

The Effectiveness of Adjunctive Hypnosis with Surgical Patients: A Meta-Analysis

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Hypnosis is a nonpharmacologic means for managing adverse surgical side effects. Typically, reviews of the hypnosis literature have been narrative in nature, focused on specific outcome domains (e.g., patients' self-reported pain), and rarely address the impact of different modes of the hypnosis administration. Therefore, it is important to take a quantitative approach to assessing the beneficial impact of adjunctive hypnosis for surgical patients, as well as to examine whether the beneficial impact of hypnosis goes beyond patients' pain and method of the administration. We conducted meta-analyses of published controlled studies ($n = 20$) that used hypnosis with surgical patients to determine: 1) overall, whether hypnosis has a significant beneficial

impact, 2) whether there are outcomes for which hypnosis is relatively more effective, and 3) whether the method of hypnotic induction (live versus audiotape) affects hypnosis efficacy. Our results revealed a significant effect size ($D = 1.20$), indicating that surgical patients in hypnosis treatment groups had better outcomes than 89% of patients in control groups. No significant differences were found between clinical outcome categories or between methods of the induction of hypnosis. These results support the position that hypnosis is an effective adjunctive procedure for a wide variety of surgical patients.

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Despite the advances in anesthetic and surgical technique, surgical treatment still entails some level of physical and emotional cost to patients (1–5). The principal approach to improving perioperative outcomes has been through pharmacologic interventions. Whereas these methods have greatly improved surgical recovery, pharmaceuticals are rarely completely effective and may be associated with significant side effect profiles (4,5).

Nonpharmacologic interventions have been successfully used to address side effects in surgical patients (6) and come without their own associated side effect profile. One of the most promising of these interventions is hypnosis. Hypnosis has been defined

as a situation or set of procedures in which a person designated as the hypnotist suggests that another person designated as patient experience various changes in sensation, perception, cognition, or control over motor behavior (7). In clinical work, the hypnotic context is generally established by an induction procedure. During hypnotic inductions, the hypnotist typically guides patients through peaceful and relaxing imagery with the goal of helping patients feel more relaxed, distracted from aversive stimuli, and more open to therapeutic suggestions. The induction phase is followed by an application phase in which suggestions are made by the hypnotist to the patient. Suggestions may include that patients experience changes in sensorial or cognitive processes, physiology (e.g., heart rate), or behavior (8). For example, suggestions for reduced pain, reduced stress, increased vitality, and increased sense of personal efficacy are common in the literature (for details, see (9)). The literature supports the use of hypnosis as a nonpharmacologic, adjunctive approach with surgical patients. That is, patients receive standard surgical and anesthesia care according to protocol but with hypnosis added to the treatment package. It is important to note that not since the early part of the twentieth century has hypnosis been considered a stand-alone treatment. Rather,

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hypnosis is usually considered an adjunctive technique for surgical patients.

Meta-analysis (10,11) is an established methodology for evaluating the efficacy of interventions using data from multiple studies. Individual clinical studies have suggested that hypnosis, which like other complementary therapies has been gaining in popularity in the United States (12), is effective for controlling a variety of symptoms and improving patient treatment course and recovery (e.g., reduced pain, nausea, and hospital stays) (13-18). However, there have been no meta-analyses to confirm the efficacy of hypnosis and to determine the magnitude of the benefits with surgical patients. Moreover, the relative effectiveness of hypnosis for ameliorating specific side effects of surgery has yet to be established. For example, consistent with published literature (19), it may be that hypnosis is very effective in reducing patients' pain but relatively less effective in reducing distress, recovery, or use of medication. A quantitative analysis of the literature to evaluate hypnosis is required to inform clinical personnel so that the total package of medical and psychological interventions offered to patients addresses both the intensity and breadth of their likely symptoms and experiences.

