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Behavioral management of pain in children and adolescents**

Terapia behawioralna bólu u dzieci i młodzieży

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S u m m a r y

The purpose of this paper is to discuss the behavioral techniques of pain management used in clinical practice in children and adolescents and to review the results of studies aimed at assessing their effectiveness. The results of the studies with respect to both the epidemiology of pain in children and adolescents and the effects of pain on children's and adolescents' functioning were summarized. The following three types of behavioral therapies for pain were discussed: the operant, respondent and cognitive-behavioral therapy. Case studies and meta-analyses of randomized controlled trials concerning the effectiveness of behavioral techniques of pain management in children and adolescents were reviewed. It is concluded that even though the results of case studies have an anecdotal character and the results of meta-analyses of randomized controlled trials show a variability, they quite clearly support the use of behavioral techniques in the pain management in children and adolescents.

Key words: adolescents, behavioral therapy, children, pain management

S t r e s z c z e n i e

Celem artykułu jest prezentacja behawioralnych technik terapii bólu wykorzystywanych w praktyce klinicznej u dzieci i młodzieży oraz przegląd wyników badań nad ich skutecznością. Podsumowano wyniki badań nad epidemiologią bólu u dzieci i młodzieży oraz nad wpływem bólu na funkcjonowanie dzieci i młodzieży. Omówiono trzy rodzaje behawioralnych terapii bólu: sprawczą, reaktywną oraz poznawczo-behawioralną. Przeprowadzono przegląd studiów przypadku oraz metaanaliz randomizowanych, kontrolowanych badań nad skutecznością behawioralnych technik terapii bólu u dzieci i młodzieży. Chociaż wyniki studiów przypadku mają charakter anegdotyczny, a rezultaty metaanaliz randomizowanych, kontrolowanych badań są zróżnicowane, to zasadniczo potwierdzają one użyteczność behawioralnych technik terapii bólu u dzieci i młodzieży.

Słowa kluczowe: dzieci, młodzież, terapia behawioralna, terapia bólu

PAIN IN CHILDREN AND ADOLESCENTS

The epidemiology of pain in children and adolescents

Every child experiences acute pain from time to time, especially as a result of an injury.

Although chronic and recurrent pains are considered to be common among elderly people, children and adolescents suffer from such pains quite often. For example, the results of the Dutch study (1) show that 53.7% of children aged 0-18 reported pain in the previous three months including 25% reporting chronic pain. One-third of the chronic pain sufferers have experienced frequent and severe pains. The occurrence of chronic pain increased with age and girls aged 4-18 reported chronic pain significantly more often than boys. Moreover, girls reported multiple and severe pains more often. Limb pain, headache and abdominal pain were the most common types of pain in children. In a German study (2), 83% of the children aged 6-18 have experienced pain during the preceding three months. Thirty point nine percent of pain sufferers reported pain present for more than six months and 35.2% reported

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pain occurring at least once a week. The mean pain intensity in children and adolescents was 5.7 (max. value = 10). The most prevalent pain types were: headache (60.5%), abdominal pain (43.3%), sore throat (35%), limb pain (33.6%) and back pain (30.2%). In a longitudinal survey conducted in Canada (3), children were examined every other year from the age of 10-11 years till the age of 18-19 years. It was found that headache occurred once a week or more often in 26.2%-31.8% of the studied sample, stomachache in 13.5-22.2% and backache in 17.6-25.8%. Girls had higher rates of pain than boys in respect of all the types of pain, at all time points.

Summing up, pain seems to be a very common phenomenon among children and adolescents, as they often suffer from severe chronic and recurrent pains. However, a recent review (4) of the studies on the epidemiology of chronic pain in children and adolescents revealed a high variability of the results. The prevalence rates were as follows: headache – 8-82.9%; abdominal pain – 3.8-53.4%; back pain – 13.5-24%; musculoskeletal/limb pain – 3.9-40%; multiple pains – 3.6-48.8%; other/general pain – 5-88%. Two general conclusions can be drawn from the results of the previous studies: prevalence rates for most pain types were higher in girls and they increased with age.

The impact of chronic pain on children and adolescents

Chronic and recurrent pain can have a negative impact on the function, quality of life and psychological well-being of children and adolescents. Children with pain show a substantial impairment within many domains of daily life. For example, 72% of children with chronic pain of unknown origin suffered impairment in sports activities, 51% reported absence from school, 40% experienced limitations in social functioning, and 34% had problems with sleeping. Generally, the number of somatic symptoms was higher in girls than in boys (5). In the German study cited above (2), children with pain reported pain causing: sleep problems (53.6%), inability to pursue hobbies (53.3%), eating problems (51.1%), school absence (48.8%), and inability to meet friends (46.7%). The prevalence of limitations in daily life caused by pain increased with age. In a recent study (6), a significantly higher rate of overweight and obesity was observed among youth with chronic pain in comparison with a normative sample.

