PAIN MANAGEMENT

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Quality of life in chronic low back pain patients treated with instrumented fusion

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Aim. The aim of this study was to examine pain and quality of life in a group of preoperative chronic low back pain patients (n = 25) and a group of postoperative chronic low back pain patients (n = 101) treated with instrumented fusion 1–8 years ago.

Background. Reduced quality of life is common in chronic low back pain patients and the aim of treatment is to improve quality of life.

Design. In the present study, a comparative survey design was used.

Methods. The McGill Pain Questionnaire and the SF-36 Health Survey were used to examine pain and quality of life.

Results. The pre- and postoperative groups did not differ with regard to age, gender, education, other chronic conditions or previous spinal surgery. Compared with the preoperative group, the postoperative group reported significantly lower total, sensory, affective and evaluative pain, used less pain medication ($p < 0{\cdot}05$) and reported better scores in all SF-36 components ($p < 0{\cdot}05$), except for general health. The effect size was ≥0·8 for all pain components and ≥0·4 for all SF-36 components, except for general health (effect size = 0·009). With regard to long-term follow-up, patients who underwent surgery 5–8 years ago reported better physical role functioning ($p < 0{\cdot}05$) compared with those who underwent surgery 1–2 years ago.

Conclusion. Results showed that the postoperative group reported significantly less pain and better physical and mental health compared with the preoperative group. However, despite surgery, the postoperative group reported suffering from pain and reduced quality of life.

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Relevance to clinical practice. Psychosocial interventions focusing on psychosocial consequences of pain are needed to modify the pain experience and increase the quality of life in patients who have undergone this kind of surgery.

Key words: chronic low back pain, nurses, nursing, pain, quality of life, spinal fusion

Introduction

Reduced quality of life is common for patients suffering from chronic low back pain (CLBP) and the goal of treatment is to optimise patients' quality of life in terms of less pain and better functioning (Boden *et al.* 2000, Glassman *et al.* 1998, Kleeman *et al.* 2001, Beurskens *et al.* 1995, Fairbank *et al.*, 2005). Conservative treatments, such as exercise, information and advice to remain physically active are generally the first treatment choices and believed to be the 'gold standard' (Pruitt & Korff 2002, Waddell 2004, Shirado *et al.* 2005, Long 2006, VanTulder & Koes 2006). However, when such treatments are ineffective, spinal surgery, such as fusion, can be an alternative (Christensen & Bünger 2004).

Traditionally, assessment of success after spinal fusion has focused on technical aspects and comparison of different treatments, with less attention directed towards multidimensional aspects of quality of life (Boden *et al.* 2000, Fritzell *et al.* 2001, 2003, 2004, Kleeman *et al.* 2001, Christensen *et al.* 2002, Brox *et al.* 2003). Results from previous studies with CLBP patients treated with spinal fusion vary. Some studies have found that both back and leg pain decreases 1–2 years after fusion (Leufven & Nordwall 1999, Fritzell *et al.* 2001, Kleeman *et al.* 2001, Brox *et al.* 2003). In a study of CLBP patients who underwent spinal fusion, Madan and Boeree (2001) found significant low back pain at follow-up at between 2–5 years, but did not find the same result for leg pain. Other researchers have shown that both back and leg pain increased 3–5 years following spinal fusion (Leufven & Nordwall 1999). With regard to quality of life, studies have found improved physical and mental health (MH) 1–2 years after spinal fusion compared with the period before patients had undergone the operation (Boden 1998, Glassman *et al.* 1998, Kleeman *et al.* 2001, Christensen *et al.* 2002, Ekman *et al.* 2005, Fairbank *et al.* 2005). In a long-term follow-up study of CLBP patients who had undergone spinal fusion, Christensen *et al.* (2002) found significant improvement in both physical and mental health 2–5 years after surgery compared with the time before patients had undergone the fusion.

In a recent study of pre- and postoperative CLBP patients treated with instrumented fusion, we found that the postoperative patients as a group reported significantly less back and hip pain, less leg pain, less disability, less use of analgesics and were more frequently employed than the group of preoperative patients (Bentsen *et al.* 2008). Most of the postoperative patients (74%) reported using less analgesic than before the operation. However, six from the group of postoperative patients reported very severe or worst imaginable pain and five were crippled or bed bound. Patients who underwent surgery from 5–8 years ago tended to report less disability compared with patients who underwent surgery 1–2 years ago (Bentsen *et al.* 2008). To expand our knowledge of pain from a broad perspective and quality of life in this patient group, the present study aimed to explore different aspects of pain (total, sensory, affective and evaluative pain) and quality of life in pre- and postoperative CLBP patients treated with instrumented fusion 1–8 years ago.