The goal of the present study was to estimate the effectiveness of adjunctive hypnosis in controlling signs and symptoms after surgery. This goal was addressed on three levels using meta-analytic techniques (10,11) with data from the published literature. Specifically, the present study provides: 1) a quantitative estimate of the overall effect size of adjunctive hypnosis intervention across outcome domains and methods of the administration, 2) a comparison of effect sizes by outcome domains, and 3) a comparison of effect sizes by methods of the hypnosis administration. Also explored were differences in effect sizes caused by study design. Randomized clinical trials have been described as the gold standard for research on clinical interventions (20), and therefore, we also compared effect sizes found in randomized clinical trials with those found in nonrandomized trials.

Methods

Studies included in the present sample were identified from previous reviews of this literature (21-24) and a computer search of the Medline and PsycLIT databases as of June 2001 by entering the search terms hypnosis and surgery, hypnosis and operation, hypnotherapy and surgery, and hypnotherapy and operation. The computer search algorithm was set to accept plurals (e.g., hypnotherapies and surgeries) and word variants (e.g., hypnotic, hypnotically, hypnotize, hypnotizability, and operative). Initial inclusion criteria were as follows: 1) an explicitly defined hypnosis

intervention administered to a sample was administered to at least one group of subjects undergoing surgery, 2) the inclusion of a no-treatment, routine care, or attention control group in the study design, and 3) sufficient data (e.g., means, SD, and inferential statistics) were reported to allow calculation of effect sizes (10,11). Because of the use of the word hypnosis to describe pharmacologically induced states in the anesthesia literature, for the purpose of the present study, the methods sections of published studies had to be carefully screened to determine that the authors were specifically describing a behavioral intervention as hypnosis. Consistent with the published clinical literature, among these studies, hypnosis was typically administered to patients in the form of a relaxing induction phase followed by suggestions for control of side effect profiles (e.g., pain, nausea, and distress).

After these standardized methods, 22 effect sizes were initially calculated from 20 papers (3 effect sizes were derived from a single paper that included multiple hypnosis groups). Overall, effect sizes were based on the reports of 1624 patients. To protect against the possibility that studies with larger numbers of dependent variables (e.g., pain and nausea) would have undue influence on the final overall estimate of the beneficial impact of hypnosis (10), effect sizes were calculated as the mean effect for each paper, with one exception. In the present sample of studies, one study (25) contained more than one hypnosis treatment condition (i.e., three) as well as the required statistical data for computation of effect sizes. For this study, effect sizes were calculated for each treatment because the hypnosis treatment groups were separate samples of patients, and therefore the risks to statistical independence caused by multiple treatments from the same study are relatively small. In addition, in one study (26), we selected the matched sample of patients ($n = 38$) as a more rigorous test of the beneficial impact of hypnosis.

Secondary analysis of differences among clinical outcome categories was also performed. Clinical outcome categories included: 1) negative affect (e.g., anxiety and depression), which was measured by both self-report and observations by others (e.g., nurse), 2) pain (both self-report and observations by others), 3) pain medication (e.g., analgesics and anesthetics), 4) physiological indicators (e.g., blood pressure, heart rate, and catecholamine levels), 5) recovery (e.g., return of muscular strength, postoperative vomiting, and fatigue), and 6) treatment time (e.g., length of procedure and inpatient stay). These outcome categories were based on common classifications in the literature (27) as well as on the results of principal component analyses of surgical outcomes (3).

Effect sizes were calculated according to published procedures (10). Briefly, mean differences between hypnosis treatment groups and control groups were

calculated for each study and then divided by the SD. To estimate the overall effect of adjunctive hypnosis interventions (Hypothesis 1), the 95% confidence interval (CI) for the difference between hypnosis control groups was calculated and then compared to zero. If the 95% CI included zero, there would be no significant effect of hypnosis. Next, effect sizes and 95% CIs were calculated for each clinical outcome category. CIs were assessed for their inclusion of zero to test the significance of the individual category effects, and a between groups analyses of variance (ANOVA) approach was used to determine if the categories differed from each other. To determine if effect sizes because of hypnosis differed based on type of the administration, 95% CIs were calculated for effect sizes associated with both live and taped approaches. In addition, a one-way ANOVA was performed to assess whether they differed from each other. An identical statistical approach was also used to determine if effect sizes differed based on study design.