Two recent systematic reviews (7, 8) were aimed at assessing problems in the functioning of children and adolescents with chronic pain. It was found that chronic pain negatively affected cognitive and school functioning, however, children's cognitive and academic disruption was not related to general intellectual deficits. Children with chronic pain function either at or above age expectations according to standardized psychological measures of general intelligence (7).

Chronic pain causes also deficiencies in social functioning and peer relationships in children and adolescents. Reports show that children with chronic pain have fewer friends, are subjected to more peer victimization, and are viewed as more isolated and less likeable than healthy peers (8). Children with pain report having higher levels of distress, anxiety and depression. For example, adolescents aged 13-19 years with frequent headaches had higher levels of anxiety or depressive symptoms (9). Generally, depression is strongly associated with functional disability caused by pain (10). The Canadian longitudinal survey cited above (3) demonstrated that anxiety and depression at the age of 10-11 years had been predictive of the trajectories of pain, which indicated high levels of pain during the observation period and trajectories of pain that increased over time. Moreover, 21-28% of children and adolescents with unexplained chronic pain had clinically relevant psychiatric disorders i.e. anxiety, affective and disruptive disorders (11).

There is a growing evidence that children and adolescents with pain report a worse quality of life (12, 13). For example, it was found that the higher the intensity and frequency of the pain, the lower the quality of life in the youngsters aged 12-18, especially regarding the psychological functioning (e.g. feeling less at ease), physical status (a greater incidence of other somatic complaints) and functional status (more impediments to leisure and daily activities) (14). Chronic pain had also a negative impact on family life, mainly because of the worse child's physical and psychological functioning. A recent review (15) of studies on family functioning in families of children and adolescents with chronic pain confirmed that in general families of children with chronic pain had poorer family functioning than healthy populations. However, pain-related disability rather than pain intensity was found to be related to family functioning.

Most importantly, children and adolescents with pain are at a risk for continuing into adulthood with chronic pain, physical symptoms, and psychological problems. For example, it was found that children with frequent headaches had an increased risk of headaches, multiple physical symptoms and psychiatric morbidity during adulthood (16). Last but not least, the economic impact of chronic pain in childhood and adolescence is very high. For example, in the United Kingdom the mean cost per adolescent experiencing chronic pain was estimated at £8000 per year. Taking into account the prevalence data of adolescent chronic pain in UK, the cost-of-illness to UK society is approximately £3840 million yearly (17).

Summing up, the impact of chronic pain on children is pervasive. Chronic and recurrent pains in children and adolescents affect nearly every domain of functioning, including physical, cognitive, psychological, social and family functioning. Moreover, chronic pain in childhood and adolescence may increase the risk of chronic pain and other symptoms in adulthood and has a very high economic impact. That is why effective management of pain in childhood is a matter of key.

THE TECHNIQUES OF BEHAVIORAL MANAGEMENT OF PAIN IN CHILDREN AND ADOLESCENTS

Operant behavioral therapy

The operant behavioral therapy was probably the first psychological intervention that gained wide acceptance for treating chronic pain problems not only in childhood but also in adulthood. According to the theory of operant conditioning, all overt behaviors are significantly influenced by their consequences and the surrounding context in which they occur. It means that reinforced behaviors tend to an increase in frequency and last over time, while behaviors that are punished or that are not reinforced are likely to be extinguished or decrease in frequency (18). Reinforcement can include things a person enjoys or derives pleasure from (positive reinforcement) as well as a removal of negative experiences (negative reinforcement). On the other hand, punishment involves unpleasant experiences or aversive situations (19).

Fordyce (20) was the first who systematically extended and described the application of operant conditioning to chronic pain. He proposed that observable pain behaviors (such as medication consumption, guarding, rubbing, limping, grimacing, resting) and more adaptive overt well behaviors (such as smiling, working, walking, standing, engaging in social-recreational activities), although probably initially triggered by antecedent events (e.g. injury, disease), are governed by their contingent consequences (21). Fordyce (20) theorized that pain behaviors are natural responses to acute pain that can persist after healing if they are reinforced and competing well behaviors are not sufficiently reinforced. This may lead to overt pain behaviors occurring not only in response to nociception but also in response to environmental contingency and discriminative stimuli (18). Various stimuli in one's environment acquire discriminative or cue-like properties. Based on association with the target behavior and contingent consequence, these stimuli acquire the ability to signal the person that emission of a given overt behavior is likely to result in a certain consequence (19). Many overt pain behaviors are controlled by discriminative stimuli (22, 23).

