et al., 1998). Furthermore, Verhaak et al. (1998) demonstrated that different kinds of methods for the study of chronic pain (telephone surveys, postal questionnaires, direct interviews) all yielded wide ranges of estimates.

Our prevalence estimate is low compared with most of these studies. Probably for three reasons. Firstly, our project was confined to unexplained pain, and not all chronic pain, which will obviously make a difference. A recently published study from Finland showed that about 8% of patients had experienced pain for over 6 months while 1.1% of patients had unexplained pain lasting over 6 months (Mäntyselkä et al., 2001).

Secondly, our inclusion criteria 3, 4 and 5, based on the DSM-IV, (pain is the most prominent aspect in the clinical presentation; pain is serious enough to justify clinical attention; and pain has led to obvious discomfort and disabilities in daily life) has focused the attention on very severe chronic pain patients, in contrast to other studies where patients are ‘often troubled by pain’ (Crook et al., 1984), or using the term ‘chronic’ without any specification (Måkelä and Heliovaara, 1991; Andersen, 1994; Croft et al., 1993). So we did not only look for unexplained pain, but also for severe chronic pain. A third reason in comparison with other studies is that we have operationally defined ‘chronic’ as more than 6 months. Theoretically, the longer the time span, the fewer patients will be found. A well designed study of Von Korff et al. (1988) showed that, while 37% reported recurrent pain, only 8% had severe and persistent pain and less than 3% had such pain lasting more than 6 days.

There is in the literature some consensus about the characteristics of the patients who suffer from chronic pain: they are relatively often middle-aged women. This agrees with our findings. Lower back, neck, and shoulder are the body areas most frequently affected, in our study as well as in previous studies.

Chronic pain is often associated with depression or other kinds of psychological distress. Blyth et al. (2001) found some psychological distress in chronic pain patients (compared to persons without pain) and a lot of psychological distress in males and females reporting interfering chronic pain. Our patients also reported that the pain interfered with their daily activities and they also reported a lot of affective distress. The MPI tries to cover psychological, social and behavioural aspects of the chronic pain disorder. The MPI has been widely used in pain-clinics. Compared to our patients, in general practice, a heterogeneous chronic pain clinic sample (Rudy, 1989) had much more affective distress, and more interference with daily life activities. Patients in pain clinics also rated their pain as more severe and elicited more punishing response from their partners. Patients in general practice are able to perform more activities than patients in pain clinics. Figures of a homogeneous sample of pain clinic patients show the same results (Lousberg et al., 1997). All these finding are consistent with the circumstance that patients in pain-clinics experience more illness-burden than patients in general practice.

One could question if the study was not limited by using the general practice as population at risk. Therefore, this study is not a community study and hence does not provide estimates of pain prevalence in the population. However, as we pointed out, in the Netherlands GPs have a central role in the health care system. Most other health professionals cannot be consulted without a GP’s referral. So if chronic pain patients in the population choose to visit physiotherapists or complementary practitioners they still need to go to the GP for a referral. When it became clear that a majority of the GPs was unable to apply the project’s inclusion criteria on a day-to-day bases, we visited all the practices at the beginning of 1997 to look for further USCP patients. So even if a patient did not visit their GP in 1996 chances are high that he or she was included in the record review in 1997.

A major methodological problem remains the lack of true diagnostic criteria for USCP. The complex nature of chronic pain means that its prevalence cannot be measured by means of assessing well-defined physical conditions as is the case with diabetes or malaria. Accordingly chronic unexplained pain is partly a matter of interpretation. The variation between participating doctors in their reported prevalences is illustrative for this problem. Some sentinel GPs who meticulously recorded patients during 1 year
had prevalence estimates up to 24.68 per 1000 patients. Other GPs did not include a single patient during that year. A multi-axial approach is helpful for a better understanding and interpretation of the patients, but is does not solve the problem of case-finding. We suppose that it is likely that, given some under-registration, patients with less severe pain will be less likely to be registered. One would therefore predict that GPs with low registration rates would have on average more patients with severe pain. However, there is no significant correlation between the GP registration rates and the average pain intensity of their patients.

In the course of the study we encountered cultural problems as well. Doctors with a lot of foreign patients told us that patients from north African countries often give chronic pain as a reason for encounter even if their medical condition is the same as that of patients from other countries who will give other reasons for encounter. The same phenomenon is reported by Gureje et al. (1998) who encountered large variations in frequency across pain centres in different countries.

This study reveals a number of findings that are of practical value in general practice.

At first, there is the large variation between GPs in their perception of chronic inexplicable pain. This might be an indication for the diagnostic difficulties a GP faces when he or she is confronted with enduring unexplained pain complaints. It might be important for the GP to explore patients' views of the pain and particularly his way of coping with it. The relatively large number of people who combine severe pain reports with lots of social support without altering the pain behaviour in the long run is a sign of undesirable behaviour that keeps being reinforced. In such cases cooperation between GPs and psychologists might be a possibility to change such behaviour.

Another finding, that runs in line with the former remarks is the regularly found combination of pain with distress. Here again, the cooperation of medical doctors and psychological services might be of great help.

An improved understanding of chronic pain has led to significant advances in the management of this major and complex health problem (Smith et al., 1999). Managing chronic pain in general practice should be based on the assertion that chronic pain is never a symptom that exists in isolation. Even with unknown pathophysiology, it tends to create a cluster of related problems such as chronic fatigue, sleep disturbance, excessive rest and withdrawal from activity, compromised immune function and mood disorder. The physician should make every effort to prevent pain and to relieve pain promptly and effectively when it does occur. How patients think about their pain and whether the physician seems to care about the pain and its relief are also crucial factors (Chapman and Gavrin, 1999).

What is needed is a differentiated approach of pain patients, dependent on their differences in medical, psychological and behavioural respects, as indicated by the IASP classification and MPI score. Factors that need to be considered for the effective management of chronic pain include the somatic source for the pain, the patient's emotional status and personality, family factors, previous pain experiences, cultural factors affecting pain expression, education, and encounters with professional caregivers (Librach, 1993). However, our study revealed also that, compared with studies carried out in specialized pain clinics, patients in general practice have less serious symptoms than patients in clinical settings. This is only natural and common in all sectors of health care. As a result, approaches developed in multi-disciplinary pain centres are not always applicable in the general setting nor is it possible to refer all patients with USCP in general practice to a pain clinic. Therefore, two developments in general practice are critical in our view:

Firstly: GPs should make an effort to develop guidelines for differentiated diagnosis and treatment of chronic pain in general practice. These guidelines should be inspired by the work done in specialist clinics but adapted to the restrictions of general practice and the general practitioners.

Secondly: GPs and specialists as well should strengthen their mutual bonds, wherever they exist and should develop them in case there is no relationship yet, lest the knowledge of pain
specialists can spread to general practice and general practice can fall back on the specialist.

ACKNOWLEDGEMENTS

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Children’s pain at home following (adenotonsillectomy

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The aim of this study was to evaluate the prevalence and severity of children’s pain at home following (adenotonsillectomies. The subjects were parents of 161 children (86 boys, 75 girls) undergoing myringotomies, adenoidectomies and (adenotonsillectomies. The mean age of the children was 5.5 years (SD = 2.4; range 1–14). Parents were asked to assess the child’s average pain on the day of operation and 7 days after the operation, using a 100 mm Visual Analogue Scale (VAS). Parents from (adenotonsillectomy patients were also interviewed by phone on day 7.

The mean VAS pain intensity scores by period (day of operation until 7th day after operation) differed between the myringotomy (3.2), adenoidectomy (10.6), and (adenotonsillectomy (22.1) group \((F_{2,133} = 31.65; p < 0.001)\). The VAS ratings were highest for the tonsillectomy group \((p < 0.001)\). There was a trend that pain intensity scores for adenoidectomies were significantly higher than scores for myringotomies \((p = 0.07)\). In the interviews, 81% of the parents stated that their child suffered pain at home. However, this was not necessarily a reason to administer an analgesic. Furthermore, parents reported pain-related problems like problems regarding eating, fluid intake, vomiting and sleep disturbance. Finally, 67% of the children at home recalled severe pain experience in the hospital.

It was concluded that especially following (adenotonsillectomy children suffer clinically significant pain at home and that the management of pain and related problems needs to be clearly improved. © 2002 European Federation of Chapters of the International Association for the Study of Pain. Published by Elsevier Science Ltd. All rights reserved.

KEYWORDS: pain, (adenotonsillectomy, home, children.

INTRODUCTION

In many countries like the USA, UK, Canada, Finland, Germany and the Netherlands, minor surgeries are performed as an out-patient procedure (e.g. Astfalk et al., 1991; Gedaly-Duff and Ziebarth 1994; Tan et al., 1994; Finley et al., 1996; Kokki and Ahoen, 1997; Hamers et al., 1999). This is especially true for ENT-related operations, like tonsillectomy, adenoidectomy, and myringotomy and tube placement (Yaster et al., 1994).

It is known that the cost-savings of out-patient procedures are substantial (Yaster et al., 1994). These procedures are also assumed to be beneficial for children; they are known to reduce the child’s stress by minimizing the extent of time spent away from home and family (Tan et al., 1994). The question is, however, whether this holds true for management of postoperative pain at home.

Children undergoing (adenotonsillectomies are known to experience high levels of pain on the day of operation (Dommerby and Rasmussen, 1984; Bone and Fell, 1988; Warnock and Lander, 1998). In a study by Hamers et al. (1999) 60% of the children reported suffering extreme pain 1–2 hours after operation. This finding supports physicians’ and nurses’ judgments that tonsillectomies are one of the most painful types of surgery in children (Kokke et al., 1993).

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children undergoing (adenotonsillectomies) are discharged from the hospital 4–5 hours after operation, the question is whether their pain is managed adequately at home. This issue is also raised by parents who are extremely concerned about their child experiencing postoperative pain (Sikich et al., 1997). Finley et al. (1996) reported significant pain intensity scores during the first 3 days following surgery. However, parents were hesitant to use medication; 42% of the parents felt that pain medication should be used as a last resort. In a study by Woodgate and Kristjanson (1996) it was found that most parents had limited knowledge with respect to analgesia and held misconceptions about their use. The parents assumed or expected a certain degree of recovery daily, which to some parents meant that their child would require less medication. In this study the parents expressed the need to be told more about how to handle their child's pain at home. In a study by Gedaly-Duff and Ziebarth (1994) parents appeared to use a trial and error tactic for managing pain. Furthermore, these researchers reported that most of the parents tried stretching the time between medicines. Finally, it should be stressed that inadequate pain management is related to problems regarding fluid intake, sleep disturbance and behavioral changes (Sutters and Miaskowski, 1997).

The purpose of the present study was to evaluate the prevalence and severity of children's pain at home following (adenotonsillectomy). Furthermore, we explored the existence of other (pain related) problems like sleep pattern disturbance and inadequate fluid intake.

METHODS

Design

To get insight into the prevalence and severity of children's pain this study employed a descriptive (cross-sectional) design.

