Preinvestigation psychological state and related demographic factors as predictors of pain perception in women undergoing hysterosalpingography

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Abstract:

BACKGROUND: The majority of women described hysterosalpingography (HSG) as a painful procedure. There is little information on the features of HSG-associated pain and factors that predispose to increased pain experience.

OBJECTIVES: This study investigated preprocedure psychological state and related demographic factors as predictors of pain perception in women undergoing HSG.

METHODS: The sample included 99 women selected through consecutive sampling at the Radiology Department, University of Benin Teaching Hospital, Benin City, Nigeria. The study utilized a cross-sectional survey design to collect data using Spielberger's State-Trait Anxiety Inventory, Zung Self-rating Depression Scale, and Visual Analog Scale for the perception of pain and state anxiety.

RESULTS: The women with lower state anxiety reported significantly lower pain perception ($\bar{X} = 6.69$) than the women with high anxiety ($\bar{X} = 7.93$). Trait anxiety, state anxiety, and depression jointly predicted pain perception among the women undergoing HSG, with $R^2 = 0.117$, $F_{(3,95)} = 6.797$; $P < 0.001$. They collectively accounted for about 17.7% variance in pain perception.

CONCLUSION: Patients being prepared for the HSG procedure can be educated on concerns related to anxiety and coping strategies and be provided with anxiolytics or other medication as clinically indicated.

Keywords:
Demographic factors, hysterosalpingography, pain perception, preinvestigation, psychological state, women

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Introduction

In current years, the prevalence proportion of infertility has progressively increased, now accounting for approximately 15%–18% of the populace at the gestational age.[1,2] Some reasons, such as the fallopian tube factor, ovulation failure, and the uterus factor, give rise to infertility in female.[3-5] The fallopian tube issue, accounting for about 30%–40%, of infertility, is the foremost factor, the most central of which is the fallopian tube jam.[6,7]

Hysterosalpingography (HSG) is frequently sought as part of first-line inquiries for women with infertility, menstrual abnormalities, and congenital or acquired uterine disorders.[8-11] Tubal pathology accounts for about 60% of female infertility in Nigeria and HSG is usually one of the first lines of investigation in many infertility treatment clinics.[8,12-14] It offers a clear condition of the uterine cavity and the fallopian tubes, permitting the discovery of endometrial and tubal pathologies[11,15] with accuracy as high as 90%–95%.[1] It is mostly

conducted as an outpatient procedure, preferably in the follicular phase of the menstrual cycle. Although it is frequently used, the major side effect of HSG is pain.[16]

The majority of women regard HSG as extremely painful since it involves placement of a cervical tenaculum, traction on the cervix, instillation of dye through a cervical cannula, and tubal spilling.[17]

Despite its common use, there is little information on the features of HSG-associated pain, factors disposing to increased pain experience, and methods to decrease pain experienced during the procedure.[18-22] According to Woo,[23] pain theories have progressed fundamentally away from the early nociceptive Cartesian belief, where a specific lesion in the body is experienced as pain by the brain. This has been substituted by the generally recognized biopsychosocial model, where tissue damage, psychology, and environmental influences all interrelate to regulate pain experience. Pain has been defined by the International Association for the Study of Pain (IASP)'s as an unpleasant sensory or emotional experience associated with tissue damage. This definition further emphasizes the important role of mood and emotions for pain perception. Out of these, depression and anxiety have been discovered as significant determinants of pain perception and have been comprehensively studied.