Results

The meta-analysis revealed a significant benefit of hypnosis with surgical patients. Mean effect sizes averaged for treatments within studies, type of surgery, type of control condition, type of design, modality of intervention, and sample size for each study included in the analyses are presented in Table 1 (28–41). Analyses of these data revealed a medium to large average effect size due to hypnosis ($D = 0.72$, SD of $D = 0.68$) based on published criteria (42). Ninety-nine percent CIs indicated that this effect size statistically differed from zero ([0.36–1.08], $P < 0.01$). Because bias can be introduced into effect size calculations through variations in individual study sample sizes, we also reran the analyses correcting for study sample size based on published procedures (10). Specifically, both the mean difference and the variation of difference were adjusted for variation in study sample sizes (D and $VarD$, respectively). Results revealed a large weighted effect size ($D = 1.20$; $VarD = 0.83$) (42), and again the 99% CI indicated that D differed significantly from zero ([0.71–1.69], $P < 0.01$). Expressed in a different way, these results indicated that surgical patients in hypnosis treatment conditions demonstrated better outcomes than 89% of patients in the control conditions.¹

Because the overall beneficial effect of hypnosis with surgical patients was significant, it was interesting to examine whether effect sizes differed by clinical

outcome categories. Mean corrected effect sizes for each of the 6 clinical outcome categories along with 95% CIs and $VarD$ are presented in Table 2. A ANOVA approach failed to reveal any differences in effectiveness ($F[5, 100] = 1.27$; $P > 0.28$) based on clinical outcome category. Rather, an examination of the CIs for each category revealed that hypnosis had significant effects ($P < 0.05$) on every outcome in the expected positive direction (Table 2). These results support the view that there is a broad beneficial impact of hypnosis interventions with surgical patients across clinical outcome categories. A similar pattern of results was also found among unadjusted effects.

The effect sizes for traditionally more subjectively experienced indicators (i.e., negative affect and pain) and the more objective outcomes (i.e., pain medication, physiological indicators, recovery, and treatment time) were equivalent (mean self-report $D = 1.38$ and mean objective $D = 1.45$; $P > 0.05$). Because the effect for recovery may be an outlier, the mean effect size for objective data was recalculated after its removal. Consistent with the original results, the recalculated data effect size for the objective data was not significantly different from the subjective data ($P > 0.05$), and the objective data effect size remains in the medium to large range (42).

In this sample of studies, 14 of the hypnosis interventions included live administration by a health care professional, and 8 of the interventions relied solely on audiotapes. One-way ANOVA results revealed that the mean difference between effect sizes associated with live ($D = 1.4$; 95% CI, 0.94–1.86) or taped ($D = 0.55$; 95% CI, 0.13–0.97) administration was not significant ($F[1, 20] = 0.64$; $P > 0.43$). Both effects were significantly larger than zero ($P < 0.05$), indicating the efficacy of hypnosis presented by either mean.

This sample of studies also included two primary research designs, and therefore we explored the effects of research design on effect sizes. First, studies included in our sample used both randomized and non-randomized designs. Thirteen studies used randomized designs, and nine did not. An analysis of differences in mean effect sizes caused by study design did not reveal a significant effect ($F[1, 20] = 2.64$; $P > 0.12$). Effect sizes for both randomized and non-randomized studies were significantly more than zero ($P < 0.05$), indicating that both types of study design revealed significant benefits because of hypnosis. Another methodological difference within this sample of studies was the type of control condition used. Three of the treatment conditions were compared with attention control conditions where patients participated in a session with a health care professional for the same amount of time as those in the hypnosis treatment condition. Nineteen of the treatment conditions were compared with standard care control conditions. Analyses did not reveal an effect because of type of

¹ The percentage of patients that benefit in hypnosis treatment groups relative to control groups is calculated by looking up the mean effect size in a normal distribution table to determine the area under the curve.

