Effectiveness of Non-pharmacological and Non-surgical Interventions to Support Pain Management after Spinal Cord Injury

Thilo Kroll, PhD[1]; Matthew E. Kehn, BA[2]; Suzanne L. Groah, PhD MSPH[2]

[1]University of Dundee, Alliance for Self Care Research, School of Nursing & Midwifery, Dundee, Scotland (UK)

[2]National Rehabilitation Hospital (NRH), Research Division, Washington, DC

Background

- Estimates of chronic pain prevalence after spinal cord injury (SCI) vary between 26 and 96% (Dijkers, Bryce & Zanca, 2009; Cardenas et al., 2004; Ravenscroft, Ahmed & Burnside, 2000).
- Chronic pain has a substantial impact in terms of psychological functioning and social integration (Jensen, Hoffman & Cardenas, 2005).
- Pharmacological treatments, especially the use of anti-inflammatory drugs are used widely (Cardenas & Jensen, 2006)
- Research has shown that many people with SCI them is dissatisfied with the way their pain is controlled (Cardenas & Jensen, 2006).
- Pharmacological and surgical treatments may have undesirable side effects (Rintala et al. 2007)
- Coping styles and pain-related cognitions have been found associated with pain interference as has perceived social support (Raichle et al. 2007)
- Non-pharmacological and non-surgical interventions (NPNSIs) such as physical therapy are perceived as helpful (e.g. Widerstrom-Noga & Turk, 2003).
- Greater use of NPNSIs could potentially reduce dependence on medication
- A search of the Cochrane Collaboration's library of systematic reviews did not reveal any existing systematic reviews on NPNSIs in the area of spinal cord injury.

Aim

To determine the scope and effectiveness of non-pharmacological and non-surgical interventions (NPNSI) to manage pain after SCI.

Design

Systematic narrative review of randomized controlled trials

Methods

Sources

Four electronic databases: Medline, Embase, Cinahl, PsycInfo

Search

Boolean search string combinations of thesaurus text word terms and expert search strings (Cochrane reviews, Centre for Reviews and Dissemination, York, UK) for 'spinal injuries', 'chronic pain' and 'randomized controlled trial'.

Filter and Limits Applied

- Time frame January 1996 - January 2009
- Human subjects
- Randomized controlled trials/controlled trials

Inclusion Criteria

- Spinal cord injury population
- Non-pharmacological and non-surgical (i.e. invasive) interventions
- Pain-related outcome measures

Quality Appraisal

Jadad Score: numerical score calculated on the basis of 7 items (randomization, blinding, attrition) varying between 0 (weakest)-5 (strongest) as an indicator of reported study design quality (Jadad, Moore, Carroll et al., 1996).

Results

610 papers were identified after deduplication across the four databases, 13 were included in this review after check against the inclusion criteria. Two additional papers (Naim, 2008; Soeken, 2002), both focusing on acupuncture were potentially eligible but were excluded since they did not have an abstract. 7 studies were conducted in the US, 5 in Canada, one in Israel; all included Canadian studies were led by a team based at McMasters University in Hamilton, Ontario.

Data Extraction Table and Quality Rating (Jadad Score)

