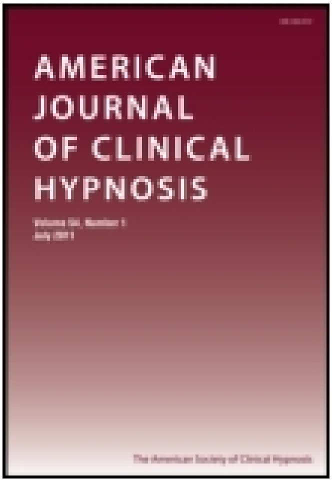

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Use of Hypnosis before and during Angioplasty

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Use of Hypnosis Before and During Angioplasty

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In this study, 16 patients matched with 16 controls were hypnotized prior to angioplasty. The hypnotized patients had a 25% increase in the time the cardiologist was able to keep the balloon inflated compared to the controls. Of the hypnotized patients, 13% required additional narcotic pain medication during the procedure as compared to 44% for the controls. Although we found no differences in rhythm, ischemia, blood pressure, or pulse between the two groups, the results of arterial catecholamine levels drawn at the start and at the end of the procedure were unexpected and seemed paradoxical. Norepinephrine levels were significantly higher in the hypnotized group (432 pg/ml, *SE* 51) than in the control group (281pg/ml, *SE* 23) at the start of the procedure and fell more during the procedure than in control patients. Because catecholamines reportedly act as a barometer of neuroanxiety, further studies defining their role are needed.

Dilatation, by inflating balloons in catheters, of partially occluded coronary arteries to increase blood flow to ischemic cardiac muscle has become routine. Although pain medicine, tranquilizers, and coronary dilators are given, the procedure is sometimes curtailed or modified because the patient experiences severe pain or a rhythm disturbance while the balloon is inflated. If these disturbances can be diminished, the patient might have a better outcome.

Most researchers and clinicians concur that mental stress can cause angina and may alter cardiac function. In 1975 Myers and Dewar investigated the circumstances attending 100 sudden deaths from coronary artery disease. They reported on the findings of coroner's necropsies and found the most significant relationship of sudden death was with acute psychological stress, whereas very strenuous exercise and chronic physiological stress were not so related. Since then mental stress has been added to the usual risk factors (advanced age, male sex, diabetes, hypertension, cigarette smoking, obesity, and elevation of cholesterol, especially the low density

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fraction of lipoprotein) that cause coronary artery disease.

Modern treatment includes placing patients with angina and other cardiac threatening problems into coronary care units. Many then require arteriography to determine the status of their coronary vessels. Although these units and procedures have been invaluable in saving lives, they in themselves do contribute some measure of stress (Cay, Vetter, Philip, & Dugard, 1977; Kornfeld, 1980; Vetter, Cay, Philip, & Strange, 1977).

Reviewing the findings of patients who went through such units, an international consortium on cerebral and psychopathological dysfunctions, made up of cardiologists, psychiatrists, and psychologists, found that one third of 150,000 Americans who underwent coronary bypass surgery had postoperative emotional trauma. They hoped "to persuade doctors and nurses in intensive-care units to monitor patients' mental rhythms as carefully as they now keep tabs on their heart beats and respiration" (Clark & Shapiro, 1981).

With five to six million patients treated annually for coronary artery disease and with another estimated one to two million more with equally severe disease who are not being treated, Cohn (1985) postulated that with an aging population receiving more medical benefits yearly the problem of caring for these patients becomes an evermore serious issue.

There are many reports of the effect of mental stress tests on cardiac function (Deanfield & Selwyn, 1986; Specchia et al., 1984; Campbell et al., 1986; Deanfield et al., 1984; Barry et al., 1988; Freeman, Nixon, Sallabank, & Reaveley, 1987). Rozanski et al. (1988) found that after mentally stressing patients, 23 of 39 patients (59%) had wall-motion abnormalities as shown by radionuclide ventriculography and that 14 (36%) had a significant fall in the amount of blood ejected each heart beat. Of the several mental stress tests they performed, including a mental arithmetic test, a Stroop color-word test, and a test of simulated public speaking, they found that the personally relevant, emotionally arousing speaking task induced the most change. They concluded that the magnitude of abnormality induced by the most potent mental stress was not significantly different from that induced by vigorous exercise in the same patients. He also felt that "mental stress can also lower ventricular fibrillatory thresholds and promote ventricular ectopy" and that "since mental stress may occur more frequently than stress from exercise in daily life, it could represent an important and largely unrecognized factor in the precipitation of more severe clinical coronary events."