Subjects

The subjects were a convenience sample of healthy children (ASA physical status 1 and 2) between 1 and 14 years of age, who had been admitted for a myringotomy, an adenoidectomy or an (adenotonsillectomy) to a university hospital in the Netherlands. After approval had been given by the local ethics committee, written parental consent was obtained on the day of operation.

Anaesthesia and operation

The present study followed on a randomized clinical trial on the effects of paracetamol and fentanyl after (adenotonsillectomy) (Hamers et al., 1999). As a result the surgical and anaesthesiological procedures in the (adenotonsillectomy) group were highly standardized. All children were premedicated 20–25 mins before the start of induction with rectal midazolam 0.5 mg/kg and atropine 0.025 mg/kg. An inhalation induction with halothane in N₂O : O₂ of 2 : 1 was performed with a stepwise rise to 4 vol%. After the induction of anaesthesia, an i.v. cannula was introduced into the dorsum of the left hand. Next, 1–1.5 mg/kg succinylcholine was given intravenously and oral intubation was performed. Immediately after intubation an i.m. injection of 1 mcg/kg of fentanyl or an equivalent amount of saline was given in the left upper leg. The anaesthesia was maintained with halothane 1.5–2.5 vol% in N₂O : O₂ of 2 : 1. All children breathed spontaneously with an end tidal CO₂ of 4–5 kPa. All children underwent tonsillectomy by means of the dissection method. At the end of the operation the administration of halothane and N₂O was stopped. The child was placed in a lateral position and extubated. The child stayed in the recovery room until further recovery. After responding to the recovery nurses, the child was returned to the ward, where the parents were allowed to take part in the care of their children (Hamers et al., 1999).

Pain management

All children received paracetamol suppositories (30–50 mg/kg) for postoperative pain relief. When the children were discharged their parents received paracetamol suppositories for the pain management at home. The instructions given in
the hospital for the administration of paracetamol, however, varied from ‘administer as needed’ to ‘administer at a regular interval’. The type of instruction given was not standardized and depended to a large extent on the nurses or anaesthesiologist in charge. The hospital does not use guidelines for parents after discharge.

Measurements

The parents of all patients were asked to assess the child’s average pain intensity on the day of operation and the first 7 days after the operation. They were instructed to assess the average pain at the end of each day. As a result, average pain is an overall score including pain at rest and pain during swallowing. Parents rated their answers on a 100-millimeter Visual Analogue Scale (VAS). At the left end of the scale the indication ‘0, no pain at all’ was printed, and at the right end ‘100, extreme pain’. The VASs were put in a booklet which could be returned using pre-paid addressed envelopes.

In addition to filling-in VASs, parents from only the (adenotonsillectomy)-patients also were interviewed by phone on the 7th day after surgery. By means of semi-structured interviews, questions were asked about the child’s pain complaints, and potential related problems like sleep pattern disturbance, problems regarding eating and fluid intake, vomiting and changes in the child’s behaviour. Parents were also asked whether their children did remember pain experiences in the hospital and whether parents judged pain management in the hospital satisfactory or not.

Analyses

Data were analysed using descriptive statistics. Characteristics of the children were compared using chi-squared analysis and oneway ANOVAs. Scores on VASs were analysed by repeated measures ANOVA (GLM). In this analysis, gender and child’s age were used as covariates. If the ANOVA revealed significant findings ($p < 0.05$), indicating that at least two mean scores differed, Scheffé’s multiple comparisons test was applied in order to detect which means differed. Finally, frequencies were used to present the results of the phone interviews.

RESULTS

Subjects

Parents of 161 children (86 boys and 75 girls) who had undergone myringotomies ($n = 50$), adenoidectomies ($n = 28$) or (adenotonsillectomies ($n = 83$) were asked to participate in the study. The response rate was 89%; parents of 143 children (75 boys and 68 girls) returned the completed VAS-booklets. The response rate for the 3 groups (type of surgery) was 80% ($n = 40$), 86% ($n = 24$), and 95% ($n = 79$) respectively. The mean age of the children was 5.5 years (SD = 2.4 years; range 1–14 years). In Table 1 the child’s characteristics gender and age are summarized for each of the 3 groups.

As can be seen in Table 1 the child’s characteristics gender and age did not differ between the 3 types of operations.

| TABLE 1. Characteristics of children who were admitted for different types of minor surgery. |
|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
|                                               | Myringotomy | Adenoidectomy | (Adeno)tonsillectomy |
| Gender*                                       |              |                |                          |
| Male                                          | 30           | 15             | 41                       |
| Female                                        | 20           | 13             | 42                       |
| Age**                                         | Mean ± SD    | 5.8 ± 3.0      | 4.6 ± 1.5                | 5.6 ± 2.2                |

*Chi-squared analysis revealed no statistically significant differences between the three groups; **Oneway analysis of variance revealed no statistically significant differences between the three groups.
Pain intensity

The mean VAS pain intensity scores on the day of operation until the 7th day after operation are presented in Figure 1. The mean scores by period (day of operation until the 7th day after operation) were 3.2 (myringotomy), 10.6 (adenoidectomy) and 22.1 (adenotonsillectomy). Repeated measures ANOVA revealed a main effect for period ($F_{1,132} = 165.36; p < 0.001$) indicating a significant decrease in pain intensity during the 7 days after operation. However, this effect was moderated by a statistically significant interaction with type of surgery ($F_{2,133} = 43.76; p < 0.001$); the decrease in pain intensity was highest in the (adenotonsillectomy) group. There were no effects found for gender and child’s age.

Finally, we found a main effect for type of surgery ($F_{2,133} = 31.65; p < 0.001$). As can be seen in Figure 1, mean VAS pain intensity ratings were highest for (adenotonsillectomies ($p < 0.001$). Postoperative pain intensity scores for myringotomies were close to 0, while scores for adenoidectomies were situated between myringotomy and tonsillectomy scores. There was a trend that pain intensity scores for adenoidectomies were significantly higher than scores for myringotomies ($p = 0.07$).

Phone interviews

From the 79 parents of the (adeno)tonsillectomy patients, 72 participated in the semi structured phone interview. Table 2 summarizes the prevalence of pain and pain related problems. As can be seen in Table 2, postoperative pain at home following (adeno)tonsillectomy is a serious problem according to most of the parents. Almost all (97%) of the parents said that they used paracetamol suppositories for pain management. However, there was a diversity in the frequency of administration. Of the parents 51% said that they administered paracetamol at regular intervals, while the others administered paracetamol when needed. Furthermore, for 2 parents the child’s pain was not a reason to administer an analgesic. Other parents held the opinion that ‘you cannot continue giving analgesics’. As a result two parents stopped the administration of paracetamol on the second postoperative day. One parent argued that ‘it is not necessary to administer strong analgesics (in case, paracetamol 500 mg) because the children already often have experienced throat pain’, while another parent was under the impression that the frequency of 3 suppositories each day was too high.

On the other hand, however, there were also parents (11%) who argued that the amount of paracetamol suppositories as received in the hospital was too small. As a result, they said that they had used additional suppositories. Finally,

![Graph showing pain intensity scores](image)

**FIG. 1.** Mean VAS (0–100 mm) pain intensity scores. □ (adenotonsillectomy), ▪ adenoidectomy, □ myringotomy.

*Note.* Presented are the mean VAS ratings by day. The mean VAS scores by period (OP–D7) were 3.2 (myringotomy), 10.6 (adenoidectomy) and 22.1 (adenotonsillectomy) respectively. Scores were analysed using repeated measures ANOVA; gender and child’s age were covariates. A main effect was found for type of surgery. Scheffé’s multiple comparisons proved that the VAS ratings were highest for the (adenotonsillectomy) group ($p < 0.001$). Abbreviations: OP = day of operation; D = day.

<table>
<thead>
<tr>
<th>Table 2. Prevalence of pain and potential related problems at home following (adeno)tonsillectomy as reported by parents (n = 72).</th>
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<tbody>
<tr>
<td>Pain is serious problem</td>
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<tr>
<td>Paracetamol used for pain relief</td>
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<td>Paracetamol administered at regular intervals</td>
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<td>Problems regarding eating</td>
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<td>Problems regarding fluid intake</td>
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<tr>
<td>Vomiting</td>
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<td>Sleep disturbance</td>
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<td>Changes in child’s behaviour</td>
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based on the opinion of two parents, paracetamol was insufficiently effective in relieving children’s postoperative pain at home.

As can be derived from Table 2, related to the children’s pain were problems regarding eating and fluid intake. Regarding fluid intake, several parents (24%) mentioned that they, back home, had to urge their child to eat and take in fluid; 8% of them said that they even had to force their child in taking in fluid. One parent reported that a re-admission for her child was considered because there was a risk of dehydration. However, in most cases the intensity of the problems regarding eating and fluid intake decreased on the 4th day after surgery.

Vomiting, in almost all reported cases, occurred on the day of surgery or on the first day after operation.

A significant problem reported by parents was sleep disturbance. The problem reported most often by parents was wakening up, often in combination with screaming or crying. According to the parents both nightmares and complaining about pain in throat or ears were the reasons for sleep disturbance. Among the parents who did not report sleep problems in their children, some mentioned that their child even slept more comfortably after the surgery.

Furthermore, many parents reported changes in the behaviour of their child after the surgery. According to most parents, their child has become more quiet. Furthermore, some parents reported that their child postoperatively showed fear to be left alone or to be separated from its mother. Finally, one parent stated that her child claimed more attention while two other parents said that their child showed more introvert behaviour.

Finally, asked about pain experiences in the hospital, 67% of the children at home recalled severe pain experiences in the hospital. This is in sharp contrast with the report of 79% of the parents who thought that pain management in the hospital was satisfactory.

DISCUSSION

A limitation of the present study is that pain intensity ratings were not obtained from the children themselves. In a previous study, many children were able to rate their pain using faces pain scales (Hamers et al., 1999). However, in the present study not all children were cognitively able to rate their pain using self-report scales. Furthermore, most of the children were not able to give an indication of average pain. Therefore, we decided to use parents’ ratings of pain intensity. In future studies the use of diaries by (older) children using for example faces pain scales are recommended.

In this study parents rated the pain using VAS’s. VAS’s are generally considered as reliable measures of the intensity of pain (e.g., Huskisson, 1983; McGuire, 1988). However, by asking parents to focus on children’s pain intensity there is a risk that parents overestimate pain intensity scores. Therefore, parents of children undergoing myringotomy or adenoidectomy were also asked to rate children’s average pain intensity. From different studies it is known that postoperative pain following myringotomy is almost nil (Tan et al., 1994), and that pain intensity scores following adenoidectomy can be situated between pain intensity scores following myringotomy and tonsillectomy (Finley et al., 1996; Kokki et al., 1997). The data of this study have shown the expected differences in pain intensity between the 3 different patient groups, supporting the validity of pain intensity scores of parents from (adenotonsillectomy) patients.

Especially following (adenotonsillectomy) children suffer clinically significant pain at home, according to their parents. This finding is similar to the results reported in the literature (Gedaly-Duff and Ziebarth, 1994; Finley et al., 1996). In studies by Rømsing et al. (1998) and Warnock and Lander (1998) children rated their pain to be intense or moderately intense the first 3 days.

