

The effectiveness of hypnosis for reducing procedure-related pain in children and adolescents: a comprehensive methodological review

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Abstract A comprehensive, methodologically informed review of studies of the effectiveness of hypnosis for reducing procedure-related pain in children and adolescents is provided. To be included in the review, studies were required to use a between-subjects or mixed model design in which hypnosis was compared with a control condition or an alternative intervention in reducing the procedure-related pain of patients younger than age 19. An exhaustive search identified 13 studies satisfying these criteria. Hypnosis was consistently found to be more effective than control conditions in alleviating discomfort associated with bone marrow aspirations, lumbar punctures, voiding cystourethograms, the Nuss procedure, and post-surgical pain. Furthermore, hypnosis was as at least as effective as distraction. Three hypnotic interventions met criteria as a *possibly efficacious* empirically supported therapy for reducing post-surgical or lumbar puncture pain. Several other hypnotic interventions would have achieved the status of a possibly efficacious therapy had studies used a treatment manual.

Keywords Painful medical procedures · Children · Adolescents · Hypnosis · Treatment outcomes · Empirically supported therapies

Introduction

Hypnosis holds great promise as a tool for alleviating the pain and discomfort experienced by children and adolescents undergoing invasive medical procedures. Once

associated with stage shows and fringe therapies, hypnosis has been proven to be a very effective intervention for relieving pain in adults. For example, in their seminal meta-analytic review of research on hypnotic pain reduction, Montgomery et al. (2000) reported a moderate to large effect size ($D = 0.67$) for hypnosis. These investigators determined that hypnosis could be classified as a well-established treatment for relieving pain according to the criteria for empirically supported therapies (Chambless et al. 1998; Task Force 1995). Likewise, important qualitative reviews of the use of hypnosis with clinical pain have recently concluded that hypnosis is an effective treatment for alleviating both acute and chronic pain conditions (Patterson and Jensen 2003; Jensen and Patterson 2006).

Almost all of the studies included in the aforementioned reviews were of adults. If hypnosis is effective for relieving pain in adults, it might be even more effective when used with children and adolescents. Normative studies have shown that hypnotic suggestibility (i.e., a trait-like individual difference variable reflecting the general tendency to respond to hypnotic suggestions) begins to increase starting at age 3, peaks between the ages of 8 and 12, declines to some extent between ages 12 and 16, and then remains relatively stable throughout adulthood (London 1965; Morgan and Hilgard 1978/1979). On equivalent standardized measures of hypnotic suggestibility, youngsters are more likely than adults to pass almost every one of the same set of items (London 1962). Because children and adolescents tend to score higher on hypnotic suggestibility than adults, it stands to reason that youngsters may be even more responsive to hypnotic suggestions for pain reduction than adults.

Almost 10 years ago, Milling and Costantino (2000) conducted a comprehensive methodological review of controlled studies of the use of clinical hypnosis with children and adolescents. Although the review was not

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restricted to any particular problem (e.g., procedural pain) or disorder, an extensive search identified only 15 controlled studies of hypnosis as a treatment or intervention. Most of the existing literature consisted of case materials and uncontrolled outcome studies. Of the 15 controlled studies, only four investigations evaluated the use of hypnosis for reducing the distress experienced by youngsters undergoing invasive medical procedures. Over the better part of the last decade, there has been a steady stream of controlled studies of the use of hypnosis for reducing procedure-related pain in children and adolescents. Reviews of this literature have generally pointed towards the utility of hypnosis. However, these reviews were limited to studies of either procedure-related cancer pain (Richardson et al. 2006; Wild and Espie 2004; Wood and Bioy 2008) or needle-related procedures (Uman et al. 2008). Furthermore, only one of these reviews was methodological in nature (Richardson et al. 2006).

The purpose of this article is to provide a comprehensive, methodologically informed review of empirical research evaluating the effectiveness of hypnosis for reducing procedure-related pain in children and adolescents. One objective of our review is to summarize the findings of controlled studies of the use of hypnosis for reducing the pain experienced by children and adolescents undergoing any kind of invasive medical procedure. A second objective is to evaluate the methodological strengths and weaknesses of this literature. A third objective is to assess these studies against the criteria for empirically supported therapies (Chambless and Hollon 1998). To our knowledge, this is the first comprehensive methodological review of the use of hypnosis for reducing the pain experienced by children and adolescents undergoing a range of invasive medical procedures and it is the first to systematically evaluate whether these studies contain hypnotic interventions that qualify as empirically supported therapies.

What are empirically supported therapies?