Preoperative anxiety is associated with higher pain intensity postoperatively for different types of operations. This vicious circle is intensified by worries concerning complications, loss of control, and being helpless. Being admitted to a hospital and undergoing a procedure can be an exceedingly traumatic experience for most people. However, this is not usually considered by professionals who are more concerned with preoperative care.[24]

Research findings have also revealed the relationship between depression and pain. The danger of depression increases as a result of different characteristics of worsening pain (for example, severity, frequency, duration, and number of symptoms).[25]

Nulliparity is one of the well-known risk features for the perception of severe pain.[26] However, Tokmak *et al*.[16] discovered that lower parity was associated with a lower Beck's Anxiety Inventory score and Visual Analog Scale (VAS) score. In a related study, nulliparity was found to be statistically associated with a higher pain score.[19] Sohail[27] revealed, in 250 patients undertaking investigative HSG with small size Leech Wilkinson cannula, that amenorrhea was considerably related to increased pain throughout the procedure. Because a component of pain perceived during HSG might be attributed to uterine cavity distension either at balloon inflation or during dye filling, nulliparous

patients or patients with long-term amenorrhea may have a similar mechanism of low tolerance to this investigation. Tokmak *et al*.[16] claimed that multiparity affects postoperative pain scores.

Experimental evidence on the effect of age on pain is relatively conflicting.[28,29] Studies of mechanical stress[29,30] and ischemic pain stimulation[31] showed that the pain threshold for the elderly decreases, but the pain threshold for electrical stimulation appeared to be somewhat unchanged.[28] With a few exceptions, the threshold for pain for thermal stimulation increases with age.[32-34] The chosen method of pain relief is one of the possible reasons for this difference.[35]

Many attempts have been made to identify predictors of postoperative pain.[36,37] However, the factor of "educational status" has not been studied in detail. It was found that a lower education level is associated with a higher frequency of painful conditions.[38] Several studies that assessed assessing the relationship between educational status and postoperative pain were inconclusive. They had no association;[39,40] in one case, they showed a relationship (for example, higher education levels led to less pain), but this was based on only 40 patients.

Various strategies for reducing pain associated with HSG have been described and studied.[18-22] However, the risk factors for pain associated with HSG have not been identified. Pain associated with HSG can bring a negative experience in the treatment of infertility. The main objective of this study is to identify predictors of pain prospectively associated with HSG. A better understanding of the nature of pain can help women learn more about what they can experience during the HSG procedure. In addition, identifying predisposing factors may provide a better understanding of the pathophysiology of HSG-associated pain and may lead to future advances in this area.

The following questions therefore arise:
1. What will be the relative contribution of trait and state anxiety and depression in terms of adjustment to pain perception in women undergoing HSG?
2. Will related demographic factors (parity, age, and educational attainments) determine pain perception in women undergoing HSG?

Methods

Research design
A cross-sectional survey design was used. An anonymous, self-administered questionnaire was used to collect data.

Participants
The sample comprised 99 consecutive women (i.e., all the women that came as they followed one after the other) who

presented at the Radiology Department, UBTH, Benin City, Nigeria, with request forms for HSG on account of various gynecological indications after obtaining informed consent. The mean ± standard deviation (SD) age of these participants was 34.12 years (SD = 6.25), ranging from 16 to 48. Concerning parity, 63 (63.6%) of the women (nulliparous) had never been pregnant before, while 36.4% (36) had previously given birth to one or more viable children. A total of 62 (62.6%) participants had previous abortion, while 37 (37.4%) had never experienced abortion. The sample represented diverse ethnic groups, such as Bini (41, 41%), Igbo (17, 17.2%), Ishan (14, 14.1%), Yoruba (12, 12.1%), and Urhobo (7, 7.1%). Approximately 96% of the participants were Christians, while 4% were Muslims. In terms of their educational levels, 8.1% (8) had a first school leaving certificate, 28.3% (28) had a secondary school certificate, 17.2% (17) had an ordinary national diploma, 12.1 (12) had a higher national diploma, while 33.3% (33) had a university degree. The majority (*n* = 83, 83.8%) of the women were from the monogamous family setup, while 7 (7.1%) each were from polygamous families and were not married.