Although children suffer pain at home, this does not necessarily mean that parents adequately manage children’s pain. The evidence is otherwise; post-tonsillectomy pain is poorly managed (Rømsing et al., 1998; Warnock and Lander, 1998). In the present study a number of parents stopped the administration of analgesics based on their (false) beliefs regarding the side effects of paracetamol. The impact of false beliefs and attitudes on the prescription and administration of
analgesics by nurses and physicians respectively, has been reported extensively in the literature (e.g., Schechter et al., 1986; Elander et al., 1991; Hamers et al., 1994). These beliefs are acquired early in life and are deeply rooted in people’s attitudes towards pain management in general. Caution in the use of medications especially with regard to children is as a result pervasive.

Furthermore, it should be stressed that parents in the hospital were given no uniform instructions regarding the administration of paracetamol (scheduled administration or as needed). These findings have also been reported in the literature (Gedaly-Duff and Ziebarth, 1994; Finley et al., 1996; Woodgate and Kristjanson, 1996). According to Brodsky et al. (1993) practitioners vary widely in regards to the instructions they give to their patients. This also holds true for instructions regarding postoperative diet following (adenol)tonsillectomies. Furthermore, a survey of textbooks revealed little consistency in the recommendations for postoperative (adenol)tonsillectomy instructions (Brodsky et al., 1993). As a result, clear and unambiguous instructions for pain management are needed. Obviously these instructions should be evidence-based. Furthermore, it is recommended to provide parents with a (hospital) phone number where they can call on with questions regarding the postoperative pain management.

Although the examination of the effects of pain medication was beyond the scope of this study, other studies revealed indications that in the early postoperative period at home paracetamol does not provide sufficient pain relief in children following tonsillectomy (Romsing et al., 1998; Warnock and Lander, 1998). As a result, further research regarding the efficacy of analgesics is warranted.

In addition to pain, the prevalence of related problems in this study was obvious. A significant number of parents reported problems regarding eating, fluid intake, vomiting and sleep disturbance. Furthermore, many parents reported changes in the behaviour of their child after the surgery. These findings have also been reported by Sutters and Miaskowski (1997). According to these authors these problems are related to the child’s pain experiences; children with higher pain intensity scores experienced more sleep disturbances, poorer oral intake, and more behavioural changes during the first 24 hours after surgery. The problems regarding the oral intake of food and fluids have been reported by other investigators (Brodsky et al., 1993; Bartley and Connell, 1994). As mentioned earlier there is a need for clear instructions regarding postoperative diet and dealing with pain-related problems following (adenol)tonsillectomies.

Retrospectively, bad experiences often may look less bad. Hamers (1995) reported that many parents who rated early postoperative pain following (adenol)tonsillectomy as severe, later indicated that they had probably overestimated the child’s pain. However, this seems not to hold true for the children themselves. In the present study almost 70% of the children recalled severe pain experiences in the hospital. This finding adds to the evidence that still further research is needed on effective analgesia and non-pharmacological methods for relieving children’s pain following (adenol)tonsillectomy.

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Are childhood adversities relevant in patients with chronic low back pain?

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Previous studies have found a high number of childhood adversities in patients with chronic low back pain, particularly in patients reporting persisting problems after back surgery. Our aim was to reproduce these results. Within the framework of a comprehensive diagnostic assessment and psychometric evaluation, 109 inpatients who had been treated for low back pain were examined in the orthopedics department of a German university hospital. Five risk factors investigated by Schoferman and his staff (Schoferman et al., 1993) were re-assessed in all of our patients using a structured biographical interview. The German chronic low back pain group was also compared with an age- and gender-matched control group of 109 non-chronic pain patients with respect to these childhood adversities and additional ones.

Only approximately 11% of the German chronic low back pain sample demonstrated three or more risk factors, compared with more than 50% in Schoferman’s sample, and 47.7% showed none of the five risk factors, compared to only 11% in the Schoferman sample. Moreover, no significant differences in distribution either in terms of the individual risk factors or their cumulative frequency were found in the German chronic low back pain group compared with an age and gender-matched control group without chronic pain.

Childhood adversities do not occur frequently in a non-selected group of patients with chronic low back pain. Earlier results showing an increased likelihood of the occurrence of psychosocial risk factors could not be confirmed. As a consequence, further psychosocial or psychosomatic diagnostics of patients with chronic low back pain are needed to define diagnostic subgroups. © 2002 European Federation of Chapters of the International Association for the Study of Pain. Published by Elsevier Science Ltd. All rights reserved.

KEYWORDS: childhood adversities, psychosocial risk factor, low back pain, chronic pain, failed back.

INTRODUCTION

Previous studies have repeatedly investigated the influence of psychosocial factors on the initial occurrence and course of back pain (Gatchel et al., 1995; Croft et al., 1996). All studies found psychosocial and psychosomatic factors to be better in predicting treatment success, regardless of whether surgical or conservative treatment was administered, than clinical or radiological findings (Polatin et al., 1993; Davis, 1994; Burton et al., 1995; Junge et al., 1995; Atlas et al., 1996; Schade et al., 1999; Atlas et al., 2000; Boos et al., 2000). Further, early psychosocial factors were also related to the initial occurrence of back pain or a negative course of treatment (Schoferman et al., 1992; Schoferman et al., 1993; McMahon et al., 1997). Thus, according to Schoferman et al., patients with prior surgery have a greater number of psychosocial risk factors during childhood than patients with no prior surgery. Altogether the number of risk factors in the patient group they examined was very high: more than 50% exhibited three or more risk factors such as sexual abuse, physical maltreatment, chemical...
dependence in one parent, loss of a primary caregiver, or emotionally neglect. It appears to be particularly important to confirm these results as similar associations have been found for other patients with chronic pain (Goldberg et al., 1999) and in distinct diagnostic groups, such as patients with somatoform pain disorder (Egle and Nickel, 1998) or fibromyalgia (Walker et al., 1997; Wolfe and Hawley, 1998; Van Houdenhove et al., 2001).

A high frequency of these risk factors has also been found in non-patient populations with back pain, particularly in women (Linton, 1997). In women who reported sexual abuse during childhood or adulthood, the risk of developing severe episodes of back pain during the investigation period was four times higher. Among those with physical maltreatment the rate was even five times higher. In both controlled retrospective and in prospective studies (Bryer et al., 1987; Baydar and Brooks-Gunn, 1991; Werner and Smith, 1992; Mullen et al., 1996; Kessler et al., 1997; Felitti et al., 1998; Hotopf et al., 1999; Finestone et al., 2000), a link was found between the presence of psychosocial risk factors during childhood and adolescence and psychological disorders and frequent physical illnesses.

OBJECTIVES

Some authors regarded patients with chronic low back pain to be a psychologically distressed group (Long et al., 1988; Schofferman et al., 1993). Particularly patients with high chronicity are considered abnormal in terms of their mental health, i.e. patients with a history of surgeries and persistence of reported problems, repeated inpatient and outpatient treatment, including the so-called failed back patients (Long et al., 1988; Polatin et al., 1993).

In the present study we investigated whether patients with chronic back pain demonstrate a high frequency of childhood risk factors, as described by Schofferman and his colleagues (Schofferman et al., 1993). To this end, we evaluated and compared inpatients at an orthopedic university hospital being treated for chronic low back pain and an age and gender-matched control group without chronic pain.

In addition to the risk factors investigated by Schofferman et al. (1992, 1993), we investigated factors that in previous studies had shown themselves to be relevant for the later occurrence of psychological and physical problems. The two central aims were:

1. To re-examine the frequency of occurrence of childhood risk factors described by Schofferman et al. in patients with chronic refractory low back pain.

2. To determine whether patients with low back pain differ from an age and gender-matched control group without chronic pain in terms of the cumulative frequency of the risk factors investigated.

METHOD

Hundred and nine inpatients consecutively treated in the department of orthopedics at a German university hospital for chronic low back pain were investigated during the first 2 days after admission, directly before discharge, and 1 year after the end of treatment. Patients who exhibited additional severe physical diseases were excluded. All patients underwent the entire diagnostic admission procedure, including a clinical examination, CT and MRI, and further examinations as needed. We included patients with different degrees of disc abnormalities and neural compression as well as those without any relevant abnormalities. Again each patient was examined in the clinic at the 1-year follow-up visit.

The control sample was taken from a running study. Patients with chronic pain and mental illness were excluded. Hundred and nine patients either attending the outpatient surgical unit for a radial fracture or consulting a general practice for an infection or accident were selected randomly so as to obtain an age and gender-matched sample.

Socio-demographic data, medical and psychosocial history were collected in a structured interview (Egle, 1993) administered by interviewers trained for this purpose, in order to achieve a high inter-rater reliability. The interviewers were not involved in the diagnostic process. Furthermore this data was compared to an
independent psychosomatic examination carried out in a subgroup of these patients by an experienced consulting physician. A detailed clinical, medical and psychosocial history constituted the core of this psychosomatic examination.

Both groups investigated showed no significant differences with respect to social class, as determined by surveying the school certificate/formal education level, occupation, and marital status.

The risk factors evaluated according to Schofferman et al. were defined as follows:

**Physical abuse**: regular or frequent, uncontrolled physical violence from caregivers.

**Sexual abuse**: defined exclusively as sexual intercourse and/or genital manipulation performed by a caregiver who was at least 5 years older. Schofferman et al. employed a broader definition, additionally including the showing of genitals.

**Chemical dependence**: alcohol or drug dependence in a primary caregiver. In contrast to the work of Schofferman et al., the patient’s evaluation was not included in the assessment of this factor, i.e., whether the patient judged the person in question to be dependent or not. Nor was the evaluation of the patient included as to whether he judged those in question to be dependent or not. In the current study we also include other emotional disorders in the parents, particularly symptoms of an anxiety disorder, depression, or suicidal tendencies. Therefore we expected to have a greater number of risk factors in this area.

**Abandonment**: Death or loss (separation or divorce) of a close caregiver. We forewent an additional evaluation like that of Schofferman et al. for the purpose of inquiring about an important and disruptive event accompanied by the feeling of being abandoned and helpless. In each instance the presence or absence was scored. This too is likely to increase the total number of risk factors.

**Emotional neglect or abuse**: Using a visual analogue scale from 0 to 100, the patients were able to report separately for father and mother how sound the relationship with each parent was. The relationship with the parents was rated good when the sum of each was over 100, i.e. more than 50% of the maximum score. Schofferman et al. rated statements as accurate if the interviewer interpreted the patient’s assessment as neglect. Judging from our previous experience in using this measurement procedure on other patient populations, the chosen value is to be viewed as a reasonable cut-off, but one where we must reckon with a somewhat higher number of reported, less supportive relationships with the parents.

The study by Schofferman et al. is described in more detail elsewhere (Schofferman et al., 1993). They used a (semi-structured) interview to determine the risk factors. Additionally, a psychiatrist judged some of the risk factors as being present or not.

Since we left out this step in the current investigation, we should have a greater number of reported adversities. The most essential difference in the data collection was that Schofferman et al. assessed the risk factors in their sample until age 21, whereas in the present study they were assessed until age 15. This means that a greater number of risk factors is likely to be found in the sample of Schofferman et al. Yet, we may assume that the highest incidence of risk factors investigated here are likely to have occurred by age 15.