It is logical that measures to reduce stress would be beneficial. Sedatives and tranquilizers are widely used. Wheatley (1984), in a study done in Scandinavia, noted "that out of a total of 77 patients treated with a placebo, there were *five* cases of myocardial infarction during the trial periods as compared to no such cases among 81 patients treated with anti-anxiety drugs."

Kornfeld (1980), in his review, evaluated the use of sedatives and tranquilizers and reported that patients treated with the antianxiety drugs had reduced anxiety, reduced urinary catecholamines, and a decreased extent of arrhythmias, but he noted that drugs occasionally result in several hours of confusion, agitation, and ataxia and may intertact with anticoagulants.

If tranquilizers work reasonably well to reduce stress and anxiety in the critically ill, is there an additional need for hypnosis? Can the relaxing effect of hypnosis add any additional benefit? Can it decrease the need for further medication to control pain while a balloon is inflated in a coronary vessel? Will it allow the patient to remain alert enough to follow the cardiologist's directives, and will the additional relaxation provide more time during angioplasty for the cardiologist to produce a more optimal result?

To be effective, hypnosis does not require the quiet surroundings of a plush-lined office. Deltito in 1984 showed hypnosis to be of benefit even in emergency room settings. Hypnosis is especially useful in diminishing mental pain, suffering, and anguish (Hilgard & Hilgard, 1975; Hilgard, 1975) and may even have an effect on regulating heart rate and blood pressure (Hilgard & Morgan, 1975). Watkins (1987), in discussing hypnotherapeutic techniques, suggests hypnosis is useful in treating Buerger's and Raynaud's disease by decreasing the restriction of blood flow to the extremities.

Egbert (1986) states that a preoperative anesthetic visit was much more powerful as a "tranquilizing agent" than pentobarbital 2 mg/kg I.M. given one hour before operation and that it was possible to increase the patients' ego strength so that they complained about less pain and required fewer narcotics than did a control group.

By reducing pain, hypnosis has been of help to burn victims who require daily tanking, debridement, and dressing changes. Schafer (1975) and Wakeman and Kaplan (1978) state that less pain medication was required to control symptoms.

In 1981 in a pilot study involving seven patients, I (E.J.W.) was successful in alleviating stress and anxiety in the acute setting of a coronary care unit. Follow-up evaluations by our mental health staff stated that the use of hypnosis was well received by both the patient and the patient's family (unpublished data).

Despite the use of tranquilizers, according to Turton, Deegan, and Coulshed (1977), patients in the cardiac catheterization laboratory still have a good deal of anxiety. They also may develop angina while the coronary artery is temporarily occluded (Robertson, Bernard, & Robertson, 1983).

This study was done to see if hypnosis would also be useful in a cardiac catheterization laboratory. Here vital signs can be monitored and the time of balloon inflation can be measured. The amount of additional pain medication required to control symptoms can be ascertained, and arterial catecholamines, which serve as a barometer of sympathetic activity, can be evaluated.

Method

Patient Population

We selected 32 Kaiser Permanente patients (16 subjects and 16 controls) and carried out the study in the cardiac catheterization laboratory at St. Vincent Hospital, Portland. Because all patients have chart numbers, those with odd numbers on their charts were hypnotized, and those with even numbers on their charts were the controls. Committees for protection of human subjects at Kaiser Permanente and at St. Vincent Hospital approved of this study, and all patients included in the study signed an informed consent.

All patients had severe coronary artery disease, as demonstrated by prior angiography, and were candidates for the dilatation of one or more coronary arteries. All received their usual medications before angioplasty. The exclusions were only for deafness and senility. The identical cardiac work-up was done on both groups, including physical examinations, laboratory tests, and cardiograms.

Procedure

All patients were admitted the afternoon or evening before their planned balloon angioplasty. I (E.J.W.) interviewed those patients with the odd-numbered charts.

I met with the patient and his/her family the evening of admission at the hospital and explained to them how hypnosis may be used as an adjunct to their routine care. I told them that relaxing effects of hypnosis have been used elsewhere in the medical field with benefit, notably in the field of obstetrics and dentistry where one might anticipate anxieties about the discomfort of the procedures. I told them that they do not have to go into a deep trance to get benefits. I advised them that they can get the effects of relaxation without the possible side effects or aftereffects of additional chemicals. They were told that there were no demonstrable physiological risks.

At the patient's bedside I used a hypnotic procedure, lasting about a half hour, modified from that devised by Barber (1977). After they were progressively relaxed, I gave a posthypnotic suggestion that they could achieve the same sense of relaxation the next morning while undergoing angioplasty. Other than hypnosis, both groups received identical treatment, including preoperative medications (diazepam, atropine, and antihistaminics).