The American Psychological Association (APA) has advanced the concept of *empirically supported therapies*, or psychological therapies identified via research as likely to be helpful for a particular problem and population. More specifically, the APA Division 12 Task Force on Promotion and Dissemination of Psychological Procedures (Task Force 1995) developed a framework for evaluating studies of the efficacy of a psychological treatment that was later refined by Chambless and Hollon (1998). According to the refined framework, to identify a treatment as *possibly efficacious*, there must be at least one between-group design experiment demonstrating that the treatment is superior to no treatment, a placebo, or an alternative treatment, or the equivalent of a treatment previously shown to meet the criteria for possibly

efficacious classification. To categorize a treatment as *efficacious*, there must be two between-group studies that meet these criteria conducted by two different investigative teams. Finally, to be identified as *efficacious and specific*, a treatment must be proven by two separate investigative teams to be superior to a placebo or a treatment previously established as efficacious in experiments controlling for nonspecific processes. To satisfy the APA standards, a study must clearly define the sample to which the treatment was provided, use a treatment manual, and adhere to general principles of sound research methodology, such as random assignment, adequate statistical power, and appropriate treatment outcome measures. In our review, studies of the use of hypnosis for reducing procedure-related pain in children and adolescents were assessed using the Chambless and Hollon (1998) framework with the aim of identifying hypnotic interventions that meet the criteria for empirically supported therapies.

Method of review

To be included in this review, studies were required to use a between-subjects or mixed model design in which a hypnotic or hypnotic-like intervention for pain was compared with at least one alternative intervention, or a placebo, attention, standard care, or no-treatment control condition in reducing procedure-related pain. No studies were included that used participants older than 19 years of age or that failed to incorporate pain as a dependent variable. An exhaustive search of the PsycINFO and PubMed databases, as well as an examination of related reviews in this area identified 13 clinical pain studies satisfying these criteria. Table 1 summarizes the major characteristics of these studies, including types of pain, size and nature of samples, treatment conditions, and key findings. The studies can be organized into the following six groups, according to the nature of treatment conditions that were compared: (a) hypnosis versus control conditions only; (b) hypnosis versus other psychological treatments; (c) effects of different types of analgesia suggestions; (d) effects of adding hypnosis to a topical anesthetic; (e) effects of self-hypnosis; and (f) effects of hypnotic-like imagery. (It should be noted that many of the studies in groups b through f incorporated a control condition; however, the studies in group a compared hypnosis with only a control condition of some kind.)

Summary of controlled studies

Hypnosis versus control conditions

A small number of studies compared hypnosis with only standard care or attention control conditions in reducing the

Table 1 Characteristics of studies of hypnosis for reducing children's procedure-related pain

Study	Type of pain	Sample	Treatment conditions	Summary of key findings
Katz et al. (1987)	BMA ^a	36 children 6–11 years	H-Hypnosis PT-Play therapy	H no different from PT in reducing pain
Butler et al. (2005)	VCUG ^b	44 children 4–15 years	H-Hypnosis SC-Std. med. care	H reduced observer-rated distress more than SC
Wall and Womack (1989)	BMA or LP ^c	20 children 5–18 years	H-Hypnosis D-Distracton	H no different from D in reducing pain
Zeltzer and LeBaron (1982)	BMA or LP	33 children 6–17 years	H-Hypnosis D-Distracton	H reduced pain more than D
Kuttner et al. (1988)	BMA	48 children 3–10 years	H-Hypnosis D-Distracton SC-Std. med. care	H reduced pain more than D and SC in younger children; H and D reduced pain more than SC in older children
Smith et al. (1996)	Venipuncture or infusaport access	27 children 3–8 years	H-Hypnosis D-Distracton	Highly suggestible children receiving H reduced pain more than other groups
Lioffi and Hatira (1999)	BMA	30 children 5–15 years	H-Hypnosis CB ^d C-No-treatment	H reduced observer-rated pain more than CB and C; H and CB reduced self-rated pain more than C
Hawkins et al. (1998)	LP	30 children 6–16 years	DS-Direct suggestions IS-Indirect suggestions	DS no different from IS in reducing pain
Lioffi and Hatira (2003)	LP	80 children 6–16 years	DS-Direct suggestions IS-Indirect suggestions AC-Attention control SC-Std. med. care	DS and IS reduced pain more than AC and SC; DS no different from IS in reducing pain
Lioffi et al. (2006)	LP	45 children 6–16 years	EMLA ^e + hypnosis EMLA + attention EMLA only	EMLA + hypnosis reduced pain more than EMLA + attention or EMLA only
Lobe (2006)	Nuss procedure	10 children 12–18 years	SH-Self-hypnosis SC-Std. med. care	SH had shorter hospital stay than SC
Lambert (1996)	Post-surgical pain	52 children 7–19 years	I-Imagery AC-Attention control	I reduced pain more and had shorter hospital stay than AC
Huth et al. (2004)	Tonsillectomy/ adenoidectomy	73 children 7–12 years	I-Imagery AC-Attention control	I reduced pain more than AC immediately after surgery

^a Bone marrow aspiration

^b Voiding cystourethrogram

^c Lumbar puncture

^d Cognitive-behavioral therapy

^e Eutectic mixture of local anesthetics

distress experienced by youngsters undergoing an invasive medical procedure. Katz et al. (1987) contrasted the effects of hypnosis and an attention control condition in reducing the discomfort associated with bone marrow aspirations. Participants were 36 pediatric oncology patients, age 6–11, suffering from acute lymphoblastic leukemia. Patients were randomly assigned to hypnosis or nondirective play conditions. The hypnosis intervention consisted of training in hypnosis and self-hypnosis that included active imagery tailored to the child's interests, plus suggestions for pain reduction, relaxation, distraction, positive affect, as well as

mastery and control. Patients were also given a post hypnotic suggestion for re-entering hypnosis after receiving a cue from the therapist during the procedure. The nondirective play condition was designed to control for the amount of time and attention received from the clinician. Although both conditions produced significant pre to post reductions in self-reported pain, there was no difference between the groups on this variable or on observer ratings of distress. However, it should be noted that to keep the observers blind to condition, hypnosis was not actively performed during the actual bone marrow aspiration. This

may help to explain why hypnosis was no more effective than the attention control condition in relieving pain and distress.