Based on several prospective studies and a series of well-controlled retrospective studies (Bryer et al., 1987; Baydar and Brooks-Gunn, 1991; Werner and Smith, 1992; Fergusson et al., 1996; Kessler et al., 1997; Felitti et al., 1998; Johnson et al., 1999; Van Houdenhove et al., 2001 among others), there is scientific evidence that psychosocial adversities during childhood and early adolescence have long-term consequences for mental well-being in adulthood. The chances of developing psychic and psychosomatic disorders in adulthood increase significantly according to the frequency of such factors. For example those exposed to sexual abuse during childhood, the most frequently evaluated risk factor, have a greater risk of sexual vulnerability during adolescence. Severe sexual abuse during childhood is related to risky behavior in adolescence and early adulthood, to earlier onset of sexual activity, unprotected intercourse, sexually transmitted diseases, multiple sexual partnerships, rape and attempted rape (Fergusson et al., 1996, 1997).
Nevertheless, this is the most essential difference between the groups investigated. To control for a potential bias we also compared the results to a matched control group of patients without chronic pain. Another reason for this comparison was that the rate of sexual abuse in the German sample was found to be lower by a factor of 3 compared to the American data (Wetzels, 1997).

Statistical evaluation

Significant group differences in terms of qualitative data were checked with the Chi-square analysis. Independent samples were compared using two-sample $t$-tests, and in cases of non-normal distribution a logarithmic transformation [ln(raw value + 1)] was performed beforehand. The statistical evaluation was carried out using SPSS 10.

RESULTS

Hundred and nine patients with chronic low back pain consecutively treated at the department of orthopaedics in a German university hospital were included in the study. 59.6% were men and 40.4% women. The average age was 43.4 years. The average duration of illness was 55.7 months and patients with previous surgery ($n = 30$) had a longer duration of illness, had consulted more physicians, and had spent more time in hospital because of back pain (Table 1).

The two low back pain samples compared (Table 2) had a similar age and gender distribution.

Regarding each of the five risk factors investigated by Schofferman, no significant difference arose between the control sample and the German low back pain sample (Table 3). Nor did we find differences in terms of their cumulative frequency. In each instance, 50% (matched control) and 47.7% (chronic low back pain sample) reported none of the five risk factors. In the Schofferman sample this was only 10.9%. Only very few of those examined (6.8% of the control group, 11.0% of the chronic low back pain sample) reported 3 or more risk factors, compared to 52.5% in Schofferman’s sample. Following Schofferman and colleagues, we tested the extent to which significant differences exist between patients with and without prior surgery. The two groups with 0 to 2 risk factors and

<table>
<thead>
<tr>
<th>TABLE 1. German low back pain sample.</th>
<th>No surgery</th>
<th>Surgery</th>
<th>Total</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>79</td>
<td>30</td>
<td>109</td>
<td></td>
</tr>
<tr>
<td>Gender (female, $n$, %)</td>
<td>30 (38.0)</td>
<td>14 (46.7)</td>
<td>44 (40.4)</td>
<td>n.s. $^a$</td>
</tr>
<tr>
<td>Age (mean, SD)</td>
<td>40.3 (10.7)</td>
<td>46.0 (9.5)</td>
<td>43.4 (9.9)</td>
<td>n.s. $^a$</td>
</tr>
<tr>
<td>Age at onset of back pain (M, SD)</td>
<td>36.6 (10.0)</td>
<td>38.4 (10.4)</td>
<td>n.s. $^a$</td>
<td></td>
</tr>
<tr>
<td>Duration of illness (month, M, SD)</td>
<td>59.1 (61.7)</td>
<td>59.4 (86.9)</td>
<td>55.7 (74.2)</td>
<td>&lt;0.0001 $^{b,c}$</td>
</tr>
<tr>
<td>‘Doctor shopping’ (M, SD)</td>
<td>2.5 (2.4)</td>
<td>4.1 (2.1)</td>
<td>2.8 (1.7)</td>
<td>&lt;0.0001 $^{b,c}$</td>
</tr>
<tr>
<td>Inpatient treatment (weeks, M, SD)</td>
<td>1.3 (4.5)</td>
<td>10.0 (9.4)</td>
<td>3.7 (7.3)</td>
<td>&lt;0.001 $^{b,c}$</td>
</tr>
<tr>
<td>Time out of work during the past two years (weeks, M, SD)</td>
<td>4.5 (10.7)</td>
<td>18.8 (30.3)</td>
<td>8.5 (19.3)</td>
<td>&lt;0.001 $^{b,c}$</td>
</tr>
</tbody>
</table>

$^a$Chi-square; $^b$two-sample $t$test for independent samples; $^c$logarithmic transformation: ln(raw value + 1).

<p>| TABLE 2. Age, sex and duration of complaints in the low back pain samples. | German low back pain sample | Schofferman and co-workers |
|---|---|---|---|---|---|---|</p>
<table>
<thead>
<tr>
<th>Feature</th>
<th>no surgery</th>
<th>prior surgery</th>
<th>no surgery</th>
<th>prior surgery</th>
<th>no surgery</th>
<th>prior surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>M (Range)</td>
<td>43.3 (24–60)</td>
<td>46 (26–58)</td>
<td>43 (28–64)</td>
<td>43 (26–72)</td>
<td></td>
</tr>
<tr>
<td>Duration (month)</td>
<td>M (SD)</td>
<td>39.1 (81.7)</td>
<td>99.4 (86.9)</td>
<td>33</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Gender (female)</td>
<td>N (%)</td>
<td>30 (39.0)</td>
<td>14 (46.7)</td>
<td>19 (42.2)</td>
<td>28 (50.0)</td>
<td></td>
</tr>
</tbody>
</table>
TABLE 3. Cumulative risk factors.

<table>
<thead>
<tr>
<th>Adversities</th>
<th>Control</th>
<th>German CLBP-sample</th>
<th>Schofferman and co-workers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no pain</td>
<td>no surgery</td>
<td>surgery</td>
</tr>
<tr>
<td></td>
<td>n=109*</td>
<td>n=79</td>
<td>n=30</td>
</tr>
<tr>
<td>0</td>
<td>55 (50.5)</td>
<td>38 (46.1)</td>
<td>14 (46.7)</td>
</tr>
<tr>
<td>1</td>
<td>34 (31.2)</td>
<td>20 (25.3)</td>
<td>9 (30.0)</td>
</tr>
<tr>
<td>2</td>
<td>14 (11.9)</td>
<td>13 (16.5)</td>
<td>3 (10.0)</td>
</tr>
<tr>
<td>3</td>
<td>5 (5.5)</td>
<td>5 (6.3)</td>
<td>3 (10.0)</td>
</tr>
<tr>
<td>4</td>
<td>1 (1.0)</td>
<td>3 (3.8)</td>
<td>1 (3.3)</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>


*Control (no chronic pain) × (no surgery) × (prior surgery) (German low back pain sample), df = 2, Chi-square \((3 \times 2) = 1.77\), n.s.;

*bControl (no chronic pain) × German low back pain sample × Schofferman, df = 2, Chi-square \((3 \times 2) = 76.7, p < 0.0001\);

no surgery × (prior surgery in the Schofferman sample: df = 1, Chi-square \((2 \times 2) = 0.92, p = n.s.\)

3 or more risk factors, respectively, were tested against each other. There was no significant difference between the German low back pain patients with and without prior surgery, and the same was true for the sample of Schofferman, but with a significantly higher total amount of risk factors.

Even though more adversities were taken into consideration than by Schofferman *et al.* in their study, the German low back pain sample did not differ significantly from the control group with regard to nearly all adversities investigated (Table 4).

The only two exceptions do not belong to the risk factors originally investigated by Schofferman and colleagues. Moreover, a decisive comparison would be, in the sense of Schofferman *et al.*, between the groups of patients with prior surgery and those without. However, these two groups showed no differences.

DISCUSSION

The present study investigated the extent to which childhood risk factors are related to chronic low back pain. The work by Schofferman *et al.* (1992, 1993) formed one basis for this study as we attempted to reproduce their results. Additionally we compared the frequency of childhood adversities in the sample of low back pain patients with a matched control group of patients (general practitioner) without chronic pain.

Although the relevance of biographical data was underlined (Van Houdenhove *et al.*, 1994), the most telling criticism of retrospective studies on childhood adversities, and thus to the present as well as to Schofferman’s study, is that recollection is biased. This was examined in some studies on patients with a depressive disorder assuming a possible confounding effect of present mood on memories of the past (Lewinsohn *et al.*, 1980; Parker, 1981; Robins *et al.*, 1985; Kendler *et al.*, 1991; Bemporad and Romano, 1993; Van Houdenhove *et al.*, 1994). These studies demonstrate a tendency for more false-negative than false-positive results regarding childhood adversities. Prospective studies themselves have major problems and traps, an example being the prospective study on childhood victimization and pain in adulthood by Raphael and colleagues (Raphael *et al.*, 2001). They use ‘documentation by the court’ to investigate traumatization and this may be a relatively reliable criterion, yet it generally leads to steps, i.e. some form of interventions, that can prohibit long-term negative effects of the trauma (compensatory effective protective factor). Raphael and colleagues do not take this into consideration. In another prospective study (Fergusson *et al.*, 1996, 1997), a large representative cohort of 520 New Zealand-born young women was studied in regular intervals from birth to age 18. In this study the authors
TABLE 4. Risk factors during childhood and adolescence.

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>German LBP-sample</th>
<th>χ²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no pain</td>
<td>no surgery</td>
<td>surgery</td>
</tr>
<tr>
<td></td>
<td>n = 109</td>
<td>n = 79</td>
<td>n = 30</td>
</tr>
<tr>
<td>Gender (female)</td>
<td>n (%)</td>
<td>44 (40.4)</td>
<td>30 (38.0)</td>
</tr>
<tr>
<td>Age (year)</td>
<td>M (SD)</td>
<td>43.5 (16.0)</td>
<td>43.3 (10.7)</td>
</tr>
<tr>
<td><strong>Childhood adversities</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death of a parent a</td>
<td>n (%)</td>
<td>11 (10.1)</td>
<td>11 (13.9)</td>
</tr>
<tr>
<td>Severe sexual abuse b</td>
<td>n (%)</td>
<td>7 (6.4)</td>
<td>1 (1.2)</td>
</tr>
<tr>
<td>Poor emotional relationship with parents b</td>
<td>n (%)</td>
<td>15 (13.8)</td>
<td>18 (22.8)</td>
</tr>
<tr>
<td>Frequently beaten/physical maltreatment b</td>
<td>n (%)</td>
<td>19 (17.4)</td>
<td>11 (13.9)</td>
</tr>
<tr>
<td>Father chronically physically ill physically handicapped</td>
<td>n (%)</td>
<td>22 (20.2)</td>
<td>10 (12.7)</td>
</tr>
<tr>
<td>Mother chronically physically ill physically handicapped</td>
<td>n (%)</td>
<td>23 (21.1)</td>
<td>19 (24.1)</td>
</tr>
<tr>
<td>Father with mental illness/ addiction b</td>
<td>n (%)</td>
<td>14 (12.8)</td>
<td>9 (11.4)</td>
</tr>
<tr>
<td>Mother with mental illness/ addiction b</td>
<td>n (%)</td>
<td>6 (5.5)</td>
<td>8 (10.1)</td>
</tr>
<tr>
<td>Separation/divorce of parents b</td>
<td>n (%)</td>
<td>8 (7.3)</td>
<td>12 (15.2)</td>
</tr>
<tr>
<td>Chronic family discord with physical arguments</td>
<td>n (%)</td>
<td>41 (37.6)</td>
<td>32 (40.5)</td>
</tr>
<tr>
<td>Parents under work tension from early on in patient’s life</td>
<td>n (%)</td>
<td>59 (54.1)</td>
<td>32 (40.5)</td>
</tr>
<tr>
<td>Poor economic situation during first 7 years of patient’s life</td>
<td>n (%)</td>
<td>27 (24.8)</td>
<td>32 (40.5)</td>
</tr>
<tr>
<td>Age difference to next sibling (&lt;18 month)</td>
<td>n (%)</td>
<td>31 (28.4)</td>
<td>24 (30.4)</td>
</tr>
</tbody>
</table>

aChi-squared tests (3 × 2) between the 3 groups: matched control, no surgery and prior surgery; bRisk factors evaluated by Schofferman and co-workers.

collected adversities as well as protective factors. Data on sexual abuse was collected retrospectively at age 18 due to severe practical and ethical problems.