The objective of an operant conditioning treatment of pain is not a reduction of an individual's subjective experience of pain but a restoration of functioning by changing overt pain behaviors that can interfere with functioning. Some conditions, which have to be fulfilled, determine the effectiveness of operant conditioning methods. Firstly, there should be identified specific overt behaviors and effective positive and negative consequences for those behaviors. It is also important to apply consequences consistently and contingently upon the occurrence of target overt behaviors. Although the shortest time between the application of consequences and the target behavior is the most preferable, it is worth to mention that as long as the patient is aware of the administration being contingent upon emission of the behavior, this time rule is not crucial (19). However, spontaneous occurrence of a given overt behavior is sometimes impossible without an application of some additional shaping procedure, which involves systematically reinforcing consecutive approximations of a given overt behavior until the complete response is obtained (24). Another condition for obtaining an increase in effectiveness of operant conditioning for chronic pain management is the use of other learning-based and behavioral techniques, such as relaxation training, modeling, and desensitization procedures for escape-avoidances and fear responses (25).

One of the most important components of a behavioral treatment based on the operant conditioning model for chronic pain is the identification of (1) target pain behaviors or the lack of well behaviors, (2) discriminative stimuli that precede and influence these behaviors, and (3) reinforcers and punishers for these behaviors (26). Information about these factors is obtained by a direct observation of patients, behavioral assessment questionnaires and a self-monitoring by the patient. Direct observation techniques play a crucial role in the assessment of children who are too young for self-monitoring.

The effectiveness of operant conditioning for pain management is contingent upon the following conditions that should be met: (1) overt pain behaviors are present; (2) salient positive and negative reinforcers or punishers can be identified; (3) there is sufficient environmental control to contingently apply antecedent and consequent stimulus conditions; (4) the patient is not experiencing any major non-drug-related cognitive-learning impairment; and (5) the patient is willing to participate actively (19, p.131). One should point out that operant conditioning may be useful even if none of the indicators are present. In such situations more adaptive well behaviors (like smiling, exercising or walking without cane) can be increased. On the other hand, the presence of all basic indicators does not exclude concurrent presence of ongoing nociception from annoyance or some other factor (19).

There are only few recommendations on the application of operant conditioning in chronic pain patients (20, 27). The first step is an assessment of patients using functional behavioral analysis methods. It enables therapists to identify relevant overt pains and well behaviors, the controlling of antecedent and consequent stimuli and the level of patient and family cooperation. It is also important to identify the extent of physical pathology, which should be included in the process of preparing realistic goals for behavioral interventions. The monitoring of the amount of behavioral change during treatment is crucial for making meaningful decisions about effects of intervention.

The treatment recommendations, used by Sanders (19), are general and can be applied in a wide range of painful conditions. The first suggestion is to reduce overt pain behaviors by using extinction and to increase well behaviors by applying positive and negative

reinforcements. The second suggestion is to reduce medication-taking behavior by using time-contingent delivery. This procedure reduces the amount of medication taken per dose or day. It is recommended to use initial baseline levels and gradually increase them at present amounts (determined with patient cooperation) with abundant reinforcement in order to increase the general activity level, uptime and physical exercise. There are also suggestions to use the method of shaping or gradual change for well behaviors, whenever possible. When target behavior occurs consistently it is recommended to reduce the frequency of the application of positive and/or negative reinforcement. To maximize generalization and discriminative stimulus efforts, it is important to apply operant methods to every overt pain and well behavior across as many different environmental conditions and people as possible. In addition, the elimination or reduction of most external controlling stimulus conditions maintaining overt pain behaviors outside the treatment environment is also of importance.

One of the treatment stages often consists in educating patients and important people in their lives in pain behaviors and in asking these people to ignore pain behaviors and reinforce opposing well behaviors (18). The treatment effectiveness usually increases when family members are included, because these individuals often provide various forms of reinforcement for patient's pain and well behaviors. Moreover, family members spend more time with the patient so they can apply operant conditioning methods in a more regular way. Some authors are of the opinion that behavioral methods need time to work. Therapists should be sure to follow patients for at least three to six months after active treatment in order to facilitate maintenance of change. According to the last recommendation, operant conditioning methods should be used in combination with other psychological and physical treatments (e.g. relaxation, physical therapy, antidepressant and anti-inflammatory medications) within an interdisciplinary treatment approach (19).

Respondent therapy

The respondent therapy constitutes the other type of behavioral therapy applied for pain management, especially in those pain responses, which are based on unconditioned reflexes, escape/avoidant behavior and/or generalized emotional responses. The fundamentals of respondent therapy are based on the Pavlov's respondent conditioning model, with special attention given to a conditioning involving the use of aversive unconditioned stimuli such as tissue damage or irritation (28). The respondent therapy includes two techniques commonly used for treatment of chronic pain: (1) progressive muscle relaxation and (2) biofeedback.