More recently, Butler et al. (2005) evaluated whether hypnosis could reduce children's distress during a voiding cystourethrogram (VCUG) more than standard care. A VCUG is a radiological procedure consisting of urethral catheterization, insertion of radiologic contrast materials into the bladder, and imaging during urination. Forty-four youngsters, age 4–15, were randomly assigned to hypnosis or routine medical care conditions. The hypnosis condition consisted of 1 h of training in hypnotic imagery in which youngsters were helped to imagine floating in a bath, lake, or tub, or visiting an amusement park, friend's house, or playground. Patients were encouraged to practice the hypnotic imagery at home and a therapist was present during the VCUG to help the child use the imagery during the procedure. As part of the standard care condition, 83% of the patients elected to participate in the hospital's recreational therapy program, which provided modeling of the procedure with dolls, training in relaxation and deep breathing, as well as assistance during the procedure. Although there was no difference between the two conditions in self-reported distress, parent and observer ratings of distress were lower in the hypnosis group than in the standard care group. Considering that the vast majority of participants in the standard care condition actually received intervention, these outcomes are suggestive of the potential of hypnosis.

Hypnosis versus other psychological treatments

Hypnosis versus distraction

Many of the first controlled studies of the use of hypnosis for alleviating pediatric procedural pain compared its effectiveness with external distraction. Indeed, there is considerable evidence that distraction techniques such as breathing, party blowers and counting, are effective and efficient ways of reducing the discomfort experienced by children and adolescent undergoing invasive medical procedures (Blount et al. 2003; Dahlquist 1999a, b; Powers 1999).

Wall and Womack (1989) compared the effectiveness of hypnosis and distraction in reducing the pain associated with bone marrow aspirations and lumbar punctures. Participants were 20 outpatients, age 5–18, at a hematology/oncology clinic. Participants were randomly assigned to condition and met for two training sessions prior to undergoing the actual medical procedure. In the hypnosis condition, participants received procedural information, followed by a hypnotic induction and suggestions for relaxation and visual imagery. In the distraction condition,

participants received procedural information, followed by presentation of four activities designed to shift attention to motoric movements or sequential information.

During the posttreatment bone marrow aspiration or lumbar puncture, participants were cued by audiotape to make use of the techniques they had learned during training. However, the techniques were not actively delivered during the medical procedure. In both conditions, there were significant pre to post reductions in self-reported and observer-reported pain. However, there was no difference in effectiveness between the conditions. Unfortunately, the absence of a control group and a very small sample size make it difficult to interpret these findings. Moreover, only two of the ten youngsters assigned to the hypnotic condition reported afterwards that the treatment they had received actually involved hypnosis. Because of these limitations, the results of the study can be best described as inconclusive.

Zeltzer and LeBaron (1982) compared the effectiveness of imagination-focused hypnosis with distraction in reducing the pain associated with bone marrow aspirations and lumbar punctures. Participants were 33 oncology patients, age 6–17, suffering from leukemia, non-Hodgkins lymphoma, or neural tumors. These youngsters were randomly assigned to one of two treatment conditions. In the hypnosis condition, participants were helped to become involved in imaginative activities that were exciting or pleasant. A formal induction was not used and it is not clear that participants understood they were receiving hypnosis. In the distraction condition, patients were helped to use deep breathing or to focus their attention on objects in the procedure room. Hypnosis was more effective than distraction in reducing self-reports of pain and anxiety. These results are interesting because they suggest the potential of imagination-focused hypnosis for relieving children's procedure-related pain.

Kuttner et al. (1988) compared the efficacy of hypnosis, distraction, and standard medical care in reducing the distress associated with bone marrow aspirations. Participants were 48 pediatric oncology patients, age 3–10, with acute lymphoblastic leukemia or acute myeloblastic leukemia. These youngsters had been identified by medical staff as needing help in managing the distress associated with the bone marrow aspirations. Participants were randomly assigned to one of three conditions. The hypnosis condition was somewhat similar to imagination-focused hypnosis pioneered by Zeltzer and LeBaron (1982). Youngsters in this condition heard imaginative stories individually tailored to the child's interests, as well as direct suggestions for modification of the pain sensations. In the distraction condition, the child was shown toys, puppets, pop-up books, and bubbles and was asked to select the distractor he or she wanted in the room during the proce-

cedure. Finally, in the standard medical care condition, procedural information and reassurance was provided. Participants received a 5–20 min preparation session before the bone marrow aspiration and a clinician actively delivered the interventions during the medical procedure.