With regard to the data collection and content, the study of Schofferman et al. and the present one is comparable, even though they differ in some aspects. The risk factors in the German sample were surveyed in a manner both simple and reproducible, foregoing an external assessment in order to avoid possible errors of interpretation. Contrary to the definition of Schofferman et al., this implies a somewhat higher number of risk factors. The fact that Schoffermann et al. employed a broader definition of sexual abuse and surveyed a longer time period, until age 21 as opposed to age 15 in the current study, could increase the number of risk factors they found.

In order to control for a potential bias even by minor differences in defining and evaluating risk factors, we additionally compared the results to a matched control group of patients without chronic pain. Another reason was that the rate of sexual abuse in the German sample was found to be lower by a factor of 3 compared to the American data (Wetzel’s, 1997). This allowed us to test the extent to which patients with chronic low back pain differed from the matched control group in terms of the psychosocial risk factors investigated during childhood and adolescence.

Thus, apart from some differences, we were able to test the central statement of the investigation by Schofferman et al., namely that patients with chronic low back pain exhibit a higher frequency of psychosocial risk factors during childhood and adolescence, and patients with lower back surgery have significantly more
adversities than those without prior surgery. These results could not be verified. Patients with or without prior surgery did not differ in terms of the risk factors investigated or in their cumulative frequencies. Beyond this, no significant difference arose between the German patients with chronic low back pain under investigation and the matched control group in terms of the cumulative frequency of the risk factors. In contrast, both groups differed distinctly from the sample of Schofferman et al. (Table 3). The clear difference to the results from Schofferman et al. can most easily be explained by a selection bias, due, for instance, to a special population seeking treatment with a high proportion of comorbid mental illnesses.

The relevance for childhood adversities in such diagnostic subgroups of chronic pain patients was found in patients with somatoform pain disorders (Egle and Nickel, 1998) and fibromyalgia (Walker et al., 1997; Wolfe and Hawley, 1998; Van Houdenhove et al., 2001). In controlled retrospective and prospective studies (Bryer et al., 1987; Baydar and Brooks-Gunn, 1991; Werner and Smith, 1992; Mullen et al., 1996; Kessler et al., 1997; Felitti et al., 1998; Hotopf et al., 1999; Finestone et al., 2000), the relevance of childhood risk factors for the occurrence of later mental and physical illnesses has been shown.

Therefore, the discrepancy in the results might be explained by the relevance of diagnostic subgroups. Accordingly, it might be possible that patients with chronic low back pain and an additional psychological comorbidity (Polatin et al., 1993) or a strong disposition to somatize (Nickel et al., in press (a); Nickel et al., in press (b)) have a worse outcome of treatment. This would mean that chronic low back pain patients would have to be differentiated in such a way so as to include details on important psychopathological findings such as anxiety, depression, or disposition to somatize.

Moreover, it has been verified (Atlas et al., 1996; Hollingworth et al., 1998; Schade et al., 1999; Atlas et al., 2000; Boos et al., 2000) that social factors and the influence of the healthcare system are relevant for the chronification of reported problems and on treatment outcomes. Quite possibly the interaction between social and psychosocial factors (consisting of comorbid mental illness and childhood adversities among others) may ultimately play a decisive role (Gatchel et al., 1995).

As a consequence, the assumption that there is a direct link between childhood adversities and pain syndromes in adulthood is oversimplified. The relationship is likely to be complex, and the common assumption that medically unexplained pain is of psychological origin should also be questioned. There is no doubt that there is a need for more sensitive and comprehensive investigative methods, and that social factors and healthcare systems may also be relevant.

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Pain-related fear in acute low back pain: the first two weeks of a new episode

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The overall aim of this study was to explore the natural course of pain-related fear during the early stage of a new low back pain episode, using a prospective case series design. Specific research questions addressed the existence of typical patterns in individual time series of pain-related fear and sequential relationships between the occurrence of pain-related fear, pain and pain catastrophizing. Forty-four general practice patients who consulted their physician with a new episode of non-specific low back pain were recruited. They completed diaries on pain-related fear, pain and pain catastrophizing for 14 days following the consultation. Follow-up questionnaires on disability were completed at 3 months and 12 months. Time series analyses produced subgroups of patients with descending, stable and rising levels of pain-related fear over the 2-week period. These groups differed on baseline characteristics and outcome at follow-up. A time-shift between the occurrence of pain-events and pain-related fear or pain catastrophizing could not be demonstrated.

In summary, these results fit in with previous findings in chronic patients. A relevant subgroup of patients who might benefit from early intervention could be identified. These findings support the need for further research into fear mechanisms in acute low back pain. © 2002 European Federation of Chapters of the International Association for the Study of Pain. Published by Elsevier Science Ltd. All rights reserved.

KEYWORDS: acute low back pain, pain-related fear, kinesiophobia, fear-avoidance model.

INTRODUCTION

Chronic low back pain and its consequences account for important medical and socioeconomic problems. Lifetime incidence of low back pain is high; 59–70% of all adults will experience low back pain at some stage of their life (Picavet et al., 1996; Andersson, 1999). Non-specific low back pain by its nature appears to be a universal, benign, self-limiting condition, although residual symptoms and recurrences are common (Waddell, 1998). Most patients recover within a few weeks, but those who do not, are at risk of developing a chronic pain syndrome. This relatively small group of chronic low back pain patients is faced with physical disability, work absenteeism and a range of psychological problems (Dionne, 1999). Given the serious consequences of chronic pain, and because sufficient evidence supporting primary prevention of acute low back pain is still lacking, it seems to be more appropriate to look for possibilities to prevent acute pain from becoming chronic (Linton et al., 1993).

The easiest way to select patients at risk is to wait and see for some weeks. Most episodes of back pain resolve spontaneously within days or a few weeks, often without work loss or health care. Those patients who are still off work after a
month have a 20% risk of chronic disability (Waddell, 1998). This self-selected group requires special attention from health care providers to prevent long-term problems. This course of action is adopted for example by the Dutch General Practice Guideline for Low Back Pain (Faas et al., 1996). A drawback of this approach is however, that it may be difficult to reverse the negative consequences of back pain once it has already existed for several weeks.

Another option is early screening of all acute back pain patients, in order to identify high-risk patients as soon as possible. Preventive intervention during the acute stage might be easier to do and more cost-effective than rehabilitation of subacute or chronic patients (Linton, 1999). For example screening on 'psychosocial yellowflags' has been found to be an effective tool to early select patients with a poor prognosis (Linton and Hallden, 1998; Hurley et al., 2000, 2001).

A recently developed concept, that may be useful as a theoretical framework for early screening and intervention, is the fear-avoidance model (Lethem et al., 1983; Asmundson et al., 1999; Vlaeyen and Linton, 2000). Several studies (Crombez et al., 1999; Vlaeyen et al., 2001) support this cognitive-behavioural model in explanation of the development of chronic musculoskeletal pain. Key variables in this model are the level of pain catastrophizing and associated pain-related fear a patient reports as a response to a back pain experience. In back pain patients, pain-related fear often shows as a specific fear of movement or reinjury. Some low back pain patients are highly fearful of typical movements in which the spine is involved (for example twisting, rotating or bending) and accompanying pain signals (Kugler et al., 1999). Fearful patients strongly believe that these particular movements will cause serious damage to their backs. This fear of a possible negative influence of movement on pain and recovery can result in the patient avoiding specific activities or movements. When this avoidance behaviour persists beyond the acute stage of a low back pain episode, this may have detrimental consequences, such as increasing disability (both physically and socially), physical deconditioning (due to disable) and a lower pain threshold (due to both psychological and physiological responses). The patient is likely to end up in a cycle of fear, inactivity, disability and pain.

Within the framework of this theory it is unclear whether pain-related fear plays a crucial role in the process of acute pain becoming chronic, or that it is merely a maintaining factor once a patient has developed a chronic pain syndrome. In order to obtain an answer to this question, research should focus on acute patient populations and longitudinal designs. For example, Linton et al. (2000) studied the role of fear-avoidance beliefs in a general population in relation to the inception of back pain. Their results indicate that fear-avoidance beliefs may be important at a very early stage in the development of back pain and associated activity limitations. Another recent study showed fear-avoidance beliefs about work in acute patients to be significant predictors of disability and work status after 4 weeks (Fritz et al., 2001).

The overall aim of the study presented in this paper is to explore the characteristics of pain-related fear during the acute stage of low back pain. Daily measurements and time series analysis techniques are used to create a detailed picture of the first 2 weeks of a back pain episode. Specific research questions are: (1) What is the course of pain-related fear and pain intensity during the first 2 weeks after consultation? (2) Within the first 2 weeks after consultation, are increases in pain preceded or followed by increases in pain-related fear and/or pain catastrophizing?

**METHODS**

**Subjects**

Subjects were patients of 16 general practices located in the southern part of the Netherlands and the Flemish-speaking region of eastern Belgium. Patients who consulted their physician (GP) between September 1999 and January 2000 with a new episode of low back pain were recruited. A new episode of low back pain is defined as: (1) pain localized below the scapulae and above the gluteal folds (following IASP
taxonomy (Merskey and Bogduk, 1994)), (2) duration since time of pain onset no longer than 2 weeks, (3) after a period of at least 3 months without significant activity limitations due to back trouble. Additional selection criteria were (4) 18–65 years of age, (5) no specific cause or strong suspicion of specific cause (such as a tumour, inflammation or vertebral fracture), (6) no pregnancy, (7) sufficient knowledge of Dutch/Flemish language and (8) informed consent.

