

Invasiveness of Radiological Procedures: State-Trait Anxiety in Women Undergoing 3 Different Investigations and 3 Months Follow-Up

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Abstract: Over the past decade, there has been considerable growth in interest in the application of stress management techniques for the preparation of patients needing to undergo noxious medical procedures. Here, we studied state-trait anxiety in women awaiting three different radiological examinations; abdominal ultrasonography, mammography, and hysterosalpingography, which involved various degrees of intrusiveness, and low, intermediate, and high levels of pain and physical/emotional discomfort respectively. We aimed to

investigate whether the degree of anxiety corresponded to the level of invasiveness. In addition, we examined the impact of demographic variables on the degree of anxiety and conducted three months of follow-up measurements. Our results suggest that in order to plan appropriate strategies for stress reduction, the medical team, including radiologists and technicians, should be aware of expected levels of state anxiety.

Key Words: intrusiveness, invasiveness, radiological examinations, state-trait anxiety, women

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Introduction

Women who undergo uncomfortable medical procedures experience some degree of reactive anxiety. They are concerned with anticipated pain, embarrassment and discomfort, lack of knowledge of the procedure and of any opportunity to establish control, possible physical damage during the examination, and potential diagnostic and prognostic implications (1-5).

Knowledge of the anticipatory anxiety levels of women awaiting a specific radiological procedure could assist the medical team in providing appropriate preparation for the patients in order to reduce discomfort that they may experience during the examinations, and later during the follow-up period.

This study investigated the degree of state-trait anxiety reported by women awaiting three different radiological examinations varying in the extent of invasiveness. The degree of state-trait anxiety 3 months later was also included in the evaluation. The examinations chosen were abdominal ultrasonography (US), mammography (MG), and hysterosalpingography (HSG), representing a low, intermediate and high level of intrusiveness respectively. In addition, we examined the impact of demographic variables on the degree of anxiety. Three months of follow-up was also included in the evaluation.

Materials and Methods

Subjects. One hundred and twenty women participated in this study. All were awaiting one of the three medical examinations: US (n= 35), MG (n= 40) and HSG (n= 45). None of them were pregnant.

Radiological Examinations. Abdominal US examination is performed using transmission gel spread over the abdomen. Images are created by the reflection of echoes produced when sound waves are dispersed by the transducer and are absorbed by the tissue being scanned (5). MG is an x-ray examination of the breast during which the breast is pressed firmly against the film holder (6). MG, in comparison with the abdominal US procedure, involves more discomfort because it necessitates exposure of the breast and causes pain due to pressure.

During HSG a cannula is inserted into the patient's cervix and contrast material is injected through it while the radiologist screens the procedure, outlining the uterine cavity and the fallopian tubes (7). In the clinics involved in the present study it is performed without anaesthesia. Compared with US and MG, HSG is extremely uncomfortable and noxious, due to the cannula's use in probing the intimate parts of the woman's body.

Procedure. One of the four experimenters approached the subject waiting for the scheduled examination, identified herself or himself by name and professional affiliation, and explained that a study of people's feelings in radiological settings was being conducted. The researcher then asked for the subjects' consent to participate, assuring them that their responses would be completely confidential and anonymous within the research. Approximately 10% of the women approached in each group did not want to participate. The questionnaires answered by the participating patients three months later were also evaluated to define state-trait anxiety (2).

Measures. The subjects were asked to fill in the demographic data sheet and Spielberger State-Trait Anxiety Inventory (8). The demographic data included age, education (in years), the where place they had lived most of their lives (city or urban area), why the examination was required (or complaints), past experience of the examination (once, twice...), and whether they had had any operation for the same complaint or reason.

SPIELBERGER STATE-TRAIT ANXIETY INVENTORY. The Spielberger State-Trait Anxiety Inventory (STAI)-Forms TX 1 and TX 2 were used as a measure of state anxiety (how one feels at a particular moment) and trait anxiety (how one usually feels). The state anxiety score is based on 20 items which a person rates on a scale of antiety from 1 (not at all) to 4 (very much so). The trait anxiety score is also composed of 20 items which a person rates according to how she generally feels from 1 (almost never) to 4 (almost always). According to Spielberger et al. (8), higher scores of current stress, worrying, anxiety, and so forth represent greater state anxiety.