During the first posttreatment bone marrow aspiration, older children (7–10 years) using hypnosis or distraction reduced pain more than those in the standard medical care group. However, among younger children (3–6 years), hypnosis was more effective than distraction or standard medical care. During the second posttreatment trial, all children showed reductions in pain, but there was no difference in the effectiveness of the three conditions, leading the investigators to speculate that medical staff may have begun using distraction with patients in the standard medical care group. All in all, the results suggest that younger children benefited the most from hypnosis, whereas older children benefited from both hypnosis and distraction.

Finally, Smith et al. (1996) compared the effectiveness of hypnosis and distraction in reducing the pain associated with venipuncture or infusaport access. Participants were 27 children, age 3–8, with nonmalignant blood disorders and cancer. Hypnotic suggestibility was assessed with the Stanford Hypnotic Clinical Scale for Children. Participants then received two treatments in counterbalanced order. In the hypnosis treatment, parents were taught to help their children imagine going on a journey together to the child's favorite place. In the distraction condition, a pop-up distraction toy with loud sounds was activated during the medical procedure. Each intervention involved training sessions for the parents and practice sessions for the children. Results showed that highly suggestible children receiving hypnosis reported less pain than low suggestible children receiving hypnosis, as well as high and low suggestible children receiving distraction.

Together, the results of these studies suggest that when a therapist is present in the examination room and actively provides suggestions during the medical procedure, hypnosis may be at least as effective as distraction, especially among younger children (i.e., those in the 3–8 year old age range), and those who are more hypnotically suggestible.

Hypnosis versus cognitive-behavioral intervention

Multi-component cognitive-behavioral intervention packages have been shown to be very useful for reducing the pain experienced by children and adolescents undergoing invasive medical procedures (see Powers 1999). For example, Jay et al. (1987) developed a sophisticated cognitive-behavioral package consisting of filmed modeling, positive-reinforcement, breathing, imagery and behavioral

rehearsal that was based on Stress Inoculation Training (Turk et al. 1983), but tailored for children and adolescents. Jay et al. demonstrated that this package was more effective than medication and an attention control condition in reducing the pain and distress associated with bone marrow aspirations.

Only one study has evaluated the relative effectiveness of hypnosis and a multi-component cognitive-behavioral intervention package in reducing children's procedure-related pain. Lioffi and Hatira (1999) compared hypnosis with a cognitive-behavioral package and a no-treatment control condition in reducing the discomfort associated with bone marrow aspirations. Participants were 30 children, age 5–15, suffering from leukemia. These patients were randomly assigned to one of three treatment conditions. The hypnosis treatment consisted of three 30-min sessions in which the youngsters experienced an induction, plus suggestions for muscle relaxation, pleasant imagery, well-being, competence, as well as direct suggestions for modification of pain sensations. Patients also received a post-hypnotic suggestion that the hypnotic experience would be repeated in the examination room. The cognitive-behavioral intervention consisted of muscle relaxation, breathing and coping self-statements. The third condition was a no-treatment control condition.

The hypnotic and cognitive-behavioral interventions were significantly more effective than the control condition in reducing self-reports of pain. Also, hypnosis was more effective than the cognitive-behavioral package in reducing observer-rated distress, but not self-reported pain. It should be noted that the cognitive-behavioral package used in this study lacked many of the elements (e.g., imagery, modeling) contained in the program developed by Jay et al. (1987).

Effects of different types of analgesia suggestions

The classic use of hypnosis involves direct suggestions for modification of pain sensations (see Chaves 1993). However, some contemporary clinical hypnotists prefer to deliver standard cognitive-behavioral pain interventions in a hypnotic context (see Kirsch et al. 1995). Along these lines, Hawkins et al. (1998) compared the effectiveness of direct and indirect hypnotic suggestions for reducing the discomfort associated with lumbar punctures. Participants were 30 children, age 6–16, with leukemia and non-Hodgkins lymphoma. These patients were randomly assigned to one of two conditions. In the direct suggestion condition, children were given suggestions for alteration of pain sensations, such as suggestions for numbness (allow your back to go to sleep), topical anesthesia (paint numb medicine on back), local anesthesia (inject anesthetic), and glove anesthesia (let numb feeling transfer from hand to

affected body part). In the indirect suggestion condition, children were given suggestions for relaxing images of the setting sun or adjusting to spicy Mexican food. Patients were given an opportunity to experience the suggestions during training and then were accompanied by a therapist during the lumbar puncture. However, no formal induction was used during the lumbar puncture.

Results showed that although there were significant pre to post reductions in pain, there was no difference in effectiveness between the conditions. Unfortunately, the absence of a control group and the relatively small size of the sample in this study makes it difficult to interpret the findings. These limitations were addressed in a follow-up study by several of the same investigators. Lioffi and Hatira (2003) compared the identical direct and indirect suggestion conditions used in Hawkins et al. (1998) with attention control and standard medical treatment control conditions. The attention control condition consisted of nonmedical play and interactions. Participants were 80 children with leukemia and non-Hodgkin's lymphoma who were randomly assigned to condition. Results showed that the direct and indirect suggestions were more effective than the control conditions in reducing pain and distress. However, once again, there was no difference in effectiveness between the two kinds of suggestions. This suggests that the distinction between indirect and direct suggestions may not be especially meaningful.