Methodology

Design and sample

The study used a comparative survey design consisting of preoperative CLBP patients and postoperative CLBP patients treated with instrumented fusion because of degenerative disc disease, at the same hospital unit.

Group 1 (preoperative patients): a total of 34 CLBP patients (age range 25–60 years) waiting for instrumented fusion; of these, 25 (74%) wished to participate in the study.

Group 2 (postoperative patients): 126 CLBP patients (age range 25–60 years) who underwent instrumented fusion 1–8 years ago were available; of these, 101 (80%) were willing to participate. There was no statistically significant difference between the postoperative responders and non-responders with regard to age ($p = 0{\cdot}1$) and gender ($p = 0{\cdot}9$).

The surgeons selected patients for instrumented fusion by examining them for pain and function.

Inclusion criteria for surgery for groups 1 and 2

- All patients had to suffer from degenerative disc disease. Disc degeneration of at least one segment had to be confirmed by CT and/or MRI.

- Conservative treatments, such as physiotherapy and physical training had failed to improve the patients' condition.
- A positive pain provocation test in at least one segment of the lower back.

Exclusion criteria for surgery for groups 1 and 2
- Malignant spinal disease.
- Spinal disc herniation.

Treatment procedure
Patients in the study were, or planned to be, treated with posterior lateral fusion (PLF) or anterior lumbar inter-body fusion (ALIF). In the PLF procedure, pedicle screws were used together with a bone graft from the iliac crest to the transverse processes. In the ALIF procedure, a bone block from the iliac crest was inserted between the vertebrae, together with a metal cage for added strength. One to four segments were fused. All patients were largely confined to bed rest for three months. Rehabilitation did not follow a specific protocol, but was decided according to individual surgeons' judgement.

Data collection

The preoperative patients (group 1) received the survey questionnaire at the hospital during the autumn of 2001 and 2002 at the time of their pain provocation test. In November 2001, the questionnaire was sent to the postoperative patients (group 2) by post from the hospital with a hand-signed cover letter and free return post envelope. After three weeks, a reminder letter was sent to patients who had not responded. Regional Committees for Medical Research Ethics and the Data Inspectorate approved the study.

Outcome measures

Pain
To examine the pain experience, the Norwegian Pain Questionnaire (NPQ) was used. The NPQ is an approximation of the McGill Pain Questionnaire (Strand & Wisnes 1991). It was designed to measure total, sensory, affective and evaluative components of pain (Wall & Melzack 1994). The NPQ includes 106 words categorised into four major classes describing the total, sensory, affective and evaluative qualities of the pain experience. The sensory words described sensory qualities of pain experience in terms of temporal, spatial, pressure, thermal and other properties. The affective words described affective qualities in terms of tension and fear and the evaluative words described the overall pain experience. The total pain was a sum of all words and described the subjective total pain experience. The scores were coded, summed and transformed into scales of 0 'no pain'–1·0 'maximum pain' (Strand & Wisnes 1991, Wall & Melzack 1994, McCaffery & Beebe 1996). High internal reliability had been demonstrated for all groups and the questionnaire included the most common descriptors of pain in the Norwegian language (Strand & Wisnes 1991, Strand & Ljunggren 1997).

Quality of life
The patients evaluated their quality of life using the SF-36 Health Survey; one of the most commonly used measures of quality of life. The questionnaire was developed in the USA by the Medical Outcomes Study (MOS). It consisted of 36 questions that are summarised in eight subscales: physical functioning (PF); role limitations – physical (RP) (referred to in this paper as physical role functioning); bodily pain (BP); self-reported general health (GH); vitality (VT); social function (SF); role limitations – emotional (RE) and mental health (MH). The scores range from 0–100, with higher scores indicating better quality of life (Ware *et al.* 1994, 1997, Ware 2000). The SF-36 has been well tested in relation to psychometric properties in several countries, including Norway (Ware *et al.* 1997, Loge *et al.* 1998, Ware 2000).