In this study, a Turkish version of the scale was used (9). In the current sample, the test-retest reliability coefficients for the trait anxiety score ranged from .71 to .86 and for state anxiety ranged from .26 to .68. The Kuder Richardson (alpha) reliability of the Turkish version of the scale was found to range from .83 to .87 for trait anxiety scoring, and from .94 to .96 for state anxiety, showing a high degree of internal consistency (9). In this study, subjects who returned questionnaires leaving several items unanswered were not included in the evaluation.

Results

The average age of the women was 37.40 (SD:11.47), with ages ranging from 19 to 69; the mean

number of years of education was 12.07 (SD:2.87), with individual figures ranging from 8 to 18. The proportion of subjects who had lived in a city for most of their lives was 67.5%. The proportion of subjects who had lived in an urban area for most of their lives was 32.5%. Subjects who had had an operation for the same complaint constituted 10.8%. The average number of previous examinations of the same kind was 0.64 (SD:1.05), with individual figures ranging from 0 to 5.

A comparison of the three groups of patients (abdominal US, MG, and HSG) according to demographic background variables was carried out using one-way analyses of variance (ANOVA, Table 1). The three groups were significantly different in level of education. The group awaiting HSG was significantly different from the other groups in terms of two variables. Women currently seeking treatment for infertility were younger and less educated than the women in the MG and the abdominal US groups.

The overall average of state anxiety reported by the sample was 42.33 (SD:8.03), with scores ranging from 25 to 59. The average of the trait anxiety was 40.82 (SD:6.75), with scores ranging from 24 to 61. The state anxiety of the subjects varied significantly according to the level of invasiveness of the examination they were anticipating (Table 1). A Student Newman Keuls test ($\alpha = .05$) showed that the women awaiting HSG reported significantly higher levels of state anxiety than did the women awaiting abdominal US and MG. The subjects awaiting MG reported an intermediate level of state anxiety that was not significantly different from that of those waiting for abdominal US.

In order to determine the effect of intrusiveness on state anxiety when taking into account the subjects' differing demographic data, we performed multiple regression analysis with intrusiveness as a continuous (predicted) variable. Important variables were defined with the step-wise elimination method.

The regression equation was significant: $F=(32.117)=30.45, p>0.001$, explaining 34% of the variance. An examination of the parameters estimated showed that in defining predicted state anxiety caused by radiological examination (US, MG, HSG), two variables had a significant effect: intrusiveness and age. In the multiple regression analysis, invasiveness was rated from 1 to 3, representing the US, MG and HSG groups respective-

Table 1. Average Levels of Background Variables and State-Trait Anxiety in Women Awaiting Abdominal Ultrasonography (US, n=35), Mammography (MG, n=40), and Hysterosalpingography (HSG, n=45).

Background Variables	US		MG		HSG		F	P
	M	SD	M	SD	M	SD		
Age	35.17	10.26	45.57	5.32	28.31	5.09	98.64	.000
Education	11.43	2.29	14.32	2.32	10.55	2.47	28.52	.000
No. of previous examinations	0.97	1.27	0.82	1.15	0.22	0.52	6.44	.002
State anxiety 1	38.03	6.27	39.02	7.77	48.60	5.06	34.67	.000
Trait anxiety 1	39.60	6.23	44.97	6.41	38.06	5.66	14.62	.000
State anxiety 2	36.29	5.76	35.67	7.18	38.13	5.57	1.82	.1672
Trait anxiety 2	38.89	5.456	44.02	6.25	37.22	5.45	15.80	.000

M=mean, SD=standard deviation

ly. The invasiveness of the procedure positively and strongly predicted the level of state anxiety ($p < 0.001$), thus providing further support for the study's main finding. Age was positively correlated ($p < 0.05$), whereas the factors of past experience of the examination, level of education, whether the operation had been performed for the same reason (being familiar with the situation), cultural background (coming from a city or an urban area) were not related to the state anxiety level ($p > 0.05$). The reasons for US examination were heterogeneous. We did not find any positive correlation between the reason for the examination and the level of state anxiety in any of the groups ($p > 0.05$).