At the time of the angioplasty I was available in the catheterization laboratory to assist, if necessary, in the relaxation. All patients were alert during the angioplasty procedure and responded equally well to requests by the cardiologist to such things as "take a deep breath, hold it," etc.

We measured blood pressure, pulse, rhythm, and ST-T changes. Arterial blood was drawn for total catecholamines at the start and at the end of the procedure. The number of patients requiring additional pain medication and the total times for balloon inflation were recorded.

Results

Patient Population

Table 1 shows the make-up of the 32 patients with arteriosclerotic coronary artery disease on admission. All had one or more coronary vessels that were severely occluded, and all underwent angioplasty. All of the patients were on their usual medications prior to their admission. There were no significant differences between groups regarding age, height, and weight. Pulse rates were obtained from admission cardiograms.

The mean pulses of the control patients and hypnotized patients at the time of admission were similiar, 59 (*SD* 9) and 58 (*SD* 6) respectively. At the start of the procedure the next morning the mean pulses for both groups increased: to 70 (*SD* 12) for the control patients, and to 69 (*SD* 12) for those who were hypnotized. These increases were significant ($p < 0.01$) but largely due to atropine given shortly before the patients arrival in the cardiac catheterization unit.

Effect of Angioplasty on Pulse and Blood Pressure

Each time the balloon was inflated, the pulse rate and rhythm, and the blood pressure were monitored through the arterial catheter and recorded. Balloon inflations lasted from 15 to 120 seconds. Several

Table 1
Patient Data

	Hypnotized		Control	
	Mean	(SD)	Mean	(SD)
Patients (n)	16		16	
Age (years)	60	(8)	59	(11)
Weight (lbs.)	189	(32)	190	(30)
Height (inches)	68	(3)	69	(4)
Pulse	58	(6)	59	(9)

such measurements were recorded for each patient and their averages are listed in Table 2.

There were minimal changes in pulse and blood pressure in the hypnotized group and only minimal, but not significant, elevations in the blood pressure measurements in the control group.

Catecholamine Levels at the Start and End of Angioplasty

Table 3 records the results of the total arterial catecholamine blood levels and of the epinephrine and norepinephrine components. The blood was drawn shortly after the catheter was put in place and prior to the first balloon inflation. A second arterial sample was drawn at the end of the procedure before the patient returned to the ward.

In the hypnotized patients the total catecholamine levels (538 pg/ml, *SE* 60) and the levels of its major component, norepinephrine (432 pg/ml, *SE* 51), were significantly elevated above their corresponding control levels (361 pg/ml, *SE* 31 and 281 pg/ml, *SE* 23) at the start of the angioplasty procedure ($p < .01$). These were unexpected findings. The epinephrine level in the hypnotized group was also higher than the corresponding level in the control group but did not reach a level of significance.

At the end of the procedure, catecholamine levels had fallen in both groups, but the drop or total catecholamines in the hypnotized group of 124 pg/ml (*SE* 33) was greater than the corresponding drop of 37 pg/ml (*SE* 25) in the control group. This was significant at $p < 0.025$. Why the two groups handled catecholamines differently is not clear.

Table 2
Pulse and Blood Pressure[1] at Start and End of Balloon Inflations

	Hypnotized				Control			
	Start		End		Start		End	
	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)
Pulse	67	(13)	69	(13)	72	(11)	74	(11)
Sys. BP	123	(20)	123	(20)	123	(27)	127	(26)
Dias. BP	76	(12)	80	(11)	81	(13)	87	(13)

[1]Pulse and blood pressure measurements were taken from the arterial catheter.

Table 3
Catecholamine, epinephrine, and norepinephrine arterial levels in pg/ml[1]

	Control			Hypnotized		
	Start	End	Difference	Start	End	Difference
Total	361 (31)	326 (25)	37 (25)	538 (60)	415 (56)	124 (33)
Epinephrine	71 (12)	50 (6)	19 (10)	93 (15)	46 (6)	47 (11)
Norepinephrine	281 (23)	260 (23)	23 (18)	432 (51)	358 (52)	75 (29)

[1]Standard error of the mean (SE) in parentheses.
Dopamine levels (total minus epinephrine and norepinephrine) were minimal.

Differences in Additional Pain Medication Between the Two Groups

If the patient had severe angina or had an undue amount of discomfort during the procedure, additional pain medication was given as was felt necessary by the cardiologist. Doses of meperidine in 12.5 mg to 25 mg increments or 3 mg of morphine were given intravenously.