Table 1. Study Characteristics and Mean Effect Sizes by Publication Date

| Study | Type of Surgery ^b | Method of Administration | Type of Design | Type of Control Condition | No. | <i>d</i> |
|--|---|--------------------------|----------------|---------------------------|-----|----------|
| Doberneck et al. (1959) (28) | Cholecystectomy, colectomy, and, gastrectomy | Live | Nonrandomized | Routine care | 62 | 0.50 |
| Werbel (1960) (29) | Hemorrhoidectomy | Live | Nonrandomized | Routine care | 22 | 1.13 |
| Field (1974) (30) | Orthopedic surgery | Tape | Randomized | Attention control | 60 | 0.21 |
| Surman et al. (1974) (31) | Elective mitral valve | Live | Randomized | Routine care | 40 | -0.33 |
| Hart (1980) (32) | Cardiopulmonary bypass | Tape | Randomized | Routine care | 40 | 0.53 |
| Goldmann et al. (1988) (33) | Elective gynaecological surgery | Live | Randomized | Attention control | 52 | 0.96 |
| John & Parrino (1983) (18) | Radial keratotomy | Live | Randomized | Routine care | 59 | 0.80 |
| Rapkin et al. (1991) (34) | Head and neck cancer surgery | Live | Nonrandomized | Routine care | 32 | 0.63 |
| Greenleaf et al. (1992) (35) | Coronary artery bypass | Live | Randomized | Routine care | 20 | 0.78 |
| Enqvist et al. (1995a) (25) | Bimaxillary orthognatic surgery | Tape | Nonrandomized | Routine care | 48 | 0.48 |
| | Bimaxillary orthognatic surgery | Tape | Nonrandomized | Routine care | 36 | 0.48 |
| | Bimaxillary orthognatic surgery | Tape | Nonrandomized | Routine care | 36 | 0.48 |
| Enqvist et al. (1995b) (26) ^a | Orthognatic surgery | Tape | Randomized | Routine care | 38 | 0.23 |
| Faymonville et al. (1995) (36) | Plastic surgeries | Live | Nonrandomized | Routine care | 309 | 1.93 |
| Lambert (1996) (37) | Elective pediatric surgeries | Live | Randomized | Attention control | 50 | 0.31 |
| Ashton et al. (1997) (16) | Elective coronary artery bypass | Live | Randomized | Routine care | 32 | -0.02 |
| Enqvist et al. (1997) (15) | Elective breast reduction | Tape | Randomized | Routine care | 48 | 2.07 |
| Mauer et al. (1998) (38) | Hand surgery | Live | Nonrandomized | Routine care | 60 | 0.82 |
| Ghoneim et al. (1999) (39) | Third molar surgery | Tape | Randomized | Routine care | 60 | 0.01 |
| Meurisse et al. (1999) (40) | Cervical endocrine surgery | Live | Nonrandomized | Routine care | 339 | 2.47 |
| Lang et al. (2000) (41) | Invasive medical procedures (peripheral vascular and renal interventions) | Live | Randomized | Routine care | 161 | 0.41 |
| Montgomery et al. (2002) (6) | Excisional breast biopsy | Live | Randomized | Routine care | 20 | 0.90 |

^a Enqvist et al. (1995a) included three hypnotic treatment groups.

^b Type of surgery refers to how the original authors described their sample of patients in the methods section.

Table 2. Population Effect Size as a Function of Clinical Outcome Category

| Clinical Outcome Category | No. | <i>D</i> | Var <i>D</i> | 95% Confidence Interval |
|---------------------------|-----|----------|--------------|-------------------------|
| | | | | of <i>D</i> |
| Negative affect | 18 | 1.07 | 1.38 | 0.53-1.61 |
| Pain | 13 | 1.69 | 4.37 | 0.56-2.82 |
| Pain medication | 19 | 1.17 | 2.85 | 0.41-1.93 |
| Physiological indicators | 23 | 0.27 | 0.08 | 0.16-0.38 |
| Recovery | 12 | 3.61 | 24.0 | 0.85-6.37 |
| Treatment time | 21 | 0.76 | 2.15 | 0.14-1.38 |

control condition ($F[1, 20] = 0.35; P > 0.55$). Both effect sizes were significantly more than zero ($P < 0.05$).