Publication	NPNSI Category	Population	Design	Intervention	Comparison	Outcome Measure	Effect	Jadad Score
Jensen et al. 2009	Relaxation/ Hypnosis	SCI for at least 6 mos, daily chronic pain, no psychopathology or cognitive impairment (TICS)	RCT	n=23 Self hypnosis (HYP) 10 sessions (5 noncompleters) daily or weekly, randomized relaxation suggestions	n=14 EMG biofeedback (BIO) 10 sessions (4 noncompleters), received audiorecording without relaxation suggestions	Average daily pain intensity, current pain intensity, perceived pain control, Brief Pain Inventory (BPI) - Pain Interference, Survey of Pain Attitudes Control	Pre-posttest pain intensity decreases similar for HYP and BIO; HYP significant pret-post increases in perceived control	2
Wind Wardell 2006	Relaxation/ Hypnosis	SCI for at least 6 mos, chronic neurogenic pain, stable pain medication, Veterans (male only)	Controlled mixed methods pilot	n=7 Healing Touch (HT), individualized, 6 weekly home visits	n=5 Guided Progressive Relaxation (GPR), Group format	VAS (current pain, most severe pain, coping), Brief Pain Inventory Short Form - Pain Interference	VAS pain intensity decreased after each treatment with return to baseline after; GPR decrease in most severe pain; HT reported less pain interference	1
Martin Ginis et al. 2003	Exercise	Traumatic SCI for at least 1 yr, medically cleared to exercise, chronic pain, excluded if acute shoulder pain	Controlled trial, matched based on yrs postinjury and relative mortality risk, random assignment after matching	n=21; exercise training twice weekly in small groups; on avg 15 weeks to complete 24 sessions	n=11; controls (did not attend exercise seminar offered); usual activity, instructed to refrain from starting exercise	2 pain items SF-36; Perceived Stress Scale, Symptom Self Efficacy and perceived control (Beliefs Scale) as mediators of the effect of exercise on subjective well-being	Exp reported less pain, less stress than Con after 3 mos; no differences in terms of self efficacy or perceived control	3
Hicks et al. 2003	Exercise	Acquired SCI at C4 and below (ASIA A-D)	Controlled trial, matched based on age, yrs postinjury and relative mortality risk, random assignment after matching	n=11; progressive exercise training twice weekly for 9 mos (90-120 minutes)	n=12 (wait list control); bi-monthly education sessions together with Exp on exercise physiology, osteoporosis, relaxation techniques	2 pain items SF-36; 6-point scale (how much pain experienced; how much pain interfered with normal work in last 4 weeks)	ANCOVA analysis showed significant less pain reporting for exercisers compared to controls	2
Ditor 2003	Exercise	(see Hicks et al 2003)	9 mos follow-up (see Hicks et al 2003)	n=7 (see Hicks et al 2003)	see Hicks et al 2003	2 pain items SF-36	Trend towards pain increase between treatment end and follow-up; negative correlation between pain intensity and adherence	2
Latimer et al. 2004	Exercise	(see Hicks et al 2003)	9 mos posttest (see Hicks et al 2003)	n=11 twice weekly exercisers	n=10 non exercising controls	2 pain items SF-36; Perceived Stress Scale, Symptom Self Efficacy and perceived control (Beliefs Scale) as mediators of the effect of exercise on subjective well-being	Effects of exercise on stress were found mediated by exercise-induced change in pain; depression predicted by stress but not by perceived pain	2
Nawoczenski et al. 2006	Exercise	Manual wheelchair users with SCI (paraplegia; incomplete tetraplegia) and spina bifida; with/without self-reported shoulder pain	Clinical trial with asymptomatic control group	n=21; manual wheelchair users with shoulder impingement symptoms; home exercise program (stretching/strengthening), 8 wks	n=20; asymptomatic wheelchair users	WUSPI (Wheelchair Users' Shoulder Pain Index), 15 items (10 point VAS) to assess pain during functional activities; SRQ (Shoulder Rating Questionnaire)	Exp showed significant improvement posttreatment (after 8 wks) in WUSPI and SRQ, controls remained stable	1
Martin Ginis et al. 2007	Exercise	Traumatic, incomplete SCI (ASIA B and C) of at least 1 yr,Volunteers for a 12 mos study; age below 60	Pre-Post-Test (subjects serving as own controls)	n=14); three exercise sessions of body weight supported treadmill training	n=5; 10 daily sham TMS	Brief Pain Inventory - Current pain rating; Profile of Moods States (POMS)	Non-significant small to medium size decreases in pain in Session 1, no change in Session 3; No main effects in ANCOVA for time; mood improvements	0
Defrin et al. 2007	Cranial stimulation	Chronic traumatic SCI, chronic central pain of min 12 mos, pain not result of other causes, pain resistant to medicationand other ACTs, no acute pain	Double blind RCT with mean follow-up of 4.5 weeks	n=6; 10 daily motor Transcranial Magnetic Stimulation (rTMS)	n=20; sham CES every day for 21 days	VAS (Chronic Pain Intensity); MPQ	Effect of group (real and sham) and the interaction group x time non significant for pain intensity; Time significant (reduction of VAS for rTMS and TMS and in MPQ), not between groups	4
Tan et al. 2006	Cranial stimulation	SCI for at least 6 mos with chronic musculoskeletal or neuropathic pain of at least 3 mos duration and moderate to severe intensity	Double blind RCT with sham control and random assignment to active or sham cranial electrotherapy stimulation	n=18 1 hour active cranial electrotherapy stimulation (CES) every day for 21 days	n=9 Trager	Daily pain rating forms (VAS), record pain before after session; Pain Intensity Subscale of BPI; Pain Interference Subscale of BPI	No difference between groups in terms of average postsession pain ratings or Pain Interference; average change from pre-to posttest significantly larger in active CES; sham CES no significantly reduced pain on Pain Intensity subscale	
Dyson-Hudson et al. 2001	Acupuncture	Consecutive sample (aged 18-70), chronic SCI of at least 1 yr and chronic shoulder pain (musculoskeletal), manual wheelchair as primary means of mobility	Prospective clinical trial with subjects randomized to Acupuncture or Trager Psychophysiological Integration; 5 week pretreatment, 5 week intervention, 5 week follow-up	n=9 Acupuncture	n=9 10 treatments of invasive sham	Performance corrected (PC)-WUSPI, weekly pain log, weekly VAS, 6 point verbal rating scale (VRS)	Significant effect of time for both groups on WUSPI, numeric rating, VRS during baseline, treatment and follow-up; Mean PC-WUSPI continued to decline in follow-up	
Dyson-Hudson et al. 2007	Acupuncture	1 yr post SCI with chronic (musculoskeletal shoulder pain, manual wheelchair as primary means of mobility, excluding conditions that may interfere	Randomized double- blind, placebo (invasive sham) controlled trial	n=8 10 treatments of acupuncture over 5 wks; 3 consecutive 5-week periods (no treatment baseline, treatment, follow-up)	Self	WUSPI, shoulder pain 11 point numeric rating scale (NRS)	Shoulder pain decreased significantly for both groups (66% acupuncture; 43% sham); larger treatment effect size for acupuncture; no statistical group differences at long-term follow-up (5 wk period after treatment completion)	
Nayak et al. 2001	Acupuncture	Sustained, traumatic SCI, at least 6 mos duration, min 6 mos duration of chronic pain, overall pain at least 5 on 10-point scale	Within subjects design (A-B)	n=22 15 acupuncture treatments over 7.5 wks following 7.5 wks baseline		Numeric rating scale (NRS) of pain intensity, 3 ratings (current, average, worst pain); 1-item pain impact and interference (activity scale)	10 (46%) showed reduced pain intensity and pain sequelae after treatment; 6 (27%) reported and increase in pain, which prevailed until 3 mos posttreatment	1