**Measures**

Following the GP-visit, patients completed a general questionnaire concerning back pain history and current back pain episode. They also completed a set of standardized questionnaires addressing concepts of pain-related fear, pain catastrophizing and back pain disability. Both pain-related fear and back pain disability were reassessed 2 weeks later. Back pain disability was measured again after 3 months and at 12 months. In between baseline and first follow-up measurement the patients kept a diary with items on pain-intensity, pain-related fear and pain catastrophizing for 14 days.

**Pain-related fear:** The Dutch version of the Tampa Scale for Kinesiophobia (TSK) (Miller et al., unpublished report; Vlaeyen et al., 1995) measures the level of fear related to pain. The term kinesiophobia refers more specifically to fear of movement or (re)injury due to movement. The TSK is a 17-item 4-point scale questionnaire designed for application in a back pain population. Reliability and validity of the TSK Dutch version are well established (Vlaeyen et al., 1995; Goubert et al., 2000).

**Pain catastrophizing:** A Dutch version of the Pain Catastrophizing Scale (PCS) (Sullivan et al., 1995) was used in this study to determine patients' thoughts and feelings about pain. This scale consists of 13 items. Patients indicate on a 5-point scale the extent to which they have catastrophic ideas about pain. The PCS has been shown to have good reliability and validity (Osman et al., 1997; Van Damme et al., 2000).

**Back pain disability:** The Dutch translation of the Roland Disability Questionnaire (RDQ) (Roland and Morris, 1983; Gommans et al., 1997) was used in this study. The RDQ is designed to specifically determine the level of back pain related disability and consists of 24 yes/no-items on the ability to perform common daily activities. The number of yes-answers indicates the level of difficulty to perform these activities without help. The RDQ is known as a reliable and valid instrument (Deyo et al., 1998; Bombardier, 2000).

**Diary:** A diary consisting of several visual analogue scales (VAS) was completed every day for 14 days. A single VAS-item (a 10 cm horizontal line fixed left and right by the words ‘no pain’ and ‘worst imaginable pain’) was included to measure the current pain intensity. Other sets of VAS-items were derived from the TSK (4 items) and the PCS (3 items). The diary has not yet been validated for this purpose, however this method was successfully applied in an intervention study that was aimed at reducing pain-related fear and associated disability levels (Vlaeyen et al., 2001).

**Analyses**

Separate analyses were performed to answer both research questions.

(1) **Course of pain-related fear over time:** Individual patterns of pain, pain-related fear and pain catastrophizing were described using time series analysis (TSA). In TSA a regression equation is fitted for each subject's series of daily VAS-scores, including a correction factor for possible dependency between successive measurements (autocorrelation). In this study the AREG (AR1) autoregression-model was used to describe the time series data of each subject. Because of the limited number of measurements only complete datasets could be analysed. Individual lines were then clustered in subgroups of positive slopes ($b_1 \geq 1$ mm/day), negative slopes ($b_1 \leq -1$ mm/day) and stable slopes.
(−1 < b1 < 1 mm/day). Kruskal Wallis tests and Chi-squared tests were performed to determine differences on baseline variables between groups with different patterns. Differences on follow-up outcome were tested by MANOVA-procedures.

(2) Sequential relationships: An SPSS-algorithm was developed to determine any possible sequential order (time-shift) in the occurrence of sudden increases in pain, pain-related fear and pain catastrophizing. The goal of this algorithm is to filter out peak-segments in individual pain graphs and corresponding sequences in time in pain-related fear and pain catastrophizing graphs. A pain-peak-day was defined as the first day in a subject’s time series on which the VAS-value for pain intensity was 15 mm higher than 2 days before. Whenever the SPSS-algorithm detected such a sudden rise, all available data extending from 4 days before the peak-day to 4 days after the peak-day were extracted. All sequences originating from individual data sets were collected and mean levels for each day relative to the peak-day were calculated. Differences between the levels of pain-related fear and pain catastrophizing before, during and after the peak-day were determined by Wilcoxon signed ranks tests.

RESULTS

Subject characteristics

Forty-four patients met the selection criteria and completed baseline questionnaires. The sample consisted of 22 men and 22 women with a mean age of 42.7 years (SD = 10.8). Twelve patients (27.3%) reported no previous episodes; another 12 patients (27.3%) experienced three or less episodes before. Mean RDQ-score (level of disability) at baseline was 13.8 (SD = 5.4). Of the total sample, 37 participants (84.1%) were working at the time of the study, 4 individuals (9.1%) were on long-term sick leave. According to data from our self-report questionnaire, thirty-five patients (79.5%) consulted their physician within 14 days of the onset of their complaints. However, accurate determination and/or recall of the day of pain-onset seemed difficult for many patients. Physicians’ judgements about episode length were used instead, and data from all subjects were used for further analyses.

At the 2-week follow-up assessment, complete data sets with regard to the diaries were obtained of 34 subjects (77.3%). After 3 months 33 participants (75.0%) returned completed questionnaires, and full one-year follow-up data were gathered from 30 subjects (68.2%). No statistical significant differences on baseline characteristics were found between respondents and non-responders (p > 0.208).

Pain-related fear, pain catastrophizing and pain

(1) Course of pain-related fear over time: Complete datasets from 34 subjects could be analysed. After time series analyses of the daily measures of pain-related fear for each patient, 13 negative slopes (38.2%), 12 stable slopes (35.3%) and 9 positive slopes (26.5%) could be distinguished. Figure 1 shows a graph of mean levels of pain-related fear for each subgroup over the 14 consecutive days. The rising and descending time series could not be attributed to

FIG. 1. Mean-scores on daily VAS-measures of pain-related fear for subgroups with rising, stable and descending time series. n analysed = 34, missing n = 9: only complete data sets could be analysed by Time Series Analysis. --- descending pain-related fear: slope b ≤ −1 mm/day; n = 13, ...... stable pain-related fear: −1 < slope b < 1 mm/day; n = 12, —— rising pain-related fear: slope b ≥ 1 mm/day; n = 9.
regression-to-mean alone (Mann Whitney Test for slope by intercept; \( p = 0.248 \)). Simple regression analysis with slope as dependent and intercept as independent variables showed R-square to be 0.293, so only a minor part of the differences found could be attributed to a regression-to-mean effect. The subgroup of patients with a rising level of pain-related fear over time differed from the group with the descending pattern on one descriptive characteristic: the rising group reported a longer back pain history before the current episode (\( p = 0.004 \)).

In Table 1, differences in disability at follow-up between the descending pain-related fear group and the rising pain-related fear group are presented. MANOVA confirmed overall differences in follow-up outcome (\( p = 0.001 \) for overall course of RDQ). Post-hoc tests indicated that the mean level of baseline RDQ is lower in the rising group, but at 3-month and 12-month follow-up this group reported higher perceived disability than patients with descending pain-related fear patterns.

Figure 2 presents a graph of mean levels of pain for each of the three subgroups over the 2-week period. For the subgroups with descending and stable levels of pain-related fear, pain rapidly diminished. In patients with a rising pattern of pain-related fear, course of pain was probably different (MANOVA \( p = 0.08 \) for overall course of pain; post-hoc \( p < 0.05 \) for differences on days 8 to 10 and 12 to 14).

(2) **Sequential relationships:** In 42 individual sets of daily pain measures 28 peak-days were identified (maximum 1 peak-day per patient). Figure 3 shows the resulting mean graph, together with mean graphs of corresponding sequences in pain-related fear and pain catastrophizing. The defined increase in pain during the 2 days preceding the peak-day was accompanied by a rising level of pain-related fear (\( p = 0.022 \)), and pain catastrophizing tended to rise during this 2-day period (\( p = 0.106 \)). No time-shift between pain catastrophizing and pain or between pain-related fear and pain could be demonstrated; top-levels in pain-related fear and

![FIG. 2. Mean scores on daily VAS measures of pain for subgroups with descending, stable and rising time series on pain-related fear. \( n = 34 \), missing \( n = 9 \); only complete data sets could be analysed by Time Series Analysis. — descending pain-related fear: slope \( b < -1 \, \text{mm/day} \); \( n = 13 \), —— stable pain-related fear: \( -1 \leq \text{slope} b < 1 \, \text{mm/day} \); \( n = 12 \), —— rising pain-related fear: slope \( b \geq 1 \, \text{mm/day} \); \( n = 9 \).](image)

| TABLE 1. Mean values and standard deviations on disability (RDQ) at baseline, day 14, 3-months follow-up and 12-months follow-up for all subjects and groups with (1) descending and (2) rising patterns of pain-related fear as measured by daily VAS-items. \( p \)-values are from univariate post-hoc F-tests in MANOVA-procedure. |
|-----------------|---|---|---|---|
|                | Baseline | Day 14 | 3 months | 12 months |
|**Total**       | mean     |       |       |       |
| \( n = 34 \)    | 13.31    | 10.10  | 06.73  | 06.60 |
|**Group 1: descending fear** | mean |     |       |       |
| \( n = 13 \)    | 17.59    | 09.17  | 03.62  | 03.76 |
|**Group 2: rising fear** | mean |     |       |       |
| \( n = 9 \)     | 12.38    | 14.00  | 09.38  | 09.13 |
|**MANOVA (group 1 vs group 2)** | \( p \) | 0.032 | 0.136 | 0.010 |
|                |          |       |       | 0.040 |

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pain catastrophizing occurred on the same day as the peak in pain.

DISCUSSION

In recent years, several prospective cohort studies have been conducted to determine the predictive value of psychosocial factors as predictors of chronic low back pain disability in primary care (Linton, 2000). Few studies, however, have specifically addressed the role of pain-related fear in the development of chronicity. The purpose of the present study was to extend previous research by investigating the short-term course of pain-related fear during the acute stage of a new low back pain episode. A prospective case series design with sequential measurements was used to explore possible underlying cognitive mechanisms.

Summary of results

With respect to the actual course of pain-related fear during the acute stage of a back pain episode, subgroups of patients with descending, stable and rising levels of pain-related fear over time could be identified. These groups differed on levels of disability at baseline and follow-up. Although starting with low levels of disability, patients with rising pain-related fear levels were more disabled after one year. Furthermore, analyses regarding sequential relationships showed that increases in pain intensity were accompanied by increases in pain-related fear and probably its precursor pain catastrophizing as well. However, no time-shift between the occurrence of increases in pain, pain-related fear and pain catastrophizing could be demonstrated.

When comparing the results of this study with recent publications, another indirect but remarkable finding is that levels of pain-related fear in acute patients (mean = 39.1 and SD = 7.6 at baseline) are comparable (independent samples t-test not significant) to mean values found in subacute (mean = 37.0 and SD = 7.5 (Swinkels, 1999)) and chronic patients (mean = 40.1 and SD = 6.6 (van den Houw et al., 2001)), despite dissimilar clinical settings.

Patients with increasing fear: a subgroup at risk?

When discussing the interpretation and implications of the results, special attention must be paid to the TSA findings. In many patients pain-related fear showed a descending pattern over time, as could be expected as a result of natural recovery. A second substantial subgroup of patients showed stable patterns of pain-related fear, fluctuating around a rather low, not alarming level. The most striking result was the number of patients with steadily rising levels of pain-related fear. A few rising patterns were to be expected by chance, but a 26.5% subgroup cannot be ignored. These patients might be at risk of developing chronic disability. Their one-year outcome on disability strongly suggests a negative prognosis.