Demographic and clinical variables
Age was scored as a continuous variable (years). Gender was scored as 1 – men; 2 – women. Education was assessed as 1–10 years or less; 2–11 years (no university) and 3–11 years or more (including university). Social status was scored as 1 – living alone and 2 – living with someone. Other chronic conditions were defined as 1 – no comorbid conditions and 2 – comorbid conditions. Years after surgery were scored as 1 – 1–2 years after surgery, 2 – 3–4 years after surgery and 3 – 5–8 years after surgery. Previous spinal surgery was defined as 1 – no previous spinal surgery and 2 – previous spinal surgery. Use of analgesics for the back problem was scored as 1 – using analgesics and 2 – not using analgesics.

Statistical analyses

The Statistical Package for the Social Sciences (13.0) was used in analysing data. Missing substitution for the SF-36 was performed according to the user manual (Ware *et al.* 1997). For the NPQ, missing substitution was performed for individuals who had responded to 50% or more of the items in each of the NPQ components (Fayers & Machin 2007).

Descriptive analyses were performed for analysing demographic variables, pain and quality of life (mean, SD, 95% CI). Chi-square and independent *t*-tests were used to examine possible differences between groups 1 and 2 with regard to

age, gender, social status, educational status, previous spinal surgery, other chronic conditions, pain and quality of life. One-way ANOVA was used to examine the differences in pain and quality of life between groups of patients who underwent surgery (1–2, 3–4 and 5–8 years postoperatively). Effect size (ES) was calculated for the differences between the pre- and postoperative patients as groups and estimated as the mean difference between groups 1 and 2 divided by the SD for a 'baseline score' (group 1). ES of 0·2, 0·5 and 0·8 were interpreted as small, moderate and large effects respectively (Fayers & Machin 2007).

Results

Demographic and clinical variables

There was no statistical significant difference between pre- and postoperative group of patients with regard to age, gender, education, other chronic conditions and previous spinal surgery (Table 1).

Table 1 Characteristics of pre- and postoperative chronic low back pain patients treated with instrumented fusion (*n*, mean, %, SD)

Variable	Group 1 preoperative patients *n* = 25	Group 2 postoperative patients *n* = 101	*p*-value
Gender, *n* (%)			
Female	19 (76)	71 (71)	
Male	6 (24)	30 (29)	0·6*
Age at surgery, mean (SD)	–	42 (8·8)	
Age at examination, mean (SD)	45 (6·5)	46 (8·9)	0·7†
Years after surgery, *n* (%)			
1–2 years postoperative		40 (39)	
3–4 years postoperative		35 (35)	
5–8 years postoperative		26 (26)	
Education, *n* (%)			
10 years or less	4 (16)	21 (20)	0·1*
11 years or more, not university	16 (64)	44 (44)	
University	5 (20)	36 (36)	
Other chronic condition, *n* (%)			
Other chronic conditions	10 (40)	45 (45)	0·6*
No other chronic condition	15 (60)	56 (55)	
Previous spine surgery, *n* (%)			
No previous spine surgery	13 (52)	57 (57)	0·6*
Previous spine surgery	12 (48)	43 (43)	
Using analgesic, *n* (%)			
Using analgesic	19 (76)	55 (54)	< 0·05*
Using not analgesic	6 (24)	46 (46)	

Other chronic conditions: asthma/allergy, musculoskeletal, diabetes, cancer, heart/vessel, stomach/bowels, psychosomatic illness.
*Chi-squared test.
†Independent *t*-test.

Pain

Results showed that the preoperative group experienced more total, sensory, affective and evaluative pain compared with the postoperative group ($p \leq 0{\cdot}015$) (Fig. 1, Table 2). All 23 (100%) preoperative patients reported suffering from total, sensory and affective pain and 21 (91%) of the patients from evaluative pain. Furthermore, 21 (91%) preoperative patients reported suffering from all pain categories (sensory, affective, evaluative and total pain). As many as 83 (86%) of the postoperative patients reported that they suffered from sensory and total pain and 63 (66%) reported that they suffered from affective and evaluative pain. In addition, 56 (58%) of the postoperative patients reported that they suffered from all pain components (sensory, affective, evaluative and total pain). With regard to longer-term follow-up, there were no significant differences in pain at 1–2, 3–4 or 5–8 years ($p < 0{\cdot}3$) (Fig. 1). Further, the postoperative group also used significantly less analgesia ($p < 0{\cdot}05$) compared with the preoperative group (Table 1). Analyses showed that the ES estimates for differences between the pre- and postoperative groups were 0·9 for sensory and affective pain, 0·8 for evaluative and 1·1 for total pain (Table 2).

