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ORIGINAL ARTICLE

The psychological effects of prenatal diagnostic procedures: maternal anxiety before and after invasive and noninvasive procedures

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ABSTRACT

Objectives (1) To examine the change in anxiety before and after prenatal diagnostic procedures in women undergoing invasive (amniocentesis) and noninvasive (ultrasound) procedures; and (2) to examine predictors of anxiety before the diagnostic procedure.

Methods A short-term follow-up study was conducted on a sample of pregnant women in the second trimester. Questionnaires were administered to women scheduled for amniocentesis ($n = 37$) and ultrasonography ($n = 37$) before and immediately after the procedure. The following questionnaires were administered: the State-Trait Anxiety Inventory, the Affect Intensity Measure, the COPE inventory, and the Optimism–Pessimism Scale.

Results Prior to the administration of the prenatal diagnostic procedure, measured anxiety levels were the same in both groups of women ($p > 0.05$). An interaction effect of a two-way ANOVA revealed that anxiety decreased after the procedure in the ultrasound but not the amniocentesis group ($F(1, 72) = 5.01$, $p = 0.028$). Although coping styles and affect intensity were found to be related to anxiety ($p < 0.05$), they were not significant predictors of anxiety before the diagnostic procedure when controlling for trait anxiety and procedure type.

Conclusion Anxiety levels associated with noninvasive but not after invasive, prenatal diagnostics tests decrease immediately following the procedure. © 2013 John Wiley & Sons, Ltd.

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INTRODUCTION

Over the last few decades, at both national[1] and global levels, there has been a growing tendency for women to give birth at a later age. With higher maternal age, there is a greater risk of chromosomal abnormalities and, as such, an increased need for prenatal diagnostic procedures such as amniocentesis.[2–4] Amniocentesis carries a small risk of complications and/or miscarriage but is considered a reliable and safe procedure.[5,6] However, because of its invasiveness and long waiting period for final results, the psychological and emotional aspects of the procedure should be considered. A recent qualitative study highlighted several themes related to the thoughts and feelings experienced by women undergoing amniocentesis, some of which refer to worry about the invasiveness of the procedure – both for maternal and fetal safety, anxiety while waiting for the results, and thoughts about a lifetime commitment in the case of a abnormal result.[7] Amniocentesis is accompanied with elevated levels of anxiety in pregnant women both before the procedure[8–10] and while waiting for the results,[7,11] where the most prominently reported emotions were uncertainty and tension.[12] Elevated levels of anxiety and stress during pregnancy are related to fetal activity[13,14] and negative obstetrical outcome.[15–17] Therefore, emotional aspects should be given serious consideration, especially in women undergoing prenatal diagnostic procedures, invasive procedures in particular.

When assessing the potential stress associated with prenatal procedures, one should distinguish between the stress induced by the procedure itself (arising from a fear of pain, fetal damage, or miscarriage as a result of the procedure) and the stress induced by fear of an abnormal result or concern for fetal development.[18] Taking this distinction into account, one would expect anxiety to be higher in women undergoing amniocentesis than in women undergoing other prenatal diagnostic procedures such as ultrasound, a noninvasive procedure in which results are given immediately. However, the literature is inconsistent in regards to the effect of procedure invasiveness on anxiety level. While some studies have shown that anxiety was more elevated before an invasive procedure compared with a control group,[9,10] others have shown that emotional mood amongst women undergoing amniocentesis was similar to that of women undergoing non-

invasive procedures.[19] Moreover, few studies demonstrated that anxiety declined some time after ultrasound,[9,20] suggesting that it also induced a certain level of anxiety. In light of these ambiguous results, questions related to the degree to which invasive prenatal diagnostics induce anxiety and the nature of anxiety following the procedure need further investigation.

Coping is an important process related to anxiety experienced in stressful situations. Coping refers to behavioral and cognitive actions taken to master stressful situations.[21] These efforts have two main functions: to regulate emotions and focus on problem solving. To date, studies with women undergoing prenatal diagnostic procedures have rarely addressed the role of coping styles, even though the stressfulness of such procedures has been well documented. In the few studies that have examined this topic, results are inconsistent. Namely, while one study did not establish a correlation between coping styles and anxiety,[22] another demonstrated that coping styles were related to emotional mood but only in women who underwent amniocentesis and not in a control group.[23] It has been further demonstrated that optimism, as a dispositional trait in which positive outcomes are expected in different situations, was also important for dealing with stressful situations. In women with high-risk pregnancies, optimistic women perceived their pregnancy as more controllable and less stressful and were less likely to use an avoidant coping style, a maladaptive form of coping.[24] Still, the role of coping styles in the anxiety experienced during stressful situations such as amniocentesis remains to be investigated. Another construct potentially related to anxiety is affect intensity, a stable individual disposition for affect response in different situations. Individuals with higher affect intensity tend to respond to both positive and negative events with high emotional intensity.[25] In the present study, we speculated that women with higher affect intensity might respond with higher anxiety levels before and following diagnostic procedures, regardless of the invasiveness of the procedure.