But why the observed rising patterns of fear occur in people, who initially report surprisingly low levels of disability and fear, remains unclear. The sudden increase in pain at the beginning of the second week is an intriguing, but as yet inexplicable finding as well. In the past, several mechanisms have been put forward to explain the development of fear and these are worthwhile considering also in the context of pain-related fear:

(1) Match-mismatch processes (as proposed by Arntz et al. (1991)), in which the pain a patient...
experiences does not match pain expectations, can result in increasing pain-related fear. It is quite possible that patients with a low level of disability expect that pain will fade away within a couple of days. However, when pain persists beyond the expected time, they may start worrying about the seriousness of the pain felt. Worrying about pain is a normal process that can be triggered by situational factors (increase in pain, awareness of somatic sensations) (Eccleston et al., 2001). The fact that patients in the rising fear group reported a longer back history before the current episode might add to the worry.

(2) The aetiology of fear might be attributed to UnConditioned Stimulus (UCS) inflation (Davey, 1992; Hosoba et al., 2001). A UCS—in this case pain—is being re-evaluated with new information about this stimulus, resulting in a stronger response (fear). Pain-related information can originate from several sources such as media, relatives, other patients as well as health care providers. Noticeably, Rainville et al. (1995) proposed that 'patients' attitudes and beliefs (and thereby patients disability levels) may be derived from the projected attitudes and beliefs of health care providers' (page 288).

But, which of these mechanisms are of importance in the development of fear in acute low back pain patients remains unclear, as no data concerning the specific models are gathered in this study.

Demonstrating causal relationships within a circular model

Another theoretical issue is that of causal relationships between pain catastrophizing, pain-related fear and pain. Because of the circular nature of the fear-avoidance model, a sudden pain-experience can as well be preceded or followed by an increase in pain-related fear. Close-up examination of graphs as performed in this study did not contribute to an answer to causality-questions. Although analysis of isolated peak-segments in pain graphs confirmed that an increase in pain indeed was accompanied by increases in pain-related fear and, probably, pain catastrophizing, sequential relationships could not be demonstrated, at least not within 24-hour intervals. This might be due to methodological shortcomings, but optimized methods might not reveal sequential differences either. Maybe any time-shift between pain and pain-related fear can only be demonstrated during the very first passage through the fear-avoidance cycle. After this first cycle, a clear distinction between causes and consequences might no longer exist, fading to permanent presence of both fear and pain, increasing and decreasing together at the same pace.

Methodological considerations

In describing the natural course of pain-related fear, single case techniques reveal details that cannot be noticed by group level analyses with appropriate, large sample sizes. Critical remarks can be made with regard to the design of this study however.

Firstly, the results could have been more meaningful if additional qualitative data collection during the 2-week period had been undertaken. In the present design, the patterns found in fear and pain cannot sufficiently be explained. It is likely that the time series are influenced by the occurrence of specific events (for example: return to work or resumption of sports activities). Replication of this study, including additional monitoring of the (co)-incidence of such events, can provide more clear evidence about underlying mechanisms.

Furthermore, the sensitivity of the method used for sequential analysis can be questioned. It is possible that a demonstrable time-shift between the occurrence of pain, pain-related fear and catastrophizing is lacking, because diaries were completed retrospectively. Use of more sensitive measures and shorter intervals are needed to test sequential relationships. Hand-held computer diary-methods can probably be helpful, because of the ability to produce longer time series with shorter intervals and more accuracy.

Finally, another methodological consideration addresses the definition of a new low back pain
episode. Although a new episode can be properly defined by its occurrence in time, a patient's cognitions accompanying this new episode will inevitably be influenced by any previous back pain experiences. The optimal, though very impractical, solution for this would be to identify and uniquely select patients with a very first back pain episode, who have never gone through the fear-avoidance-cycle before.

Conclusion

After considering the interesting results together with the suggestions for improvement of the design, it seems worthwhile to replicate this study with optimized techniques of measurement and analysis, and to search for ways to further examine pain and pain-related fear mechanisms in acute low back pain patients. It might possibly lead to clues to improve strategies to prevent chronic disability. For example, a recent study with fearful chronic patients has shown that by gradual exposure to specific feared movements, the patient's incorrect attributions can be readjusted (Vlaeyen et al., 2001), resulting in lower levels of pain-related fear. It is likely that fear-reducing treatment can also be effective to prevent chronic back pain disability in acute patients (e.g. Moore et al. (2000)). More knowledge about the exact object of a patient's pain-related fear and its origin and development, might contribute to the success of fear and disability reducing therapies.

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The auditory event related potentials in episodic and chronic pain sufferers

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To examine the cognitive processing differences in chronic and episodic pain sufferers, auditory event-related potentials (P300 or P3) were recorded in two consecutive trials from 23 chronic lower back pain patients, 22 episodic tension-type headache sufferers, and from 23 age- and sex-matched healthy persons. P3 latency and amplitude showed no difference between groups at first trial. Considering P3 latency habituation, healthy controls and episodic tension-type headache sufferers showed a significant change of P3 latency whereas lower back pain sufferers failed. Comparing the amount of habituation lower back pain sufferers stood clearly apart from healthy controls. Although there was a remarkable increase of P3 latency in episodic tension-type headache sufferers, the amount of habituation was not statistically different than it was in lower back pain sufferers. Significant P3 amplitude habituation was observed only in healthy controls. Actually, episodic tension-type headache sufferers also showed some degree of habituation, which was not statistically remarkable. The amount of amplitude habituation was not different between groups. No correlation was observed between P3 habituation and age, disease duration and symptom severity. These results may point to a disturbed attentional processing in chronic pain sufferers. Our findings suggest that in spite of a similar cortical information processing, the neurocognitive networks related with decision making and memory processing seem to work differently in chronic pain sufferers from those in episodic pain sufferers in repeating tasks. Taking into consideration the reported P3 habituation abnormalities in chronic migraine patients we can say that not the location of pain but rather its temporal pattern may have a role in disturbed attentional processing.

INTRODUCTION

Since the first report of Sutton et al. (1965) emphasizing the association of event related potentials (ERP) with cognitive activity, a great deal of work has been performed to establish the clinical significance of ERPs and to study brain mechanisms underlying cognition and to characterize information processing in normals and cognitively disabled populations. In particular, the major positive component with a latency of 300 ms (P300 or P3) after a stimulus is reported to be sensitive to the cognitive processes (Johnson, 1988). P3s are not specific to the modality of the eliciting stimulus; however, they vary with the psychological meaning of the stimulus to the subject (Picton and Hillyard, 1988). P3 latency is related to stimulus evaluation time (Magliero et al., 1984), and P3 amplitude to decision making and memory processing (Hillyard et al., 1973). It is shown that alterations of ERP components are not specific for any cerebral disturbance and can be found whenever cognitive functions are impaired.

As a psychophysiological parameter of human mental processing, P3 is also used to evaluate pain mechanisms. Pain has conceptual multidimensional basis consisting of sensory-discriminative,
cognitive-evaluative and affective-motivational components (Price, 1988). During a painful experience these components interact with each other and produce somatomotor, autonomic and behavioral attributes of pain. Pain may cause psychological aberrations and maladaptive cognition. Delayed P3 latency has been reported in chronic lower back pain patients (Tandon and Kumar, 1993). If pain itself is an intruder in cognitive processing there should be some differences in P3 latency between chronic and episodic pain sufferers. This study was undertaken to examine if there exists any difference in cognitive status of patients suffering from chronic and episodic pain.

MATERIALS AND METHODS

We examined 23 lower back pain (LBP) and 22 episodic tension-type headache (ETTH) sufferers and compared them with 23 age- and sex-matched healthy persons. Patients were referred from the outpatient service of Neurology and Physical Treatment and Rehabilitation departments. Patients’ histories were repeated and analysed by the investigators. Lower back pain sufferers were diagnosed to have lumbar spondylosis, lumbar disc herniation or sciatica; and all had normal neurological examination. All complained of pain that endures almost every day, for at least the last 6 months. The duration of pain varied between 3–10 hours (mean 7.1 ± 2.0 hours) per day. For disability assessment Oswestry Disability Questionnaire (Leclaire et al., 1997) was used. This test consists of 10 sections, the first assessing pain intensity and need of pain medication and the other nine assessing difficulties in personal care, lifting, walking, sitting, standing, sleeping, sexual life, social life and traveling. Each section scores 0–5; and maximal score 50 equals to 100% disability. The mean disability score of LBP patients was 19.9 ± 8.2 that indicates a mild-moderate disability.

Episodic tension-type headache (ETTH) was diagnosed according to the criteria of the International Headache Society (Classification Committee of the International Headache Society, 1988). All had normal neurological examination and normal CT or MRI scans. They had a mean of 6.2 ± 3.8 days with pain per month (between 2–13 days in a month) and the duration of headache attacks was 10.1 ± 6.9 hours (between 2–24 hours/attack). The other demographic features are presented in Table 1. The minimum age for participating in study was 30 years. Duration of headache and lower back pain symptoms was at least 1 year. No one of the patients had any history of major head injury, psychiatric or any other disease. The patients were not allowed to take analgesics during the week before the study, and were examined on a pain free day or period. All patients gave informed consent after the purpose of the study and the protocol had been explained to them, and before any procedure was performed.

Mini-mental state examination (MMSE) which is a brief screening test for cognitive dysfunction with demonstrated reliability and validity based on a univariate or global model of organicity (Folstein et al., 1975) and Beck-Depression Inventory (BDI) (Beck et al., 1961) were performed to all patients on the day of examination. Clinical symptom severity was assessed by Likert scale, a 5-point scale (Bellamy, 1993). All had normal hearing in performed audiometric evaluation.

ERPs were recorded with Nihon-Kohden MEB 5504 K (Tokyo, Japan). Surface electrodes were placed according to international 10/20

| TABLE 1. Demographic data of the ETTH and LBP sufferers and healthy controls. |
|---------------------------------|-----------------|-----------------|-----------------|----------|
| Age in years (range)           | ETTH            | LBP             | Healthy controls | p        |
| Gender                         | 45.0 ± 8.8 (30–65) | 47.6 ± 12.0 (32–70) | 43.3 ± 9.1 (30–68) | 0.355    |
| MMSE score                     | 21 F/1 M        | 22 F/1 M        | 22 F/1 M        | 0.622    |
| BDI score                      | 24.0 ± 3.4      | 22.7 ± 4.5      | 24.5 ± 3.2      | 0.187    |
| Symptom severity               | 13.7 ± 7.2      | 15.0 ± 7.2      | 13.2 ± 7.2      | 0.702    |
| Symptom duration in years (range) | 6.2 ± 6.3 (1–30) | 8.0 ± 5.4 (1–25) | 8.0 ± 5.4 (1–25) | 0.115    |

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system. Active Ag/AgCl electrodes were placed at centrofrontal (Fz), centrocenral (Cz) and parietocentral (Pz) with reference electrodes at ear lobules (A1 + A2). The ground electrode was placed at Fpz. The input impedance was kept below 5 K ohms. Pips, 1000 and 2000 Hz tone were presented binaurally in a random fashion with an 80:20 ratio at 80 dB SL through shielded headphones. The same auditory oddball tasks were used for all of the subjects. Subjects were seated in a reclining chair in a sound attenuated room. During the experiment they were instructed to keep their eyes fixated on a point before them and keep eye movements and blinks to a minimum. Patients were instructed to attend rare tones and count them silently when they heard the rare tone. Data were recorded only after the subject understood the tasks completely through a training period. Latencies and amplitudes of ERP components were evaluated separately for the first half of the measurement (first trial) and the second half (second trial), after a 10 min interval. The filter band-pass was 0.1–50 Hz, constant interstimulus interval was 2 seconds, and analysis time was 1,000 ms. Thirty responses of rare tones were averaged.