Quality of life

The postoperative group of patients reported significantly better scores in all physical and mental health components ($p < 0{\cdot}05$), except for general health ($p = 0{\cdot}97$), compared with the preoperative group (Table 2, Fig. 2). The results also showed that the patients who underwent surgery 5–8 years ago reported significantly better physical role functioning compared with those who underwent surgery 1–2 years ago ($p = 0{\cdot}01$) (Fig. 2).

With regard to the ES, analyses showed that the ES estimates for differences between pre- and postoperative group were 1·0 or higher in all physical health components except general health (ES = 0·009) and ≥0·4 for the mental health components (Table 2).

Discussion

In this study, we examined pain and quality of life in two groups of CLBP patients: one preoperative and one postoperative. With regard to the postoperative group, all patients were treated with instrumented fusion 1–8 years ago. There were no significant differences between the pre- and postoperative groups with regard to background variables, such as age, gender, education, other chronic conditions and previous spinal surgery. Despite surgery, most of the postoperative

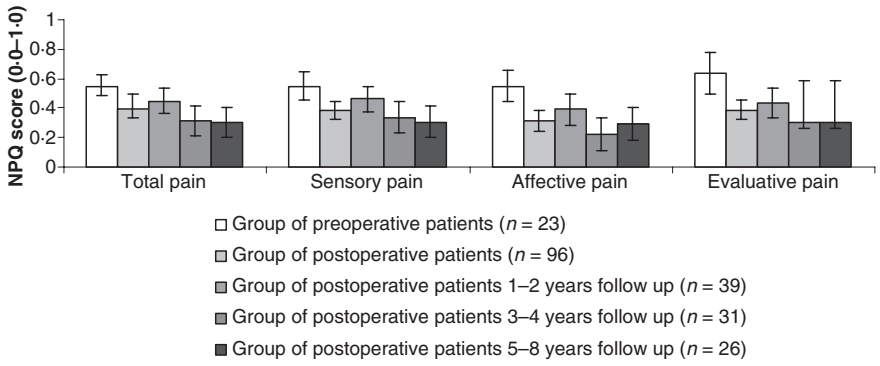

Figure 1 Pain measured with the NPQ in a group of preoperative and groups of postoperative CLBP patients treated with instrumented fusion (lines represent mean values, bars represent 95% CI).

Table 2 The scores for the Norwegian Pain Questionnaire (NPQ) components and the SF-36 components in a group of preoperative and a group of postoperative chronic low back pain patients treated with instrumented fusion (*n*, mean, SD, ES and *p*-value)

	Preoperative patients			Postoperative patients			Preoperative– postoperative patients	Preoperative– postoperative patients
	n	Mean	SD	*n*	Mean	SD	ES	*p*-value
NPQ-components								
Total pain	23	0·55	0·17	96	0·36	0·30	1·1	0·015
Sensory pain	23	0·55	0·20	96	0·38	0·30	0·9	0·002
Affective pain	23	0·55	0·26	96	0·31	0·33	0·9	0·002
Evaluative pain	23	0·64	0·32	96	0·38	0·33	0·8	0·001
SF-36 components								
Physical function	25	44·2	19·2	100	64·2	27·1	1·0	< 0·001
Role physical	25	6·0	22·0	99	39·1	44·6	1·5	< 0·001
Bodily pain	25	23·9	15·4	100	53·9	33·2	1·9	< 0·001
General health	25	64·4	21·2	98	64·6	24·7	0·009	0·97
Vitality	25	30·8	15·0	99	53·6	23·1	1·5	< 0·001
Social function	25	40·5	21·7	100	68·0	32·2	1·2	< 0·001
Role emotional	25	57·3	45·7	97	77·3	40·1	0·4	< 0·03
Mental health	25	64·8	19·8	99	74·1	21·0	0·5	< 0·05

Effect size (ES) is estimated as the mean difference between pre- and postoperative groups divided by the SD of the baseline score; *n*, the responders in different NPQ- and SF-36 components after completed the missing substitution.

