficacious therapy.

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References