We compared the amplitudes and latencies of N1, P2, N2 and P3 waveforms between groups using variance analysis (ANOVA). Latencies and amplitudes were related to age, duration of illness, pain severity, disability, MMSE and BDI scores by Spearman analysis.

RESULTS

Each group had similar task performances; of the target trials 0.22% in ETTH, 0.24% in LBP and 0.19% in healthy group were misperceived. These values were within the limits of misperception of the target stimulus (Sklare and Lynn, 1984).

Since there were no statistically significant differences at all in latencies and amplitudes at the three recording sites, only ERPs recorded at the centrocentral location are presented (Table 2). Comparison of N1, P2, N2, P3 latencies and P3 amplitudes showed no significant difference between the groups at first trial. In second trial, P3 latency significantly prolonged in healthy controls in comparison to LBP group ($p = 0.002$), whereas no significant difference was observed between healthy controls and ETTH group.

MMSE and BDI scores were not different between groups. Symptom duration was similar between two pain groups. However, patients in ETTH group reported to have significantly more severe pain than those in LBP group ($p = 0.008$). In the ETTH group, P3 latency showed a statistically not significant correlation with pain duration and BDI scores ($r = 0.342, p = 0.139$ and $r = 0.330, p = 0.144$ respectively). There was a moderate relationship between pain severity and BDI scores ($r = 0.568, p = 0.009$), which was an expected finding. P3 latencies and amplitudes showed no correlation with pain duration, pain severity, MMSE scores and BDI scores in ETTH and LBP groups, while there was a statistically not significant correlation between memory scores and P3 latency in LBP group ($r = 0.401, p = 0.058$). The P3 latency was significantly prolonged during the second trial in normals ($z = -3.615, p < 0.001$, Wilcoxon test) and ETTH group ($z = -2.929, p = 0.003$, Wilcoxon test) whereas it did not change significantly in the LBP group ($z = -1.807, p = 0.07$, Wilcoxon test).

### TABLE 2. Mean ± SD values of N1, N2, P2 and P3 latency and P3 amplitude in episodic and chronic pain patients and healthy controls.

<table>
<thead>
<tr>
<th></th>
<th>ETTH</th>
<th>LBP</th>
<th>Control</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial-I</td>
<td>N1 (ms)</td>
<td>99.1 ± 10.5</td>
<td>95.9 ± 7.7</td>
<td>104.1 ± 15.2</td>
</tr>
<tr>
<td></td>
<td>P2 (ms)</td>
<td>163.6 ± 13.0</td>
<td>160.3 ± 10.9</td>
<td>165.9 ± 21.2</td>
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<td></td>
<td>N2 (ms)</td>
<td>216.6 ± 20.6</td>
<td>212.9 ± 10.7</td>
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</tr>
<tr>
<td></td>
<td>P3 (ms)</td>
<td>313.6 ± 34.2</td>
<td>301.0 ± 28.0</td>
<td>313.0 ± 20.4</td>
</tr>
<tr>
<td></td>
<td>P3 amplitude (µV)</td>
<td>19.0 ± 6.5</td>
<td>21.4 ± 10.5</td>
<td>21.4 ± 8.7</td>
</tr>
<tr>
<td>Trial-II</td>
<td>P3 (ms)</td>
<td>320.5 ± 36.4</td>
<td>302.6 ± 26.6</td>
<td>332.2 ± 38.7</td>
</tr>
<tr>
<td></td>
<td>P3 amplitude (µV)</td>
<td>16.3 ± 6.7</td>
<td>20.6 ± 10.5</td>
<td>17.9 ± 9.8</td>
</tr>
</tbody>
</table>

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P3 amplitude showed a decrease of $3.5 \pm 5.9 \mu V$ ($z = -2.630$, $p = 0.009$, Wilcoxon test) in healthy subjects. A similar tendency, though not statistically significant, was also observed in ETTH group with a $2.3 \pm 5.6 \mu V$ ($z = -1.756$, $p = 0.079$, Wilcoxon test) decrease of P3 amplitude. In LBP group decrease of P3 amplitude was minimal $0.8 \pm 7.9 \mu V$ ($z = -0.806$, $p = 0.420$, Wilcoxon test). There was no correlation between latency and amplitude difference between trials and age, disease duration, symptom severity, MMSE and BDI scores (Spearman, $p > 0.005$).

DISCUSSION

Single trial analysis of P3 latency and amplitude showed no significant difference between groups. Pain perception is mediated and modulated through forebrain mechanisms acting at spinal, brainstem and cerebral levels. Chronic nociception results in continuous bombardment of limbic system and other associated areas by pain conveying fibers. P3 is reported to be generated by hippocampal structures (Halgren et al., 1980; Okada et al., 1983). But, also the thalamus (Yingling and Hosobuchi, 1984), the mesencephalic reticular formation (Desmedt and Debecker, 1979) and frontal (Knight, 1984) lobes have all been thought to be the generators of P3. If the scalp P3 were generated either exclusively or primarily by limbic structures, then chronic nociceptive bombardment of this area should significantly alter its distribution and/or amplitude. Our findings imply that cognitive processing in chronic and episodic nociception are not different, and chronic nociception of limbic areas do not alter stimulus evaluation time, decision making and memory processing significantly.

In previous studies, ERP evaluation of healthy subjects showed a subsequent habituation in both latency and amplitude (Simons et al., 1987). Researchers analysed several trials (five to 20 trial blocks) to demonstrate the specific loss of habituation (Kropp and Gerber, 1993; Lew and Polich, 1993; Wintink et al., 2001). However, in some recent studies it has been observed that habituation comes out in the very first three trials and some others also reported that only two trial blocks are sufficient to demonstrate a significant difference between migraine and other headache types and healthy subjects (Evers et al., 1997; Wintink et al., 2001).

Healthy subjects and ETTH patients showed a similar pattern in second trial: increased P3 latency and decreased P3 amplitude. Considering P3 latency habituation, healthy controls and ETTH sufferers showed a significant change of P3 latency whereas LBP sufferers failed. Comparing the amount of habituation, LBP sufferers stood clearly apart from healthy controls. Although there was a remarkable increase of P3 latency in ETTH sufferers, the amount of habituation was not statistically different than it was in LBP sufferers. Significant P3 amplitude habituation was observed only in healthy controls. Actually, ETTH sufferers also showed some degree of habituation, which was not statistically remarkable. The amount of amplitude habituation was not different between groups. These results may point to a disturbed attentional processing in chronic pain sufferers. The fact that P3 latency reflecting processing time prior to activity underlying attention and P3 amplitude reflecting attention to incoming information when memory representations are updated makes it possible to use it as a measure of mental workload (Donchin and Coles, 1988). The reduced habituation we observed in chronic pain sufferers may imply a mental over-workloading and may be related with the mediational role of pain and consequent levels of suffering.

P3 latency was reported to exhibit good correlation to the WAIS score (Neshige et al., 1988) and WISC-R and Wechsler memory scale (Naganuma et al., 1993) and proposed to be a suitable tool for objective judgment of minimal cognitive disturbance. In our study we observed no correlation between total MMSE scores and P3 latency or amplitude. However, in the chronic pain group there was a moderate correlation, which statistically not significant, between memory scales and P3 latency.

Experimental studies showed that acetylcholine, noradrenaline and serotonin depletion can modify ERP components (Ehlers and Chaplin, 1992; Ehlers et al., 1991; Harrison et al., 1988; Pineda et al., 1989). Moreover, ERP values may
be normalized by certain drugs affecting the aforementioned neurotransmitters systems (Ahmed, 1997; d’Ardhuy et al., 1999; Hegerl et al., 2001; Sanz et al., 2001; Schoenen et al., 1986). The loss of habituation in chronic pain patients may herald the disruption of physiological mechanisms in areas where a certain neurocircuitry is present for P3 generation. Cognitive factors are thought to play an important mediational role between pain and consequent levels of suffering. By the time the patient moves into chronic pain stage, pain-related implicit memory structures in the brain of chronic pain patients selectively draw attention to pain and pain-related stimuli (Flor et al., 1997). This maladaptive cognition with accompanying emotional disorders (Gamsa, 1990) increases the cognitive and behavioral changes due to reduction in activity and social withdrawal.

In conclusion, a disturbed attentional processing was found in chronic pain sufferers. Performance of episodic pain sufferers was much more like healthy controls’, though not statistically differed from chronic sufferers, as reported in previous studies (Evers et al., 1997; Mazzotta et al., 1995). Our findings suggest that in spite of similar cortical information processing, the neurocognitive networks related with decision making and memory processing seem to work differently in chronic pain sufferers from those in episodic pain sufferers in repeating tasks.

REFERENCES


Mazzotta G, Alberti A, Santucci A, Gallii V. The event-related potential P300 during headache-free period and...


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EFIC was formed by the Presidents of the European Chapters of the International Association for the Study of Pain (IASP) at a meeting held during the 7th World Congress on Pain in Paris in August 1993.

Aims
These are in general those of IASP, i.e. to promote research, education and the clinical management of pain. The specific aim is to create a forum for European collaboration on pain issues and to encourage communication at a European level between IASP Chapters, and also with other bodies interested or involved in the fields of pain research and therapy such as the European societies or federations of medical specialties (anaesthesiology, neurology, headache, palliative care etc.), institutions of the European Community, European and national educators and legislators.

Constitution
The affairs of EFIC are conducted by its Council, which consists of the Presidents of the European IASP Chapters, and five elected officers who form the Executive Committee. The Council meets once a year while the Committee manages affairs between meetings. EFIC is being established as a charitable foundation in Belgium.

EFIC’s Position in Relation to IASP
The bylaws of the IASP (section V) provide that national pain societies and associations may constitute Chapters of the IASP in their country. EFIC acts as a European grouping of these, so that they will benefit from the wider perspectives offered by a transnational organization while allowing for the sociocultural diversity of European nations and regions. Many of the societies have a large percentage of members who are not members of the IASP; they are nonetheless members of EFIC and will benefit from the wider perspectives offered by a transnational organization.

Specific Programmes
EFIC co-operates in the organization of Congresses, such as that in Verona, Italy, in May 1995 and that in Barcelona, Spain, in September 1997. It produces newsletter which is distributed by the Chapters to all their members and is involved with the production of the European Journal of Pain. Under its auspices, task forces are working on aspects of pain research and management, and their findings will be used to improve education and training throughout Europe.

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