Measures
Trait anxiety
Spielberger's State-Trait Anxiety Inventory (STAI-T) was used to measure trait anxiety. This is a 20-item inventory developed by Spielberger *et al*.[41] The STAI T-Anxiety Scale has been widely used in assessing clinical anxiety in medical, surgical, psychosomatic, and psychiatric patients. Psychoneurotic and depressed patients generally have high scores on this scale.[41] All items are rated on a 4-point scale (for example, from "almost never" to "almost always"). A coefficient alpha of 0.84 and Spearman-Brown split half of 0.84 had been reported.[42] Higher scores indicate greater anxiety, while lower scores indicate low trait anxiety. Internal consistency (Cronbach's alpha) for this measure in the present study was 0.88.

Depression
For the assessment of the patient's subjective view of his/her depressive symptoms, the Zung Self-rating Depression Scale (ZDRS) was used.[43] This is a self-reporting instrument and was originally developed to assess depression symptoms without the bias of an administrator affecting the results. The ZDRS contains 20 items exploring symptoms related to depressive episodes (two items for affective symptoms, eight for cognitive and somatic symptoms, and two for psychomotor symptoms). Responses are rated from 1 to 4, with higher scores corresponding to more frequent symptoms. The overall score represents the severity of depressive symptoms. Reliability for the current sample was high (α = 73).

Preoperative anxiety
All of the participants were asked to state their level of anxiety shortly before the investigation. A detailed explanation of the VAS and its application was given personally to each woman before the procedure. The VAS was a 10-cm line scaled from 0 to 10 (not anxious to very anxious). The VAS score was determined by measuring by a ruler.

Pain perception
The pain perception was scored using VAS.[44] The patients were asked to indicate a point along a 10 cm continuous line, from 0 to 10 (no pain to extreme pain). The distance, measured in cm (to the nearest 0.1 cm) of the marked point from the 0 edges, provided the VAS score. This was done immediately after the procedure. Research showed that the scale is more sensitive than a four-point verbal rating scale and equally well accepted as a face rating scale.[45]

Procedure
Approval was obtained from the department of radiology. The HSG was performed in the same room, on the same table and with the same technique on an outpatient basis by three resident doctors in the radiology department. This was done to maintain consistency and also to limit confounding variables. During the study period, March 7, 2018–December 18, 2019, all women who met the inclusion and exclusion criteria were invited to participate in the study. The inclusion criteria were as follows: should be of childbearing age (age >18), undergoing clinically indicated HSG for the evaluation of infertility, and recurrent pregnancy loss. The exclusion criteria were the following: age <18; women with a history of psychiatric illness and those taking psychotropic medications; patients with neurological disorders or significant cardiovascular, respiratory, and hepatic diseases; and patients who declined participation in the study. Hysterosalpingography was scheduled between the 6th day and the 11th day of the menstrual cycle to ensure that menstruation had ended and the women were not pregnant. A urine pregnancy test was also done to exclude pregnancy. The women who met the inclusion criteria were invited into the X-ray room. After taking a complete history, including an obstetrical and gynecological history, the women read and signed the consent form in which anonymity and confidentiality were assured. Thereafter, they completed the ZDRS, Spielberger's Trait Anxiety Inventory, and the Preoperative Anxiety Scale in the form of VAS. Later, the participants were made to lie horizontally in the lithotomy position on the fluoroscopy table. Under aseptic conditions, the vulva was cleaned and the cervix was exposed using a Cusco's speculum. The cervical os was cannulated via a Schultz cannula and 5–10 ml of iodinated contrast was injected into the uterine

Table 1: Summary of multiple regressions showing the joint influence of depression, trait anxiety, and state anxiety on hysterosalpingography pain perception

Dependent variable	Independent variables	R	r²	F	P	B	t	P
HSG pain perception	Depression	0.420	0.177	6.797	<0.01	0.048	0.464	>0.05
	Trait anxiety					0.064	0.631	>0.05
	State anxiety					0.388	4.003	<0.01

HSG: Hysterosalpingography

Table 2: Summary of table of independent *t*-test results showing the significant influence of depression, trait anxiety, state anxiety, and age on pain perception among women undergoing hysterosalpingography procedure