Narrative Summary of Key Findings

- Controlled trials on NPNSI pain management after SCI were identified in four areas: relaxation/hypnosis; exercise; (trans)cranial (electromagnetic) stimulation and acupuncture
- Trials focused primarily on chronic neurogenic and musculoskeletal pain
- Most trials used simple VAS and VRS to assess pain intensity alongside multiple-item measures and scales
- Exercise shows promise but most evidence in this review was generated on the basis of one trial
- Several trials (e.g. acupuncture, cranial electromagnetic stimulation) have found a time effect, i.e. similar reduction in perceived pain intensity after sham (placebo) interventions compared to the experimental group
- Several studies show short-term pain reductions between VAS/VRS assessments before and after sessions
- Overall quality of trials is poor with an average score of 2.15 (0=weakest, 5=strongest).
- Randomization and blinding procedures have not been described in detail
- Most studies reported only findings for small samples, attrition, especially in control groups was considerable and protocol violations occurred
- Recruitment of study participants mostly based on convenience or consecutive sampling

Due to the heterogeneity of studies included in this review a meaningful meta-analytic analysis was not possible.

Discussion

The efficacy of NPNSIs in the management of chronic pain remains unclear. While a variety of interventions have been examined in the literature, sampling, randomization and blinding procedures, as well as small sample sizes and inconsistent use of outcome measures are challenges that need to be addressed in further studies.

Limitations

- Limited to English language only
- Limited to controlled trials
- Broader search terms, i.e. cognitive behavioral therapy or a specific search on exercise or acupuncture may have revealed additional studies
- Conference abstracts, key journal abstracts and grey literature has not been considered in this review

Conclusions

Multi-center trials focused on specific, well defined NPNSI for people with SCI could enhance the current evidence base. The role of mediating variables, such as self efficacy and perceived control and setting factors need further exploration. In addition, the combination of pharmacological and NPNSIs in the context of complex interventions should be investigated in more detail.

References

Please contact the presenting author for a list of references

Acknowledgement

This review was in parts supported by the Rehabilitation Research and Training Center on Spinal Cord Injury: Promoting Health and Preventing Complications Through Exercise (NIDRR grant #H133B031114)