Effects of adding hypnosis to a topical anesthetic

EMLA cream is a topical anesthetic emulsion composed of lidocaine and prilocaine. It is used for local analgesia of normal, intact skin. When EMLA is applied to the skin, it causes a numbing that prevents pain from needle insertion, intravenous cannulation, and minor skin surgery. There is some evidence that EMLA cream is effective for reducing the pain and distress experienced by children undergoing lumbar punctures (Halperin et al. 1989; Juarez-Gimenez et al. 1996).

Lioffi et al. (2006) studied the effect of adding hypnosis to EMLA in reducing the pain associated with lumbar punctures. Patients were 45 children, age 6–16, with leukemia and non-Hodgkins lymphoma. Youngsters were randomly assigned to one of three treatment conditions. In the local anesthetic condition, patients received EMLA cream 60 min before the lumbar puncture. In the local anesthetic plus hypnosis condition, patients received EMLA and training in hypnosis that included suggestions for well-being and comfort, as well as alteration of the pain sensations. A post-hypnotic suggestion was given that the hypnotic experience would be repeated in the examination room. However, during the lumbar puncture, the therapist did not actively provide suggestions to keep observers

blind to condition, but instead stroked the child's cheek to cue him or her to begin using hypnosis. Later in the experiment, these youngsters were also taught self-hypnosis. In the local anesthetic plus attention group, patients met with the therapist for the same amount of time as those in the anesthetic plus hypnosis group and engaged in non-medical interaction. Results showed that the anesthetic plus hypnosis condition reduced pain and distress more than the other two conditions during both regular hypnosis and self-hypnosis. The results are interesting because they suggest that hypnosis may be a useful adjunct to medical treatments designed to reduce pain during invasive procedures.

Effects of self-hypnosis

As previously mentioned, Lioffi and Hatira (2003) found that direct and indirect suggestions for analgesia reduced pain more than no-treatment and attention control conditions. During the latter portion of this experiment, patients were taught self-hypnosis using Gardner's (1981) three-step model. Unfortunately, the beneficial effects of regular hypnosis steadily degraded during the self-hypnosis phase, until they completely dissipated during the final lumbar puncture.

On the other hand, in Lioffi et al. (2006), children in the anesthetic plus hypnosis condition were taught self-hypnosis using Gardner's (1981) model prior to the third lumbar puncture. The therapist was not present when the child used self-hypnosis during the third lumbar puncture or during the fourth lumbar puncture at a 6-month follow-up. Instead, a parent stroked the child's cheek to signal the child to begin using hypnosis. Nevertheless, the reductions in pain and distress observed during the second lumbar puncture were maintained during the third and fourth lumbar punctures.

Lobe (2006) investigated the use of self-hypnosis to reduce the length of hospitalization and need for post-operative analgesics in patients undergoing the Nuss procedure for pectus excavatum. This condition involves a congenital deformity of the anterior wall of the chest that is evidenced by a caved-in or sunken chest. The Nuss procedure involves inserting steel bars into the chest that push outward on the chest wall. The bars are left in place for several years and eventually the deformity is corrected. In this study, ten adolescents, age 12–18, were nonrandomly assigned to self-hypnosis or standard medical care conditions. In the self-hypnosis condition, patients were trained in self-hypnosis prior to surgery and given suggestions to relax and to imagine a place that was safe and comfortable. They were then given a post-hypnotic suggestion that they could return to their safe place whenever uncomfortable. There was no difference between the self-hypnosis group and the standard care group in terms of patient controlled

pain management, intravenous narcotic, or oral narcotic doses. However, patients in the self-hypnosis group remained in the hospital for a significantly shorter amount of time than the standard care group.

All in all, the results of these studies suggest the possibility that self-hypnosis may be useful for reducing the pain and distress associated with a variety of medical procedures.

Effects of hypnotic-like imagery

When a suggestion to experience an imaginary state of affairs is delivered without a hypnotic induction beforehand, it is sometimes referred to by hypnosis researchers as a waking suggestion or an imaginative suggestion. The latter term is probably more appropriate because hypnosis is unrelated to sleep. A cognitive-behavioral therapist would find many similarities between certain kinds of imaginative suggestions and guided imagery. In this portion of the article, we review studies in which hypnotic-like imagery, delivered without a preceding hypnotic induction, was used to reduce procedure-related pain in children and adolescents. To be included, a study was required to use hypnotic-like imagery as a primary treatment. Thus, studies using imagery as one element of a multi-component intervention package were excluded (e.g., Jay et al. 1987).

Lambert (1996) evaluated the effectiveness of hypnotic-like imagery for reducing post-surgical pain. Participants were 52 children, age 7–12, who had undergone elective surgery. These patients were randomly assigned to one of two treatment conditions. In the imagery condition, participants met with a therapist for one 30-min training session a week before the surgery. Patients were asked to select an enjoyable image, which was incorporated inside of an individually tailored relaxation exercise. During the imagery, these youngsters were guided through rehearsal of the impending surgical experience and experienced suggestions for healing, uncomplicated recovery, and minimal pain. Participants assigned to the attention control condition spent an equal amount of time discussing surgery and topics related to the children's interests. Patients assigned to the imagery group rated their post-operative pain as less intense and had shorter lengths of hospital stay than youngsters in the control group.