Dependent variable	Independent variable	n	$\bar{X}$±SD	df	t	P
HSG pain perception	Depression					
	High depression	44	7.677±1.833	97	−1.822	>0.05
	Low depression	55	6.916±2.231			
	Trait anxiety					
	High trait anxiety	46	7.554±1.867	97	−1.336	>0.05
	Low trait anxiety	53	6.994±2.248			
	State anxiety					
	High trait anxiety	45	7.924±1.942	97	−3.032	<0.01
	Low trait anxiety	54	6.696±2.058			
	Age					
	Older age	48	7.221±2.111	97	0.155	>0.05
	Younger age	51	7.286±2.087			
	Education					
	Tertiary education	63	7.39±2.029	97	−0.876	>0.05
	SSCE	36	7.01±2.197			

HSG: Hysterosalpingography, SSCE: Senior secondary school certificate, SD: Standard deviation, df: Degree of freedom

Table 3: One-way ANOVA for hysterosalpingography pain perception among the parity and childbirth/pregnancy complications

Dependent variable	Sources	SS	df	MS	F	P
HSG pain perception	Between	13.321	2	6.661	1.544	0.219
	Within	414.244	96	4.315		
	Total	427.565	98			
	Between	2.099	3	0.700	0.156	0.925
	Within	425.466	95	4.479		
	Total	427.565	98			

HSG: Hysterosalpingography, SS: Sum of squares, MS: Mean square, df: Degree of freedom

cavity. Radiographs of the pelvis were obtained in both anteroposterior and oblique projections. Subsequently, the patient was cleaned up. Following the HSG procedure, the performing physician explained to the participants how to complete the last aspect of the questionnaire packet, in which the participants were expected to state the severity of their pain during the procedure with VAS immediately after the procedure. A detailed explanation about the VAS and its application was given personally to each woman before the procedure.

Statistical analysis

The analysis of the data was conducted using the IBM SPSS (version 20.0, IBM Corporation, Armonk NY, USA for Windows). Frequency of distribution and descriptive statistics (means and SDs) were obtained for the data in this study. In addition, an independent samples *t*-test was conducted to determine the level of preinvestigative psychological state and related demographic factors with concerning pain perception. Finally, hierarchical regression analysis was utilized to determine the influences of preinvestigative psychological state on pain perception during the HSG procedure.

Results

Independent samples *t*-test was used in testing the effect of anxiety and depression on the perception of pain during the HSG investigation. As presented in Table 1, there were no significant effects of anxiety and depression on the perception of pain during HSG investigation, *t* (97) = −1.34, *P* > 0.05 and *t* (97) = −1.82, *P* > 0.05, respectively. The result implied that there was no significant difference between women with high and low anxiety and depression based on pain perception. However, when VAS was used to measure anxiety as a form of state anxiety, there was a significant effect of state anxiety on pain perception in women undergoing HSG, *t* (97) = −3.03, *P* < 0.05. The women with lower state anxiety reported significantly lower pain perception ($\bar{X}$ = 6.69) than the women with high anxiety ($\bar{X}$ = 7.93).

Multiple regression analysis was used for testing the joint predictors of anxiety and depression. The results in Table 2 revealed that trait anxiety, state anxiety,

and depression collectively accounted for about 17.7% variance in pain perception among the women undergoing HSG, with $R^2 = 0.117$, $F (3,95) = 6.797$; $P < 0.001$. This calculation showed that a small percentage of common variation in pain perception (17.7%) was explained by the three predictor variables. Therefore, the strength of the prediction of pain perception by the three predictor variables was weak, especially because 82.3% of the variance did not depend on the three predictor variables and could be assigned to other variables not considered in this study.