As a final check on the beneficial effects of hypnosis from a clinical perspective, we also explored whether there were differences in patients' overall satisfaction with their medical care. Patients in hypnosis groups reported significantly more satisfaction than those in control groups ($D = 0.93; VarD = 0.42; P < 0.05$).

Discussion

The present meta-analysis revealed that on average 89% of surgical patients in previous studies benefitted from adjunctive hypnosis interventions relative to patients in control conditions. The beneficial effects were apparent in each of the six clinical outcome categories

chosen for our analyses. Both self-report as well as objectively assessed end points were influenced. This suggests that, in a general sense, adjunctive hypnosis is a powerful tool for addressing signs and symptoms after surgery. That is, adjunctive hypnosis helped the majority of patients reduce adverse consequences of surgical interventions. We found no evidence to support the position that these findings were dependent on the method of the hypnosis administration or study design.

Analyses of clinical outcome categories revealed the broad beneficial impact of hypnosis. These effects are consistent with those previously published for a variety of types of psychological preparations for surgery (27). Although we did not find significant differences in the impact of hypnosis across clinical categories, it is important to note that, according to Cohen's (42) estimates of the magnitudes of effect sizes, there may be differences. That is, effects for negative affect, pain, pain medication, and recovery all occurred well above the cutoff for a large effect. Treatment time was in the medium to large range, and physiological changes were in the small range. Thus, one might plausibly argue that physiological change induced by hypnosis is a relatively smaller effect among the clinical outcome categories. However, given that hypnosis is a nonpharmacologic intervention by nature, the present finding of a significant positive physiological effect is potentially important. Future randomized clinical trials should attempt to determine if there are classes of

physiological variables for which hypnosis has an impact and classes of variables for which hypnosis does not. The present meta-analysis combined data across classes (e.g., blood pressure and catecholamine levels) and may have missed potential specificity of effects. Indeed, if the effects of hypnosis on physiological variables are specific, a meta-analytic approach may tend to underestimate effect sizes in this area because all individual tests of physiological change are included.

In the surgical research literature, comparisons of live versus audiotaped interventions are scant. In the present study, the comparison of live versus taped hypnosis interventions revealed no differences, perhaps because of the variability among studies. Based on these results, one might cautiously state that there is no effect of the method of the administration on the beneficial impact of hypnosis. However, the failure to find benefit for live presentation over taped may be partially because of the comparison of small numbers of studies (i.e., 14 versus 8). The more conservative interpretation of these data is that both taped and live hypnosis interventions are effective, and the potential reduction in effect size because of taped hypnosis is unknown at this time. An important question for future research is to determine the incremental cost of the beneficial effect. For example, if 33% of the effectiveness of a live intervention can be achieved via tape at 5% of the cost, surgical centers may opt for taped interventions to provide significant patient benefits while controlling costs associated with additional professional staff time.

A common perception both within the hypnosis literature and the broader medical literature is that only certain individuals, who happen to be high on trait measures of hypnotic suggestibility, benefit from such interventions. The present results argue against such a view. Eighty-nine percent of surgical patients in hypnosis groups benefitted relative to control patients. These data are consistent with previously published meta-analyses on hypnotic analgesia generally (19), as well as socio-cognitive views of hypnosis (8) and experimental studies (6). All suggest that hypnosis can be used to alter patients' expectations for their own benefit. This is not to say that all patients have equal responses to hypnosis, but rather that most people have enough ability in this area to benefit clinically. Coupled with the present finding that surgical patients in hypnosis treatment conditions have greater satisfaction than patients in control conditions, there appears to be little reason not to provide adjunctive hypnosis to the broad range of surgical patients.