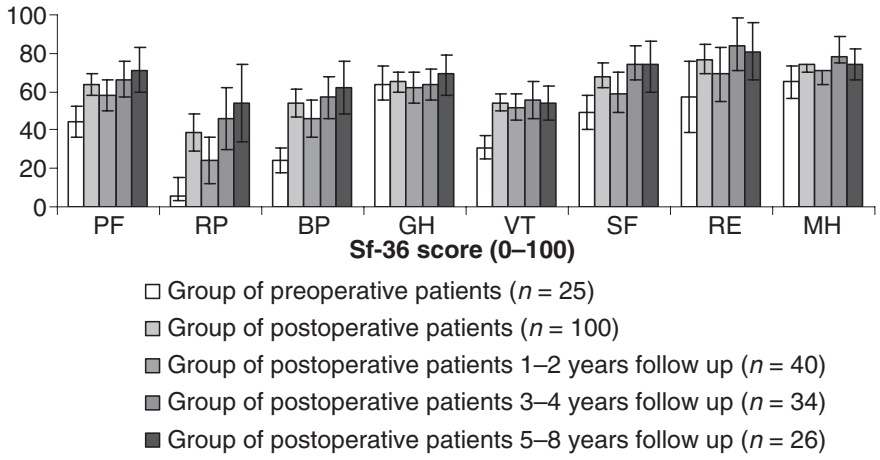

Figure 2 The SF-36 scores in a group of preoperative and groups of postoperative CLBP patients' treated with instrumented fusion) (lines represent mean values, bars represent 95% CI).

patients reported pain and reduced quality of life. The postoperative group reported less pain and better physical and mental health compared with the preoperative group. When the postoperative patients were grouped according to time intervals since surgery, no statistically significant differences were found in the pain components. However, the

patient group who had undergone surgery 5–8 years previously reported better physical role functioning compared with those who underwent surgery 1–2 years ago.

Pain

Both the pre- and postoperative patients reported suffering from sensory, affective, evaluative and total pain. With regard to clinical differences, the ES between the pre- and postoperative groups were large for all NPQ components (Fayers & Machin 2007). This suggests that the postoperative group suffered from lower sensory, affective, evaluative and total pain compared with the preoperative group. That the postoperative patients reported less pain is in keeping with several other studies, which found patients who underwent spinal fusion reported less back and leg pain in comparison with their pain before they underwent the operation (Leufven & Nordwall 1999, Fritzell *et al.* 2001, Kleeman *et al.* 2001, Madan & Boeree 2001, Brox *et al.* 2003).

Pain is a multidimensional construct consisting of sensory, affective and evaluative components (Melzack & Torgerson 1971, Melzack & Katz 2006). The sensory pain component is influenced by tissue damage; the affective component by anxiety and depression; and the evaluative component by coping (Boothby *et al.* 1999, Melzack & Katz 2006). However, it is established that patients suffering from chronic pain also report more depression. Literature also shows that more anxiety is reported in patients suffering from chronic pain compared with those who do not report suffering from pain (Craig 1994, Wall & Melzack 1994, Robinson & Riely 1999, Wall 2003). Previous studies have shown a concurrent relationship between emotion and levels of pain and that negative affect had a negative influence on surgical outcomes (Robinson & Riely 1999). It is possible that higher scores in the affective pain component influenced other pain components and outcomes of the operation. The evaluative pain component is associated with coping (Wall & Melzack 1994, Wall 2003) and results in this study showed that the postoperative group reported a significantly lower pain score in the cognitive pain component compared with the preoperative group. This suggests that the postoperative patients as a group experienced higher pain control compared with the preoperative patients as a group. Improved pain control has been found to be associated with better functioning and less depression (Jensen *et al.* 1991). That the postoperative group reported less evaluative pain indicated that they could readily control their pain, which could also have led to improved total, sensory and affective pain.

With respect to long-term follow-up, there were no statistically significant differences in sensory, affective, evaluative and total pain in the longest period since surgery. Significantly, however, those who underwent surgery 3–8 years ago tended to report lower total and sensory pain compared to those who underwent surgery 1–2 years ago. These findings are in keeping with Madan and Boeree (2001), who found lower back pain present at follow-up between 2–5 years. This suggests that pain influenced by tissue damage decreases as the time since surgery elapses.

Our results also showed that the postoperative patient group used significantly fewer analgesics in comparison with the preoperative group. This finding is in agreement with findings from other studies (Nork *et al.* 1999, Rytter 1999, Jäger *et al.* 2003) and substantiates the idea that preoperative patients suffer more pain than postoperative patients. As we did not examine change in the same patients in our study, it is not known if their pain deteriorated or remained the same as before their surgery. However, there were several indications that the postoperative patients suffered less pain than the preoperative patients. Placebo effects have been found to influence patient outcomes after any treatment, including surgery, which clinicians and patients believe is beneficial (Tuner *et al.* 2004). High expectations of improvement help patients to view their pain more positively and as more manageable. Expressive treatments also seem to be powerful in causing placebo effects (Turk & Gatchel 2002, Tuner *et al.* 2004). Patients in our study probably had high expectations that the operation would improve their pain and after surgery, they would also be likely to interpret their treatment results positively. However, the placebo effect is presumed to abate over time (Tuner *et al.* 1994) and is probably minimal 1–8 years after surgery. The differences in pain between pre- and postoperative groups are not likely to be caused by the placebo effect, but rather to the fusion intervention.