Progressive muscle relaxation (PMR) is based on an assumption that pain evokes a response in the form of increased muscle tensions which produce more pain and cause additional problems such as sleep disturbances, immobilization, and depression (29). Thus, the objective of a treatment is a reduction of muscle tension. The first step of a therapy consists in educating patients in the identification of the association between their pain and muscle tension. The second and more important stage of a therapy includes a process of learning to replace this tension with a contrary response, namely the relaxation (30). An eliciting of changes in muscle tension and pain response is achieved by the use of muscular reflex reactions and central nervous system unconditioned and conditioned stimuli (28). However, relaxation is not only a reducer of muscle tension and, as a result of this, of the pain. It also plays a role in the anxiety and sleep disturbance reduction as well as in the increase of well-being and improvement of sense of control (21).

A biofeedback also involves muscle relaxation, but it is achieved in different way. Typically, bodily responses are being monitored by a computer or special apparatus and patients get visual or auditory feedback about their physiological responding. The aim of the biofeedback is to instruct how to control physiological responses related to pain (31). Electromyographic (EMG) feedback, aimed at reducing muscle tension, is the most popular form of biofeedback applied for chronic pain management. This strategy is also used to reduce headaches, low back pain and temporomandibular joint pain (32). In some situations biofeedback and relaxation are used independently and separately, but more often those strategies are used in cooperation or in combination with other treatment approaches (21).

Cognitive-behavioral therapy

The cognitive-behavioral therapy (CBT) for chronic pain evolved from the model of behavioral therapy but it has also elements of cognitive methods. This model includes the influence of learning and behavior on patient functioning and the role of cognitions (expectations, beliefs, attributes), which can enhance or interfere with effective behavioral coping (18). According to the theory, patients who believe that they are not able to do anything to reduce their pain are less engaged in adaptive pain management strategies and the process of teaching them such strategies is ineffective. Thus, during the first phase of CBT, patients are taught healthy ways of thinking and coping behaviors that can be of assistance in the reduction of suffering, whereas later treatment phases tend to focus on skill rehearsal, generalization and maintenance.

Cognitively focused interventions involve: an identification of thoughts and beliefs about pain, an evaluation of the accuracy of those cognitions and a change of inaccurate or unhelpful cognitions into more adaptive ones. On the other hand, behaviorally focused interventions emphasize the teaching adaptive coping skills to patients that can be used to reduce pain. Behavioral as well as cognitive elements of treatment are always tailored to patient's individual needs, thus, they can include such training skills as problem-solving

skills, communication skills, assertiveness training, and physical activity rating (18). When working with a child who suffers from chronic or frequent abdominal pain, therapists will also use relaxation (breathing techniques and muscle relaxation training) and teach other pain management skills. In most cases, the parents are also actively involved in the therapy. Special skills for helping their child to deal with pain whenever it arises are taught to them (33). Although cognitive-behavioral treatments for pain may be different according to respective treatment programs and providers, due to the unique combination of cognitive and behavioral elements during each intervention, all of them share the same underlying theoretical conceptualization (18).

THE EFFECTIVENESS OF BEHAVIORAL MANAGEMENT OF PAIN IN CHILDREN AND ADOLESCENTS

The effectiveness of selected, behavioral techniques of pain management in children and adolescents is worth being illustrated by some interesting descriptions of patient cases where psychological intervention, i.e. specific treatment factors brought about a marked reduction in pain (frequency, duration, intensity), an improvement in social functioning, etc.

Case studies

Varni, Bessman, Russo i Cataldo (34) described the case of a 3-years-old girl hospitalized because of 2nd and 3rd degree burns of the buttocks, legs and perineum resulting from an intentional immersion in hot water. Complications, which developed in the course of the burns, included heart murmur, sepsis and ulcerative lesions. The patient presented with behaviors typical of chronic pain that significantly interfered both with the rehabilitation process and interactions with the medical staff. She was opposed to medical procedures such as wearing jobst stockings and knee extension splints after corrective surgeries. The data collected by observers concerned three types of pain behaviors, i.e. crying, verbal and nonverbal behaviors presented by the girl in the clinic room, bedroom and physical therapy area. The pain behaviors were recorded during treatment sessions and baseline periods and then registered on a special list of behaviors in the periods between observations.