As with most meta-analytic research, the present study has limitations. For example, some might argue against the inclusion of nonrandomized studies. Two factors should be considered that mitigate this limitation. First, not only were both effects in the same

direction, but both were significantly positive supporting the beneficial impact of adjunctive hypnosis, and there was no statistical difference between the magnitudes of the effects. Second, it has been suggested that randomized clinical trials underestimate the effects of psychological interventions (43). In clinical practice, no surgical patient is told that they may or may not receive treatment based on the flip of a coin. Rather, the clinician and the patient determine the course of treatment together. Therefore, it is possible that randomized trials may somewhat underestimate the impact of hypnosis.

A second limitation of the present sample of studies is that the majority compared adjunctive hypnosis to standard clinical care. One could argue that a placebo condition is required in all studies. However, it should be noted that the present study did not detect significant differences in hypnosis efficacy reported in studies with differing control conditions. It is left to future research to determine whether hypnosis is effective because of common elements such as additional attention from health care professionals or of specific elements associated with hypnosis. These questions could be addressed using study designs with differing control groups. The present study firmly supports the efficacy of hypnosis but does not address mechanisms beyond the speculative discussion above.

A third shortcoming of the present study is that some of the comparisons were limited by sample size. This limitation can only be addressed by a reevaluation of the literature as studies in this area continue to accumulate. Fourth, as with any meta-analyses, there is what has been referred to as the file-drawer problem. Investigators who have nonsignificant results may have not published these findings, thus biasing the sample of studies in the positive direction. To address this limitation, we calculated the number of studies with effect sizes of zero that would be required to reduce the present effect size to zero according to published guidelines (10). In this case, the hypothetical file-drawers would have to contain 242 studies with no effect, which is a somewhat improbable circumstance. Fifth, the present sample of studies spans over 40 years (Table 1). It is possible that changes and advances in clinical procedures over this time period have affected the impact of hypnosis. However, we found no obvious relation between publication date and effect size (Table 1). Changes in surgical care may be contributing to variability in the effect sizes observed, yet the overall effect remains positive despite the potential of historical influence.

The present results provide strong support of the efficacy of hypnosis with surgical patients, but the question of the mechanism by which it functions remains to be determined. Socio-cognitive theorists in this area have suggested that hypnosis may function via changes in patients' expectancies for outcomes (8),

but it is also possible that these effects may be caused by hypnosis-induced reductions in patients' distress levels. Only one study seems to have addressed the issue of mediators, reporting data consistent with an expectancy mechanism and inconsistent with a distress mechanism (6). Of course, there must also be a physiological substrate for any psychological mechanism, and recent studies have found physiological correlates of hypnosis with brain imaging techniques (e.g., positron emission tomography and electroencephalograph techniques) (44,45). Though promising, these studies have limitations. For example, they have focused on small numbers of subjects, samples have been limited to those participants who score high on hypnotic suggestibility scales, and control groups are generally not included. Because the beneficial effects of hypnosis demonstrated here generalize across a broad range of patients, it is an open question as to whether the results of laboratory brain imaging studies would generalize. The question of the underlying mechanism for these clinical effects in surgical patients clearly needs to be pursued in future randomized trials. In addition, future studies may also wish to compare the clinical effectiveness of suggestions alone in a nonhypnotic context with suggestions embedded within hypnosis. For example, previous research has demonstrated that suggestions alone during anesthesia can be effective means for reducing hospital stay (5). However, it is not known how these effects compare with those of suggestions made within the hypnotic context.

In summary, hypnosis for patients going through surgical procedures is successful for the majority of individuals. Beneficial clinical impact was detected across six clinical categories. Effects are not limited to patients with certain characteristics and can be achieved with tape-recorded presentation of hypnosis interventions. Additional studies are required to formally assess cost-effectiveness of hypnosis interventions, to reduce barriers to its practical application in surgical clinics, as well as to elucidate the mechanisms underlying such effects. In the meantime, this meta-analysis of the available data in the literature suggests that clinicians consider providing patients with a brief hypnosis session as part of surgical treatment.

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