We compared the differences in state and trait anxiety before examination and three months afterwards in all the groups in order to evaluate whether the differences corresponded to the levels of invasiveness. Kurosaki Wallis variance analysis was used instead of ANOVA since the variances were not homogenous. The state anxiety before and 3 months after HSG was significantly different (higher) from the corresponding values for USG and MG (Chi-

square=55.04, $p = 0.000$, $p < 0.001$). The difference in trait anxiety was not significant among the three examination modalities (Chi-square=0.05, $p = 0.954$, $p > 0.05$) (Table 2).

Discussion

In the current study, we investigated the degree of state anxiety produced by radiological procedures of various levels of intrusiveness. As hypothesised, women awaiting the most invasive examination (HSG) reported the highest degree of anxiety, significantly more than that of women awaiting the less painful and less intrusive examinations.

The State-Trait Anxiety Inventory has been used to measure anxiety in patients undergoing cholecystectomy (10) and US scanning during pregnancy (11). Recommendations for stress reduction in the literature are, therefore, typically procedure-specific (10,12,13). The comparative approach of the present study, which included follow-up, further develops and refines the process of

Table 2. Differences in Means and Standard Deviations of Test Scores (State-Trait Anxiety) in Women in Follow-Up.

	US		MG		HSG		Chi-square	p
	M	SD	M	SD	M	SD		
State anxiety 1-2	1.74	1.77	3.35	2.24	10.46	6.03	71.21	.000
Trait anxiety 1-2	0.71	2.12	0.95	3.66	0.84	3.75	3.25	.19

M=mean, SD= standard deviation

differentiating between the reactions of women undergoing different types of medical procedures. This is the first study known to the authors which has attempted to evaluate the relative impact of intrusiveness during and subsequent to radiological examination.

We can provide possible alternative explanations for the current results. The levels of invasiveness were represented in this study by different types of procedures, which may have been administered to samples with different backgrounds, characteristics, and concerns. The subjects awaiting HSG were younger and lacked previous experience of the procedure, in contrast to the subjects awaiting MG and abdominal US. In a future study, a HSG group with two subgroups (young/middle aged) can be investigated. The groups were also different in terms of the aetiology and prognosis of their specific medical disorders. This may have resulted in different levels of anxiety regarding the results of the examination. We did not assess anticipatory anxiety in this study because it was difficult to administer more than one questionnaire before the examinations. Nevertheless, all three groups had many reasons to be concerned: the US and MG groups about malignancy, and the HSG group about infertility.

Our findings for the level of state anxiety were higher than those reported ($M=33.97$, $SD= 8.56$) from a sample of 114 Turkish adults (9), indicating greater concern and anxiety among Turkish women awaiting radiological examinations than in the general population. We did not obtain enough data on the state anxiety of Turkish women under specific conditions. Most published research deals with samples of both sexes so we did not think it useful to compare results.

The trait anxiety levels of the mammography group ($M=44.97$, $SD=6.41$) were higher than those of the general population ($M=42.65$, $SD= 7.63$) (9), suggesting that the MG group was usually more concerned and stressed in daily life. It should also be noted that many of this group were in menopause.

Our findings in this study are dependent upon self-reported anxiety levels. Other, converging measures, such as heart rate and blood pressure, could have provided information on other facets of anxiety reaction. Although the limitations of self-report methodology are well known (8), the measure used is routinely applied in medical settings, and can demonstrate the success of anxiety-reducing interventions and discriminate between pre- and post-operation anxiety levels (14).

The degree of invasiveness was defined a priori in this study in terms of the relative degree of invasion of the patient's body and the discomfort, embarrassment and pain caused during the examination. One should note, however, that the respondents did provide their individual perception of the level of intrusiveness in the forthcoming examination. Knowledge of the procedure (15) and cognitive appraisal of its degree of threat and potential for harm (16) are known to be related to anxiety reactions.