As shown in Table 1, the age of women undergoing HSG did not significantly influence pain perception, $t (97) = 0.16$, $P > 0.877$. Using the independent sample *t*-test, the result implied that there was no significant difference between young and older women undergoing HSG based on their pain perception. This suggested that young and older women undergoing HSG were comparable in pain perception. Furthermore, there was no significant effect of the educational status of women undergoing HSG on pain perception. Table 1 indicates that HSG pain perception for women with no tertiary education was 7.01 (2.19), while the mean for the women who had had tertiary education was 7.39 (2.03). With alpha set at 0.05, the mean difference was not significant, $t (97) = -0.88$, $P = 0.383$.

Further analysis using one-way ANOVA revealed that there were no significant differences between women undergoing HSG who had never experienced childbirth (nulliparous) and those who had had one and those who had given birth to two or more children in the past on pain perception ($F [2,96] = 1.54$, $P > 0.05$). Similarly, concerning the experience of previous childbirth complications, the results indicated that there were no significant differences between the women who had never had previous childbirth/pregnancy complication and those who had had one, two, and three childbirth/pregnancy complications on pain perception ($F [3,95] = 0.16$, $P > 0.05$) [Table 3].

Discussion

This study revealed that there were no significant effects of trait anxiety and depression on the perception of pain during the HSG investigation. In other words, there was no significant difference between women with high and low trait anxiety and depression based on pain perception. However, when VAS was used to measure anxiety as a form of state anxiety, there was a significant effect of state anxiety on pain perception in the women undergoing HSG. The women with lower state anxiety reported significantly lower pain perception than the women with high anxiety. Periañez *et al*.[46] confirmed these results, as they found that patient anxiety in the

preoperative stage was a predictor of postoperative pain, regardless of the demographic and clinical characteristics of their study sample. Moreover, in their study, depression was not a predictor of postoperative pain.

Kavakcı *et al*.[47] argued that psychological factors, such as anxiety and/or depression, have become important predictors of postoperative pain. In their paper, as in this study, there was a positive relationship between the level of preoperative anxiety and postoperative pain. Furthermore, Tokmak *et al*.[16] confirmed that a higher level of anxiety before the procedure affects postoperative pain. Robleda *et al*.[48] found a significant positive association between preoperative anxiety and postoperative pain. These differences can be attributed to differences in questionnaires, types of surgery, and sample size or not using validated measurements. Painful experiences are unique to each person and vary greatly. It has been shown that the preoperative experimental assessment of pain sensitivity allows predicting the level of pain after acute surgery.[49]

In this study, the age of women undergoing HSG did not significantly influence pain perception. Age differences in pain perception are less consistent. However, some studies have shown that older people are more sensitive to experimental pain than young people, and other studies have shown that sensitivity decreases with age.[29,50] Studies using VAS showed that people experience more pain as they age.[51] In contrast, a VAS-based study published by Van Schoubroeck *et al*.[14] revealed that there is an inverse relationship between patients' age and pain perception: younger women reported higher VAS scores. The younger women experiencing more pain compared to older women can be attributed to the likelihood that older women will be more familiar with gynecological pain, uterine cramps, cervical smear procedures, and transvaginal ultrasound (TVS) test.[14]

Other results also revealed that the educational status of women receiving HSG does not significantly affect pain perception. Confirming this finding, Chia *et al*.[39] and Lau and Patil[40] found no relationship between educational status and pain perception. Similarly, Mwashambwa *et al*.[52] did not show a significant effect of educational status on postoperative pain. However, it was also found that a lower-level education is associated with a higher incidence of painful situations.[37] Several studies assessing the relationship between educational status and postoperative pains are inconclusive.

Finally, the analysis in this study revealed that there were no significant differences between the women undergoing HSG who had never experienced

childbirth (nulliparous) and those who had had one and those who had given birth to two or more children in the past based on pain perception. Nulliparity was found to be one of the known risk factors for experiencing excessive pain,[39] but Tokmak *et al.*[16] found that the decreased parity was associated with low scores on Beck's Anxiety Inventory and the VAS. This situation is explained by the negative consequences of unpleasant gynecological interventions and birth trauma, which previously occurred in some patients. In one study, pain perception during HSG was statistically significantly higher in patients with unilateral and bilateral tubal obstruction.[53] Van Schoubroeck *et al.*[14] found an inverse relationship between parity and pain. As shown by the average VAS of the HyFoSy test, the nulliparous women experienced more pain than the parous women. The observation that nulliparous women experience more pain compared to parous women can be explained by the likelihood that nulliparous women are more familiar with the pain caused by gynecology, uterine cramps, cervical smear procedures, and TVS test.[54]