Quality of life

The postoperative patient group reported significantly better physical and mental health compared with the preoperative group, which suggests that postoperative patients have better physical and mental health 1–8 years following spinal fusion compared with preoperative patients. This result is in keeping with previous, similar studies of CLBP patients treated with spinal fusion, who experienced better physical and mental health 1–2 years following fusion compared with before their operation (Boden *et al.* 2000, Kleeman *et al.* 2001, Christensen *et al.* 2002, Fairbank *et al.* 2005). On the other hand, Glassman *et al.* (1998) found that patients treated with spinal fusion only reported significantly better physical health at a one year follow-up (Glassman *et al.* 1998). Our study also showed that the ES for all the physical health components were large, except

for general health. For the general health component, there was no clinical difference between the pre- and postoperative patient groups. With regard to the mental health components, the ES were minimal to large (Fayers & Machin 2007). These findings suggest that postoperative patients might experience a better everyday life than preoperative patients with problems concerning physical activity, daily activity, work, pain, fatigue, social activity and feelings, such as anxiety and depression (Ware *et al.* 1997).

It is an important finding that the patients who underwent the operation 5–8 years ago reported significantly better physical role functioning compared with those who underwent surgery 1–2 years ago. These findings are in keeping with Christensen *et al.* (2002) who found that physical health seems to improve 2–5 years following fusion. This suggests that patients' ability to undertake general daily activities and work seems to improve as the time since surgery elapses (Ware *et al.* 1997). The postoperative patients in our study were largely confined to bed for three months following fusion. Many had also undergone one or more spinal operations previously. This implies that a lengthy period is necessary for the patients in our study to improve their physical role function.

Limitations

Lack of control over extraneous variables is a feature of comparative survey designs and problems such as age and gender distributions and differences in variance can influence results. Therefore, it is difficult to draw conclusions about causality and the direction of the relationships in pain and quality of life between pre- and postoperative patients as groups (Wood-Dauphinee 1999). In the present study, we did not examine changes in the same patients; therefore, we do not know whether the pain and quality of life had deteriorated or remained the same as before surgery. To evaluate a more credible change in pain and quality of life in patients who have had this kind of surgery, a stronger design is needed. The fact that the preoperative patients completed the questionnaire at the hospital and the postoperative patients completed it at home could be a limitation, as the questionnaire was completed under different circumstances. On the other hand, the percentage of participants wanting to participate in the study was comparable (74–80%) and there were no differences in the two samples with respect to age, gender, education, other chronic conditions or previous spinal surgery. Both methods of completing the questionnaire included self-assessment, which is known as the best means in quality of life studies to reduce social desirability (Fayers & Machin 2007).

Conclusion

The pre- and postoperative patient groups in this study did not differ with regard to age, gender, education, other chronic conditions and previous spinal surgery. Results showed that the postoperative group who underwent instrumented fusion 1–8 years ago suffered from less pain and experienced better quality of life compared with the preoperative group. Furthermore, the longer the time since surgery, the better was physical role function. However, despite surgery, the postoperative patients suffered from pain and reduced quality of life, especially physical health. These findings suggest that psychosocial interventions focusing on emotions and coping with pain may help manage or alleviate pain and improve quality of life in this group of patients after spinal fusion.

Implications for clinical practice

Research findings suggest that affective and cognitive variables influence pain and disability (Sullivan *et al.* 2006). According to Christensen *et al.* (2003), a psychosocial approach to back pain is needed because pain-related fear is one of the most potent predictors of self-reported disability (Christensen *et al.* 2003). In the present study, several patients suffered from affective and evaluative pain, which mainly concerns anxiety and coping. These findings support the view that psychosocial interventions focusing on negative emotions and coping with pain are needed to alleviate pain experiences and increase quality of life. Nurses are important healthcare providers in the planning and implementation of such interventions.

Sources

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Author contribution

Study design: SBB, BRH, AKW; data analysis: SBB, AKW and manuscript preparation: SBB, BRH, TR, AKW.

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