In terms of the method used, it would have been more appropriate to study one quasi-homogeneous population (regarding age, years of education and backgrounds) assigned randomly to different examinations of different levels of intrusiveness. Such a study has not been performed to date. In our opinion, the present study had the best alternative design, including follow-up measurements and demographic variables of a wide spectrum and increased statistical control.

Our results suggest that women with gynaecological disorders undergoing intrusive examinations such as HSG seem to experience high levels of state anxiety and need special care and attention focused on the management of their stress and anxiety. High levels of anxiety have been found to be related to recovery problems and complications during/after medical procedures (17), for example, higher perceived levels of pain during the procedure or longer examination times, fatigue, emotional upset and pain, and misinterpretations due to motion artifacts of failing to hold breath. In other words, anxiety of this kind poses a serious problem for the clinician in question. Therefore, the phenomenon of anxiety seems to be a matter of primary importance. New techniques like hysterosalpingo contrast sonography can also be considered as alternatives to HSG.

It is hoped that through a broader understanding of the phenomenology, aetiology and management of anxiety before radiological procedures, referring physicians, radiologists and technicians will be better able to manage their patients, obtain more reliable results and spend less time conducting the examinations.

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References

1. Anderson KO, Masur FT 3. Psychological preparation for invasive medical and dental procedures. *J Behav Med* 6: 1-40, 1983.
2. Gil KM: Coping effectively with invasive medical procedures: A descriptive model. *Clin Psychol Rev* 4:339-362,1984
3. Kendall PC, Watson D. Psychological preparation for stressful medical procedures. In: Prokop CK, Bradley LA, Eds, *Medical Psychology: Contribution to Behavioural Medicine*. New York: Academic Press 1981, pp 197-221.
4. Ludwick-Rosenthal R, Neufeld RWJ. Stress management during noxious medical procedures: An evaluative review of outcome studies. *Psychol Bull* 104:326-342,1988.
5. Olds SB; London ML, Ladewig PA. *Maternal Newborn Nursing: A Family-Centered Approach*. 3rd ed. Newbury Park, CA: Addison-Wesley; 1988.
6. Long BC, Phipps WJ. *Essentials of Medical-Surgical Nursing*. St. Louis: CV Mosby; 1985, pp 610-615.
7. Sutton D. *Textbook of Radiology and Imaging*, vol. 2. 4 th ed. Edinburgh: Churchill Livingstone 1992, pp 1206-1208.
8. Spielberger CD. *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press; 1983, pp 12.
9. Öner N, Le Compte A. Durumluk/ Sürekli Kaygı Envanteri El Kitabı.Boğaziçi Üniversitesi Yayınları no:333, 1985, pp 11.
10. Levesque L, Geriner R, Kerouac S, Reidy M. Evaluation of a presurgical group program given at two different times. *Res Nurs Health* 7:227-236, 1984.
11. Reading AE, Cox DN. The effects of ultrasound examination on maternal anxiety levels. *J Behav Med* 5:237-247, 1982.
12. Michelacci L, Fava GA, Grandi S, Bovicelli L, Orlandi C, Trombini G. Psychological reactions to ultrasound examination during pregnancy. *Psychother Psychosom*. 50:1-4, 1988.
13. Shipley RH: Preparation for stressful medical procedure: Application of learning principles.*Rehab Psychol* 25:195-200, 1978.
14. Schultheis K, Peterson L, Selby V. Preparation for stressful medical procedures and person x treatment interactions. *Clin Psychol Rev* 7:329-352, 1987.
15. Flam B, Spice-Cherry P, Amsel R. Effects of preparatory information of a myelogram on patients' expectations and anxiety levels. *Patient Ed Counsel* 14:115-126, 1989.
16. Lazarus RS; Folkman S. *Stress, Appraisal and Coping*. New York: Springer;1984.
17. Jamison RN, Parris WC, Mayor WS. Psychological factors influencing recovery from outpatient surgery. *Behav Res Ther* 25:31-37, 1987.