Huth et al. (2004) investigated the effectiveness of hypnotic-like imagery for reducing pain related to tonsillectomy and/or adenoidectomy. Participants were 73 children, age 7–12, who were randomly assigned to one of two conditions. In the imagery condition, 2–22 days prior to the scheduled surgery, children received training in deep breathing, muscle relaxation, and imagery of a park. Children were also seen in-hospital by a therapist 1–4 h after the surgery and approximately 24 h after hospital

discharge. Children assigned to the attention-control condition received an equal amount of pre-operative time in which the children made drawings while the therapist talked with them and their parents. Results showed that youngsters in the imagery group reported less pain on sensory (i.e., intensity) and affective (i.e., distress) dimensions than those in the attention control condition immediately after surgery, but not 24 h following surgery.

Together, the findings of Lambert (1996) and Huth et al. (2004) suggest that training in hypnotic-like imagery is an effective way of reducing post-surgical pain.

Methodological considerations

The methodological status of the reviewed studies should be taken into account before drawing conclusions about the effectiveness of hypnosis for reducing procedure-related pain in children and adolescents. Table 2 evaluates the 13 procedure-related pain studies against five key methodological criteria: (a) specification of sample; (b) specification of treatments using a manual or its equivalent; (c) active delivery of intervention during invasive procedure; (d) intervention delivered in hypnotic context; and (e) association of hypnotic suggestibility and hypnotic pain reduction. Because detailed presentations of research methodology are available elsewhere (Campbell and Stanley 1966; Shadish et al. 2002), only the most frequently occurring limitations identified in the reviewed studies are mentioned here. A study was rated as having satisfied a criterion (indicated by a *Yes* in Table 2) if it was clear from the article that the criterion was likely to have been met. Otherwise, the study was given a rating of *No*. Some criteria were not relevant to a few studies. For example, delivering a treatment in a hypnotic context would not be relevant if the treatment were hypnotic-like, rather than hypnotic, in nature. In such instances, the study was given a rating of –.

Specification of sample

Clearly specifying the demographic characteristics of the sample used in a treatment outcome study makes it possible to identify the population to which the results may generalize. Enumerating the age, sex, and ethnicity of child and adolescent participants would seem to be essential in determining the generalizability of a study's findings. Unfortunately, only six of the 13 procedural pain studies specified the age, sex, and ethnicity of participants. Most studies identified the age and sex of the children and adolescents who had taken part, but not their ethnicity. Indeed, the Division 12 Task Force has emphasized the importance of specifying the ethnicity of participants in

Table 2 Evaluation of procedure-related pain studies by key methodological criteria

Study	Specification of sample	Treatment manual	Active delivery of intervention	Intervention in hypnotic context	Hypnotic suggestibility
Katz et al. (1987)	Yes	No	No	Yes	No
Butler et al. (2005)	Yes	No	Yes	No	No
Wall and Womack (1989)	No	Yes	No	No	Yes
Zeltzer and LeBaron (1982)	Yes	No	Yes	No	No
Kuttner et al. (1988)	No	No	Yes	No	No
Smith et al. (1996)	Yes	No	Yes	No	Yes
Lioffi and Hatira (1999)	No	No	No	Yes	Yes
Hawkins et al. (1998)	No	No	Yes	No	Yes
Lioffi and Hatira (2003)	No	Yes	Yes	Yes	Yes
Lioffi et al. (2006)	No	Yes	No	Yes	Yes
Lobe (2006)	No	No	–	No	No
Lambert (1996)	Yes	No	–	–	–
Huth et al. (2004)	Yes	Yes	–	–	–

outcome studies so that it is possible to draw conclusions about the efficacy of treatments for ethnic minority groups (Chambless et al. 1996). Despite the increasing interest in diversity issues in recent years, the absence of information about ethnicity seemed unrelated to date of publication.

Treatment manual

Using a manual in outcome research is valuable because it specifies the nature of the treatment procedures under investigation. When the treatment procedures are specified, it increases the likelihood that the treatment will be delivered consistently by therapists within a single investigative team or across investigative teams. In essence, using a manual increases the reliability with which a treatment is delivered. Unfortunately, only four of the 13 reviewed studies utilized a treatment manual (Huth et al. 2004; Lioffi and Hatira 2003; Lioffi et al. 2006; Wall and Womack 1989). Of note, three of five studies published since 2000 used a treatment manual, which may suggest a positive trend.

Active delivery of intervention

Some research has suggested that when a hypnotic suggestion for analgesia is provided continuously throughout a pain stimulus, it produces more relief than when the suggestion is delivered once at the outset of the pain (Price and Barber 1987). Thus, procedural pain studies in which a hypnotic intervention was delivered continuously throughout an invasive procedure may provide a more accurate picture of the potential of hypnosis for reducing

pain than studies in which the analgesia suggestion was made once at the beginning of the procedure or before the procedure in the form of a *post-hypnotic suggestion*. In a post-hypnotic suggestion, the youngster might undergo hypnosis during a preparation session hours or days before the invasive procedure and be told that he or she will be able to re-experience the feelings of hypnotically induced comfort and relaxation later while undergoing the invasive procedure. Active delivery of a hypnotic intervention during the medical procedure would not be relevant in a study of self-hypnosis (Lobe 2006) or of post-surgical pain (Huth et al. 2004; Lambert 1996).