Conclusion

Based on the results of this study, it can be concluded that anxiety and depression do not affect the perception of pain during the HSG investigation. In other words, there was no significant difference between women with high and low levels of anxiety and depression in terms of pain perception. However, when VAS was used to measure anxiety as a form of state anxiety, the women with lower state anxiety reported significantly lower pain perception than the women with high state anxiety. The age of women undergoing HSG did not significantly influence pain perception. The current study also revealed that the educational status of women undergoing HSG does not determine pain perception. Finally, this study revealed that there were no significant differences between the women undergoing HSG who had never experienced childbirth (nulliparous) and those who had had one and those who had given birth to two or more children in the past based on pain perception.

Implications of the findings
The current research has many future implications. For example, the findings can provide obstetricians, radiologists, and clinical psychologists with a foundation to gain a basic understanding of important predictors of postoperative pain. This will help in formulating an appropriate plan for effective pain management postoperatively and attending to the pain, considering the psychological state, such as trait and state anxiety and depression and related demographic factors, such as parity, age, and educational attainments. This study showed that relevant practitioners should be highly

suspicious of patients with high-state anxiety. They may have a higher postoperative pain. Therefore, patients being prepared for the HSG procedure should be educated on concerns related to anxiety and coping strategies and provide anxiolytics or other medication as clinically indicated.

Research has shown that patients with high levels of anxiety can be correctly identified and treated preoperatively to minimize postoperative pain relief and hospital costs.[55] Many studies reported that interventions targeting preoperative anxiety disorders improve postoperative behavior and recovery.[56,57]

As noted in the literature, psychotherapy and counseling significantly reduce anxiety, depression, and pain perception in outpatient gynecological procedures.[58,59] In addition, nondrug treatments, such as guided imaging, hypnosis, and distraction, can be effective in improving the patient's perception of painful medical procedures, such as endoscopy.[60,61] Finally, like all other diagnostic medical procedures, HSG has significant potential for causing excessive anxiety in infertile women. Therefore, women with fertility problems undergoing HSG should be evaluated for levels of anxiety and should be offered appropriate psychological counseling interventions. This is because reducing anxiety levels may be beneficial for improving the accuracy of the procedure and its acceptance by reducing pain perception.

Limitations of the study
While this study makes an important contribution to knowledge about predictors of HSG pain perception, there are some limitations of the study to consider. First, this study included only women with infertility problems who were targeted for HSG assessment. Other women were referred for HSG testing but had no fertility problems. In future studies, it will be good to compare women referred for HSG investigation and others without infertility problems on their demographical and psychological determinants of postoperative pain. This study was conducted at a single hospital (UBTH, Benin City); this may limit the applicability of the findings to other environments. Future investigations with more heterogeneous samples about race/ethnicity are needed. However, the problems identified are by no means unique to any environment and deficiencies in pain education are widespread. Therefore, we posit that similar results would be observed if the was conducted elsewhere. Further, the use of VAS in the measurement of state anxiety and postoperative pain in this study poses some limitations. One of the disadvantages of VAS is the need for clear vision. Research shows the scale can be challenging for 7%–16% of patients who are unable to convert pain experience to an abstract line.

Authorship contributions

Adeyekun Ademola A. - Involved in the conceptualization, methodology, data acquisition, writing of the original draft, review and editing.

Koleoso Olaide N. - Involved in the design, methodology, data analysis, writing of the original draft, review and editing.

Akanni Oluyemi O. - Involved in the statistical review, manuscript preparation, review and editing.

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Conflicts of interest

There are no conflicts of interest.

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