Treatment procedures were different under these three conditions. An operant conditioning of non-pain behaviors was used during treatment sessions in the clinic. The girl was told that if she will not cry when the splints are put on, she will be able to play with the therapist and get a treat. At the beginning of treatment, the absence of pain behaviors was reinforced every minute and when pain behaviors were reduced, the intervals were extended to 5 minutes. Moreover, every distractive behaviors were praised (socially reinforced) as well as every pain behaviors were ignored. In the bedroom, the girl was praised and reinforced by treats for the absence of pain behaviors and the pain behaviors that appeared during the time dedicated to nap were extinguished. Finally, in the physical therapy area, where the girl practiced of descending stairs, at the beginning of treatment a continuous reinforcement was used for every step with an absence of pain behaviors. Then, a fixed-ratio schedule of reinforcements was introduced – an reinforcement was carried out during every fourth step. Before every treatment session, the reinforcement schedule was explained to the girl.

The used research schema, i.e. multiple baseline and reversal design, enabled assessment of the effectiveness of applied psychological treatments. The results showed that in all included conditions the procedures of reinforcing "well" behaviors and ignoring undesirable behaviors reduced the number of pain reactions significantly in comparison to the baseline session. Varni et al. noted that the obtained data concerning crying were "similar to those observed during programmed extinction. That is, her behavior initially occurred at a very high rate, gradually decreased, increased again to a high rate, and then decreased to 0% for the majority of the remaining sessions" (34, p. 376).

A similar pattern of behavioral treatment effectiveness was registered with regard to verbal and non-verbal pain behaviors and physical exercises. In the case of the latter, it turned out that during the baseline sessions the child had marked difficulties in descending the stairs, which subsided gradually during treatment sessions. The behavioral techniques of pain management caused a rapid increase in the number of steps. Positive changes lasted. In the follow-up measurement, the level of verbal and non-verbal pain behaviors was significantly lower than during the baseline sessions at the beginning of treatment. There were also positive changes in the social functioning of the child. Although at the beginning of treatment the girl presented with a behavioral resistance toward rehabilitation, e.g. splinting attempts, afterwards she assisted in it more and more willingly, e.g. the patient expressed desire for helping the medical staff, talked with them, boasted of achievements, i.e. of the increase in the number of non-pain behaviors.

Similar cases of patients were described by Kelley and her colleagues (35). The authors presented the story of two girls – the four-years-old Melissa and six-years-old Beth. Both of them stayed in a hospital because of 2nd and 3rd degree burns due to a fire in a house (Melissa) and a contact with hot fat (Beth). The burns in the first patient affected the arms, neck, face, back and legs, and in the second patient the face, head, shoulders, arms and back. The girls received medical treatment in a hydrotherapy room with whirlpool tubs five times weekly.

The data on pain behaviors were recorded during observation sessions that lasted about 45 minutes each. During observations which started with the girl entry into the hydrotherapy room and ended with the conclusion of the open treatment procedure, The behaviors of the patients, their parents and the medical

staff were recorded at thirty-second intervals during observations that lasted from the entrance of the girl into the hydrotherapy room till the open treatment procedure completion. Categories of behaviors were verbal (e.g. crying, screaming) and nonverbal (motor) pain behaviors (e.g. hit, bit).

The effectiveness of the treatment procedures was assessed using the same research scheme as Varni at al. (34). These authors compared the frequency of pain behaviors in girls during treatment and baseline sessions. Therapeutic interventions consisted of presentations of cartoons during medical procedures and a reinforcement of non-pain behaviors in girls by using a star feedback chart. After selecting the movie, an experimenter showed a colorful graph to record the frequency of verbal and non-verbal (motor) pain behaviors in the patients during each previous session. Moreover, the researchers explained to the children that watching the cartoons, e.g. by focusing more attention on the content of fairy tales, may assist forgetting the pain, feeling better and shortening the treatment time. The girls were also informed that they can earn stars by exhibiting pain behaviors at a lower level than they did the previous baseline days. During the baseline days, the children didn't watch the cartoons nor the star feedback chart was represented to the children.

The applied experimental procedure proved to be effective. The number of pain behaviors decreased gradually during the treatment sessions and grew again in the course of the baseline sessions. For instance, Melissa's display of pain behaviors during baseline averaged 68% and showed an upward trend across the condition, but after introducing the cartoon viewing and star feedback chart under the first treatment conditions, the pain behaviors averaged 57%. A return to baseline conditions was the cause of an increase by 35% in the number of pain behaviors, above the level seen in the previous treatment sessions. On the other hand, a re-introduction of the treatment was the reason for a reduction by 43% in pain behaviors in comparison to the previous baseline conditions. An analogous pattern of results was obtained for Beth.

In contrast, Allen, Elliot and Arndorfer (36) analyzed cases of seven children age 8-16, which were hospitalized because of pediatric headache. The diagnostic classification of headaches varied: 3 children presented with a migraine, 3 with a chronic tension-type headache and 1 with an episodic tension-type headache. The following parameters of headache were investigated in the study and recorded by the patients in the Daily Headache Dairy: frequency, intensity and duration. Moreover, parents filled in various scales designed for assessing the extent to which the headache interfered with daily functioning of the children, reactions of persons significant to the children and pain behaviors in the children.