Of the ten studies in which providing a hypnotic intervention continuously throughout an invasive procedure appeared relevant, in only six did this actually occur. In five of these six studies, a significant effect for hypnosis was obtained on at least one indicator of pain. In the sixth study, Hawkins et al. (1998) failed to find a difference between direct and indirect suggestions for pain reduction. However, when this study was replicated with the addition of several control conditions, Lioffi and Hatira (2003) reported that direct and indirect suggestions produced more relief than attention control and standard care conditions. In contrast, two of the four studies in which intervention was not provided continuously throughout an invasive procedure failed to produce an effect for hypnosis (Katz et al. 1987; Wall and Womack 1989). It is impossible to pinpoint why there was no significant effect for hypnosis in these studies, but the overall pattern of results in the literature is consistent with the view that providing a hypnotic intervention continuously throughout an invasive procedure optimizes pain reduction.

Intervention in hypnotic context

There is general agreement among hypnosis researchers that the social context in which a hypnotic suggestion is delivered has at least some impact on the response (Kirsch and Lynn 1995). For example, there is evidence that simply relabeling a cognitive-behavioral intervention as hypnosis can significantly increase its effectiveness (Kirsch et al. 1995). In evaluating the reviewed literature, it was not clear to us that participants in all of the studies explicitly understood that they were receiving hypnosis. Of course, this criteria would not be relevant in the two studies of hypnotic-like imagery. However, of the other 11 investigations, in only four was it clear that participants were aware they were receiving hypnosis (Katz et al. 1987; Lioffi and Hatira 1999, 2003; Lioffi et al. 2006). This may have reduced the effectiveness of hypnosis in the other seven studies. It is notable that in one study where participants were not explicitly told they were receiving hypnosis, only two of ten participants assigned to the hypnosis condition reported afterwards that the treatment they received had involved hypnosis (Wall and Womack 1989).

Hypnotic suggestibility

Lynn and Shindler (2002) recommend assessing hypnotic suggestibility whenever hypnosis is used as a treatment. The importance of doing so in treating pain is suggested by the results of the Montgomery et al. (2000) meta-analysis. These researchers found that there was a direct relationship between hypnotic suggestibility and hypnotic pain reduction. Eleven of the reviewed studies involved a hypnotic treatment of some kind. In 6 of these 11 studies, hypnotic suggestibility was measured and its relationship to hypnotic pain reduction was analyzed. In all but one of the six studies, suggestibility was associated hypnotic pain reduction (Kuttner et al. 1988; Lioffi and Hatira 1999, 2003; Lioffi et al. 2006; Smith et al. 1996). Although these studies conceptualized suggestibility as a moderator of the effect of treatment with hypnosis, only one study used Baron and Kenny's (1986) classic method of testing moderation.

Hypnosis as an empirically supported therapy

According to the criteria for empirically supported therapies (Chambless and Hollon 1998), hypnotic-like imagery, as described by Huth et al. (2004), appears to qualify as a possibly efficacious therapy for 7–12 year olds experiencing the immediate post-operative pain associated with a tonsillectomy or adenoidectomy. Two sophisticated studies failed to satisfy criteria for empirically supported therapies only because they did not specify the ethnic composition of

their sample (Lioffi and Hatira 2003; Lioffi et al. 2006). It was later determined that in both studies, 100% of the samples were Caucasian and the overwhelming majority were Greek (C. Lioffi, personal communication, December 29, 2008). Consequently, direct and indirect suggestions for analgesia, as described by Lioffi and Hatira (2003), seems to meet criteria for a possibly efficacious therapy for 6–17 year old Greek youngsters undergoing lumbar punctures. Likewise, adding hypnosis to EMLA cream, as described by Lioffi et al. (2006), appears to qualify as a possibly efficacious therapy for 6–16 year old Greek youth experiencing lumbar puncture pain. It is unknown whether the results of the latter two studies would generalize to youngsters who are ethnic minorities.

Several impressive studies failed to satisfy criteria for empirically supported therapies only because they lacked a treatment manual. Butler et al. (2005) showed that pleasant hypnotic imagery was more effective than standard medical care in alleviating the discomfort experienced by 4–15 year olds undergoing VCUG. Zeltzer and LeBaron (1982) reported that imagination-focused hypnosis helped 6–17 year old cancer patients reduce the pain of a lumbar punctures or bone marrow aspirations more than distraction. Smith et al. (1996) found that hypnosis was more effective than distraction in relieving the discomfort experienced by highly suggestible 3–8 year old children undergoing venipuncture or infusaport access. Finally, Lambert (1996) showed that hypnotic-like imagery was more effective than an attention control condition in reducing post-surgical pain in 7–12 year old children.