Two of 16 hypnotized and 7 of 16 control patients received pain medication. The difference is significant at $p = .05$ (Chi Square).

Electrocardiographic Changes

ST-T wave ECG changes and rhythm changes were monitored and recorded at the onset of each balloon inflation and throughout the duration of the balloon dilatation.

Half (or eight) in each group had no change. Changes that did occur in both groups were transient and were mostly minimal T-wave changes. Only one patient in each group had an elevation of the ST segment. This too was transient. Of the seven control patients given pain medication, four had ECG changes. Of the two hypnotized patients that received pain medication, one had ECG changes. There were too few with changes to comment on any difference.

Duration of the Procedure

Table 4 shows the average total time and standard deviation for the procedure for both groups in minutes and the average total time and standard deviation in seconds for the duration of balloon inflations. The total time includes the time taken for the patient to be placed on the catheterization table, prepped, catheters inserted and positioned and monitored angiographically, and it also includes the times for several balloon inflations. The removal of the catheter from the groin terminated the procedure. On the average, the total procedure time was slightly shorter for the hypnotized group, but of total procedure time, the time the balloon was inflated was 25% longer than for a similar time in the control group. This was, however, significant only at the $p = .10$ level.

Discussion

Differences in Pain Medication Between the Two Groups

Of the control patients, 44% required additional pain medication during the procedure compared to only 13% required by the hypnotized patients. This reduction was significant and is in line with reports of less pain medication required by burn victims who have had hypnotic therapy (Schafer, 1975; Wakeman & Kaplan

Table 4
Total Time in Catheterization Laboratory and Total Balloon Inflation Time

	Hypnotized		Control	
	Mean	(SD)	Mean	(SD)
Total time (minutes)	79	(22)	86	(35)
Inflation time (seconds)	353	(165)	283	(108)

1978). In this series both groups did well, and there were no apparent side effects reported from the extra pain medication required by the control group; this decreased need for medication can be called a potential benefit, but also makes it a less uncomfortable experience. Not all agree that removing pain is advantageous. Watkins & Watkins (1990) wonder why hypnotized patients exposed to painful stimuli report feeling less pain than nonhypnotized subjects. They contend that pain is a psychological phenomenon that is not eliminated by hypnosis but only displaced into a "covert" ego state and that its removal might possibly be harmful. A full discussion of ego states and dissociation is beyond the scope of this paper. Margolis (1990), following the more conventional view, feels there is no problem in removing pain except when the pain is actually caused by emotional conflict or is from a posttraumatic stress disorder. She added that hypnosis is quite helpful in decreasing the pain of the terminally ill, the acutely burned, and the great majority of patients with chronic pain.

Difference in Catheterization Time Between the Two Groups

It was hoped that a more relaxed patient would allow for the cardiologist to spend more time with balloon dilatation before needing to curtail the procedure because of pain or some other complication. Although the procedure was not terminated because of pain in any of the patients, the 25% increase in the average time the balloon was inflated in the hypnotized patients was only marginally significant. It will take a larger number of patients to see if this additional time taken is a true benefit.

Differences in Catecholamine Levels Between the Two Groups.

Catecholamines reportedly act as a barometer of neuroanxiety (Goldstein, 1981; Zaloga, 1988). Turton, Deegan, and Coulshed had already shown in 1977 that prior to catheterization catecholamine levels were elevated and returned to control levels 3 days later. One would assume that the patients in the current study also were anxious at the time of admission and that, although venous samples were not drawn at this time (venous levels do vary from arterial levels), their catecholamine levels would have been elevated. One would expect that if hypnosis does cause relaxation, then those patients who were hypnotized would have a lower arterial catecholamine level than their controls. This was not the case. Just the opposite occurred and is hard to explain. It is known that prolonged stress depletes catecholamine stores (Zaloga, 1988), but it is hard to believe that a brief hospitalized stay would cause a difference in depletion between the two groups. There is no literature dealing with the effect of hypnosis on catecholamine levels.

Electrocardiographic changes

It is not surprising that there was no difference in the ECG changes or changes in vital signs in either group or between the groups. Several reports indicate that these parameters are not altered by changes in catecholamine levels (Robertson, Bernard, & Robertson, 1983; Jakobsen & Blom, 1989). Jakobsen and Blom (1989) state: "The lack of correlation between blood pressure and plasma catecholamines and between blood pressure and anxiety suggests that blood pressure is a poor indicator of anxiety."

Further studies should be done into how pain or the perception of pain is altered by hypnosis and whether changes in catecholamine levels are related to this perception.

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