Pain behaviors were reduced by a biofeedback procedure. Each child participated in five treatment session. Every training sessions included one or two ten-to-fifteen-minute biofeedback practices during which patients learned to raise the temperature of their hand by imagining themselves in a warm and pleasant situation. Temperature changes were monitored moment-to-moment by a sensor connected to the child's fingertip and an electric light bar. The biofeedback sessions were assessed as successful if the patient increased temperature of his or her hand by at least one degree.

Moreover, the children were given a homework that consisted of exercises of changing the temperature in the hand at least once a day for 15 minutes. Exercises were monitored by means of an alcohol thermometer and a form in which the number and length of practices, as well as the amount of temperature change achieved during each homework session were recorded. The children with their therapists reviewed homework records, practiced feedback and discussed generalization of the abilities. The patients were encouraged to use biofeedback in various circumstances, also when they notice the initial onset of a headache or any common precursor to pain.

The research design used, an analogous one to cases described previously, showed that the biofeedback was an effective procedure for pain management in most patients. The researchers noted that "in the clinic, all participants consistently increased their hand temperature over baseline by at least one degree during biofeedback practices. The average maximum temperature achieved during clinic biofeedback sessions ranged from 78.55 °F to 95.41 °F. The average temperature change during the final self-control practice (no feedback) ranged from 0.6 °F to 6.5 °F" (36, pp. 181-182). The patients achieved successful results also during the homework sessions. Parents reported that they complied with therapists' hints strictly and resigned to engage in pain management methods that caused an increase in children's autonomy.

The biofeedback training had a significant influence on all the pain parameters, bringing about a reduction in pain frequency, duration and intensity in 6 of 8 patients. The reductions were gradual, with exception of Kenny in whom the change was immediate and sustained. Four of five patients „were headache free during the last week of treatment, and 2 participants, Danielle and Kelly, achieved headache-free status during the last 3 weeks of treatment" (p. 181). Only in the case of Petty, the data revealed no marked changes in the headache parameters (frequency, duration and intensity).

Gorski et al. (37) described cases of three boys aged 10-14, Charles, George and Hassan, who suffered from an end-stage renal disease (ESRD), neurogenic bladder and sickle cell disease (HbSS), respectively. During medical procedures, such as haemodialyses performed 3 times a week, Charles systematically refused to carry out the commands and protested when medical staff tried to catheterize him and complained that the treatment is source of pain. George did not agree to self-catheterization and cried and complained

of a penis pain during medical procedures. Hassen was several times admitted to hospitals due to frequent vaso-occlusive pain crises (VOC) in the abdomen and back. He also had a disease-related necrosis in his knee joint, which became exacerbated during a VOC, making weight bearing difficult for him. The boy presented a hostile attitude toward the medical staff, i.e. yelled, cursed, refused to talk with the nurses and broke the hospital rules, e.g. he was not getting out of bed at specified time, completed no hygiene care.

The data from clinical interviews that preceded the stage of pain treatment revealed that some environmental factors interfered with patients' non-compliance with hospital rules and children's pain behavior. The most important factors were: (1) lack of knowledge among patients about reasonableness and distribution of the expected daily medical procedures; (2) lack of ability to self-soothe during high-anxiety times within treatments; (3) lack of consistency in patients' daily routines; (4) lack of consistency in complying with hospital rules by the medical staff; (5) reinforcement of the anxiety about the medical treatment by the medical staff; (6) association of medical demands only with negative consequences, but not with positive ones, and (7) attention paid by the medical staff mainly to pain behaviors in children, reinforcement of such behaviors by the medical staff, while ignoring the non-pain (distractive) behaviors that led to their extinction.

Comprehensive behavioral intervention was addressed to the mentioned factors and was designed to: (1) increase patients' knowledge about medical treatment, (2) increase the predictability of the environment using a consistent daily schedule, (3) expose patients gradually to difficult steps in the medical task analysis; (4) increase patients' ability to cope with pain and anxiety by teaching relaxation and distraction techniques; (5) provide differential reinforcement for any compliance and appropriate coping behaviors observed.

Psychological treatment proved to be effective. In the case of Charles: „he was able to complete all steps of the task analysis each time the demand level was increased". Moreover: "he achieved 100% compliance and demonstrated greater independence in using his relaxation and self-distraction skills. He continued to be 100% compliant with his hemodialysis at a 2-year follow-up visit" (37, p. 11). Similarly, in the case of George, after an intervention, he "was able to catheterize himself four times per day as was medically prescribed. By the fourth session, he achieved nearly 75% of the steps in his task analysis and was inserting approximately 3 1/8 in. of the catheter into his penis. He was discharged from the hospital after his eighth session, at which time he was achieving greater than 80% of the expected steps. Boy completed 100% of the steps four times per day after 8 weeks" (37, p. 12). "Hassan demonstrated greater than 90% compliance with his behavioral contract by the end of his admission, which is significant given the severity of his inappropriate behaviors". Moreover, "he showed an increase in coping as indicated by better daily functioning and for the next 8 months, Hassan was able to manage his illness-related pain at home without being hospitalized" (37, p.13).