Generally, the findings of these seven studies suggest that relative to criteria for empirically supported therapies, hypnosis is a very promising treatment for reducing the pain experienced by children and adolescents undergoing a variety of invasive medical procedures.

Discussion

Empirical research has proven that hypnosis is very effective in reducing the pain experienced by children and adolescents undergoing a variety of invasive medical procedures. With almost uniform consistency, hypnosis and hypnotic-like imagery have been shown to be more effective than no treatment, standard medical care, or attention control conditions in alleviating the discomfort associated with bone marrow aspirations (Kuttner et al. 1988; Lioffi and Hatira 1999), lumbar punctures (Lioffi and Hatira 2003), voiding cystourethograms (Butler et al. 2005), the Nuss procedure (Lobe 2006), and post-surgical pain (Huth et al. 2004; Lambert 1996). The one study that failed to show an effect for hypnosis relative to a control condition was characterized by a very small sample size (resulting in

low statistical power), as well as a failure to actively deliver the hypnotic intervention during the invasive procedure (Katz et al. 1987).

Most controlled studies contrasting hypnosis with other psychological interventions for reducing procedural pain in children and adolescents have featured comparisons with distraction. These investigations suggest that hypnosis may be more effective than distraction in reducing children's distress (Zeltzer and LeBaron 1982), especially if the patients are younger (Kuttner et al. 1988), or score in the high range of hypnotic suggestibility (Smith et al. 1996). Only one study failed to show a difference in effectiveness between hypnosis and distraction (Wall and Womack 1989).

In contrast, there has been little research comparing the effectiveness of hypnosis and multi-component cognitive-behavioral intervention packages in reducing procedure-related pain in children and adolescents (Lioffi and Hatira 1999). More research is needed comparing hypnosis with the full range of techniques customarily contained in sophisticated cognitive-behavioral packages (see Jay et al. 1987). Establishing the relative effectiveness of these interventions is important because the typical hypnotic intervention may be more time-efficient than a cognitive-behavioral package.

Self-hypnosis is potentially a very cost-effective intervention because it eliminates the need for a clinician to be present during an invasive procedure. Furthermore, self-hypnosis may be especially practical for treating pain that is chronic or episodic in nature (e.g., post-surgical pain). However, evidence of the effectiveness of self-hypnosis for reducing procedure-related pain is mixed (Lioffi and Hatira 2003; Lioffi et al. 2006; Lobe 2006). Moreover, none of the studies demonstrating an effect for self-hypnosis compared it with hetero-hypnosis. There is evidence that simply having a supportive care-giver present in the examination room can help youngsters obtain relief from an invasive procedure (e.g., O'Laughlin and Ridley-Johnson 1995), which would give an advantage to hetero-hypnosis. Consequently, research is needed comparing the effectiveness of hetero-hypnosis and self-hypnosis for reducing procedure-related pain.

Hypnosis shows great promise as an empirically supported therapy for reducing procedure related-pain in children and adolescents. Hypnotic-like imagery met the criteria for a possibly efficacious therapy in reducing post-surgical pain (Huth et al. 2004), as did direct and indirect hypnotic analgesia suggestions (Lioffi and Hatira 2003), as well as using hypnosis as an adjunct to EMLA cream (Lioffi et al. 2006) for reducing lumbar puncture pain. Several impressive studies failed to meet the criteria for a possibly efficacious therapy only because they lacked a treatment manual (Butler et al. 2005; Lambert 1996; Smith et al. 1996; Zeltzer and LeBaron 1982).

Indeed, the absence of a treatment manual was the most common methodological issue identified in the 13 reviewed studies. As previously noted, a manual is helpful for delivering a treatment reliably within and across investigative teams and is generally necessary for establishing a treatment as empirically supported. Several other recurring methodological shortcomings limited the contribution of the existing literature. To strengthen this body of research, journal editors may wish to require investigators to more completely specify the demographic characteristics (i.e., age, sex, ethnicity) of their samples so that it is possible to determine the population to which results generalize. Also, to demonstrate the full potential of hypnosis for reducing procedure-related pain, researchers may wish to consider the benefits of explicitly presenting their interventions in a hypnotic context and actively delivering analgesia suggestions throughout an invasive procedure. Finally, hypnotic suggestibility should routinely be assessed and its relationship to pain reduction evaluated with appropriate moderator analyses (e.g., Baron and Kenny 1986).

Conclusions

In sum, empirical research has demonstrated the utility of hypnosis for reducing the pain and discomfort experienced by youngsters undergoing a variety of invasive medical procedures. It is a relatively time-efficient treatment that has proven to be more effective than standard medical care or control conditions, and at least as effective as such time-honored interventions as distraction. A variety of uses of hypnosis qualify as a possibly efficacious therapy for reducing post-surgical or lumbar puncture pain. Several other hypnotic interventions have shown considerable promise relative to the criteria for empirically supported therapies as an intervention for lumbar punctures, bone marrow aspirations, venipunctures, and voiding cystourethrograms. A growing emphasis on empirically supported therapies and evidence-based practice underscores the exciting potential of hypnosis as a tool for clinicians who work with children and adolescents undergoing invasive medical procedures.

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