Meta-analyses

Since the empirical data collected during the case studies has an anecdotal character, it is very difficult to assess the extent to which the regularities found have an universal (or statistical) nature or whether these regularities are unique to a particular group of patients (sex, age, individual differences), type of illness (headache, abdominal, musculoskeletal), and type of pain (acute, chronic). Therefore, it is worth referring to collective results of meta-analyses, which have been used to systematically evaluate the effectiveness of selected behavioral techniques of pain management (specific factors in therapy) in children and adolescents in comparison to placebo conditions (non-specific factors) and/or waiting for treatment (no factors).

The results of the meta-analyses presented below include only such studies that met strictly selection criteria, e.g. only randomized controlled trials with clearly defined types of psychological vs. medical interventions, research procedures (experimental design), statistical analyses (SD, t-, F-values, etc.) that were the base for calculating effect sizes (Rosenthal's BESD, d-Cohen, the number needed to treat – NNT, the odds ratio – OR, etc.).

On the base of the results of 41 studies, Herman, Kim and Blanchard (38) compared the effectiveness of psychological techniques of pain management in pediatric migraine or mixed headache with drugs. The authors assessed the following types of therapy: thermal biofeedback (thermal BFB), progressive muscle relaxation (PMR), progressive muscle relaxation in combination with electromyographic (EMG) or thermal biofeedback (PMR and BFB), cognitive therapy, autogenic training, autogenic training combined with progressive muscle relaxation (Autogenic Training and PMR), hypnosis, and multicomponent treatment packages, comprised treatment programs combining at least 3 treatment components such as relaxation techniques, biofeedback, pain/stress coping strategies and/or operant pain management techniques vs. psychological placebo and wait-list control. On the other hand, the following drugs were tested: beta-blockers (propranolol), calcium-channel blockers, serotonergic (5-HT) and dopaminergic agents, ergotamine, clonidine, papaverine and acetylsalicylic acid (aspirin) vs. a drug placebo.

A within-group meta-analysis of behavioral/medication treatment studies showed that both an active pharmacological and psychological management of pain, i.e.: calcium-channel blockers, serotonergic drugs (and propranolol to a lesser extent), thermal BFB, PMR, PMR and BFB and multicomponent treatment programs were superior to placebo or wait-list control conditions. Secondly, the thermal BFB, and PMR in combination with BFB led to better outcomes than all other types of treatment. PMR alone, multicomponent treatment programs and calcium-channel blockers as

well as serotonergic drugs had no significantly different treatment effects. On the other hand, a meta-analysis based on comparisons between treatment and placebo or non-treatment groups only partially reproduced the findings of the meta-analysis based on within-group comparisons. Individual a priori contrasts indicate that only thermal BFB was associated with a significantly higher treatment success than serotonergic drugs and the PMR showed a tendency to be more effective than calcium-channel blockers. Moreover, there were no significant differences between the multicomponent behavioral treatment and drugs.

As the authors noted, "discrepancies between the 2 meta-analytic approaches are not too surprising given that only a sub-sample of the original studies could be included in the second meta-analysis. As a consequence of this reduced number of studies, single studies or individual treatment categories had a disproportionate impact on the overall result" (38, p. 251).

In an another meta-analysis, Eccleston and his colleagues (39) assessed on the base of 18 trials the effectiveness of relaxation, relaxation with biofeedback, cognitive behavioral therapy and cognitive behavioral family intervention in reducing headache, recurrent abdominal pain, and sickle cell pain. It's worth noting that twelve trials took place in clinic settings and the other ones in natural settings, e.g. in classrooms. The authors conducted two sets of meta-analyses: the first series included a comparison between treatment and control groups and the second series pooled the treatment arms within each study and estimated a common treatment effect against a single control group. These two groups of analyses indicate that psychological treatments are effective in comparison with a pooled group of control conditions. The calculated NNTs rate implied that therapists need only to treat more than two patients for the same pathological state to achieve therapeutic success, but this was not done under non-treatment control conditions. Moreover, the obtained results (ORs rate) showed no systematic difference between the effectiveness of pain management modalities in clinic and community settings. Trautmann, Lackschewitz and Kröner-Herwig (40) also analyzed the effectiveness of various psychological methods of alleviating recurrent headache (migraine, tension-type headache and/or both types of headache and mixed headache) in children and adolescents. The following non-pharmacological treatments were assessed: relaxation training, biofeedback, (cognitive-) behavioral therapy, or combinations of these interventions. Listed methods were contrasted with control conditions, i.e. placebo and waiting list groups. A comprehensive literature search included data from 1966 to 2004. After a selection, 23 studies were included in the meta-analyses. For the outcome criterion 'clinically significant change' (i.e. > 50% pain reduction after intervention), large effects sizes were observed regarding between-group comparisons at post-treatment. It means that taking the percentage of responders into account, psychological pain management techniques showed greater efficacy than control conditions. However, regarding specific headache activity indices (intensity, duration, frequency), markedly smaller effect sizes were observed in the between-group comparisons. The meta-analyses based on the within-group comparisons that reflected the change in headache in the patients during different assessment periods, yielded a confirmation of a moderate, but still significant treatment effect. Thus it can be said that psychological treatment methods increased the number of patients considerably (> 50% pain reduction), whereas the control procedures stimulated a small but no marked pain reduction (i.e. reduced by about 20% the headache frequency in the subjects, which is not enough to fulfill the criterion for a clinically significant change).

The authors also found within-groups effect sizes that reflected a trend towards an increasing improvement at follow-up, so the improvement experienced by patients after therapy was lasting till 12 months after the end of treatment. In an interpretation of results, Trautmann et al. highlighted that "the practicing of coping strategies aimed at prevention of headache attacks acquired during therapy and applied in daily life leads to a stable decrease in the headache" (40, p. 1422).

Finally, in one of the most recent meta-analyses, Palermo, Eccleston, Lewandowski, Williams, and Morley (41) attempted to examine the overall effect of psychological interventions in randomized controlled trials on pain, disability, and emotional functioning outcomes in children and adolescents. The following methods were assessed: omnibus cognitive-behavioral therapy (CBT with components such as parent operant strategies, multicomponent CBT, pain coping skills), relaxation-based therapy (e.g. progressive muscle relaxation, hypnosis), and biofeedback with or without relaxation training. The type of chronic pain condition was categorized into three groups: headache, abdominal pain or fibromyalgia and the meta-analysis was based on 25 trials including 1247 young people.

In general, the results showed that psychological treatments can significantly reduce the pain intensity reported by patients with headache, abdominal pain or fibromyalgia. Considered together, psychological treatments reduced pain intensity by at least 50% in a significantly greater number of children and adolescents, as compared to control conditions at post-treatment. This effect was marked also at the 3-month follow-up. The NNTs ratio for a benefit based on these results was 2.64 at post-treatment and 1.99 at follow-up.

On the other hand, the meta-analyses revealed small and non-significant effects of psychological treatments for disability and emotional functioning outcomes. The authors argued that the modest effect sizes for pain-related disabilities and emotional functioning might be explained by factors such as the small number of studies included in the current review, different measures used in the included studies and limited available measures. Moreover, a too small number

of studies directly compared CBT, biofeedback and relaxation training, which resulted in a failure to draw conclusions about the superiority of one intervention over the others.

However, in the subgroup analysis by pain condition, the authors found positive effects in the pain reduction in children with abdominal pain and headache. Interventions delivered to children with abdominal pain produced greater changes in the disability outcomes in comparison to interventions delivered to children with headache or fibromyalgia. Different exposures to psychological treatment, i.e. self-administered treatment at home and therapist-administered treatment in clinics also were compared. The analysis have demonstrated that both forms had equivalent positive effects on pain reduction. It is worth to emphasize that novel methods of pain management, e.g. computer-based applications, also produced a significant pain reduction in youth compared to control conditions, and theirs effects were of similar magnitude in comparison to face-to-face treatment delivery.

CONCLUSIONS

Pain, both acute and recurrent or chronic, occurs commonly among children and adolescents, however, the results of studies on its epidemiology vary greatly. In general, the prevalence rates are higher in girls and increase with age. The effect of pain on children is pervasive. It affects almost all domains of functioning, including physical, cognitive, psychological, social and family functioning. Moreover, chronic pain in childhood and adolescence may increase the risk of chronic pain and other symptoms in adulthood and has a very high economic impact.

Three types of behavioral therapies of pain management can be identified: operant, respondent and cognitive-behavioral. This classification is based on the pain behavior change by means of two fundamental learning processes (operant and respondent/ /Pavlovian/classical conditioning) and – in case of the cognitive-behavioral therapy – also on the cognition change (expectations, beliefs, attitudes). The effectiveness of behavioral techniques of pain management was proved both in case studies and in randomized controlled trials. Although the results of case studies have obviously an anecdotal character and the results of meta-analyses of the randomized controlled trials vary, both groups of results quite clearly support the use of behavioral techniques in the pain management in children and adolescents.

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