The aims of the study were twofold. The first aim was to examine the change in anxiety level before and after invasive (amniocentesis) and noninvasive (ultrasound) prenatal diagnostic procedures. We expected anxiety level to be higher in the amniocentesis group and that anxiety would decrease in both groups following the procedure, but that the change in anxiety might be larger in the ultrasound group, where results are received immediately. The second aim was to establish the best predictors of anxiety level experienced prior to the procedure. We expected that, after controlling for anxiety trait and type of procedure, affect intensity and coping strategies would contribute to the level of state anxiety.

METHODS

Participants

The study was conducted at the Department of Obstetrics and Gynecology at the University Hospital Center in Zagreb, Croatia. Pregnant women older than 18 years and in the second trimester of pregnancy were recruited prior to two different prenatal diagnostic procedures: amniocentesis (invasive procedure) and ultrasonography (noninvasive procedure). At the clinic, ultrasonography is the standard procedure administered to all pregnant women and a convenient sample of women undergoing ultrasound was chosen. Indications for amniocentesis were as follows: maternal age (in 59.5% of women), abnormal results at the double or triple maternal serum screening test (27.0%), and/or family genetic risk (13.5%). Eighty women agreed to participate in the study, but 6 of them did not complete post-procedure questionnaire (7.5%), so were excluded from analyses. The final sample included 37 women who underwent amniocentesis and 37 women who underwent ultrasound.

Procedure

This short-term follow-up study was conducted at a prenatal clinic while women waited for a scheduled amniocentesis or ultrasound procedure. Women were informed about the study and asked to sign informative consent before completing the questionnaires. A booklet containing all questionnaires was anonymously completed by all participants immediately prior to the procedure. In the same envelope there was an additional anxiety questionnaire that women filled immediately after the procedure. In that way, participants could stay anonymous and still their data from pre-procedure and post-procedure could be linked at an individual level. Ethical approval for the study was obtained from the Ethical Committee of the University Hospital Center.

Materials

Participants were first asked to complete a demographic questionnaire comprised of general questions regarding age, marital status, education, employment, and place of residence (rural/urban). This questionnaire also included obstetric and gynecological questions regarding parity (number of children), gestational week, previous gynecological conditions, and chronic illnesses. Women undergoing amniocentesis were also asked to provide the reasons for undergoing the procedure.

Maternal anxiety was assessed using the State-Trait Anxiety Inventory (STAI).[26] The STAI is a commonly used measure of anxiety and has been proven to be a reliable and valid measure. It consists of two separate self-report scales: 20 items measure state anxiety (STAI-S), or current anxiety (measured as tension, worry, and restlessness), whereas another 20 items measure trait anxiety (STAI-T), or the general tendency to respond to stressful events with anxiety. Respondents rate each item on a scale from 1 to 4. The STAI demonstrates high internal consistency, where Cronbach α for women is 0.94 and 0.91 for trait and state anxiety, respectively. Pregnant women scoring above the cut-off score of 40 on either STAI-T or STAI-S are considered to be highly anxious.[27] The STAI has been previously translated and validated in a Croatian sample.[26] In the current study, a coefficient of internal consistency Cronbach α was 0.91 for trait anxiety, and 0.94 and 0.95 for state anxiety before and after the procedure, respectively.

The Affect Intensity Measure (AIM) was developed to measure the intensity of individual emotions in positive and negative situations.[28] This 40-item self-report questionnaire measures the trait of emotionality, where ratings are made on a six-point scale on which higher results indicate higher affective intensity.

Examples of items are: 'My happy moods are so strong that I feel like I'm in heaven' and 'When I am nervous, I get shaky all over'. The AIM has been demonstrated to be related to a stronger emotional response to daily life events.[28] In the current study, the Cronbach α was 0.86.

Dispositional coping styles of participants were measured using the COPE inventory.[29] This questionnaire measures the coping methods, thoughts, and behavior of an individual under stress. In the present study, the short version of the Croatian adaptation of the inventory was used.[30] This 13-item questionnaire examines three coping styles: problem-focused coping (six items, e.g., "I think hard about what steps to take."), emotion-focused coping (three items, e.g., "I get comfort and understanding from someone."), and avoidance (four items, e.g., "I refuse to believe that it has happened."). The Cronbach α established in the current study was 0.62, 0.82, and 0.61 for problem-focused coping, emotional-focused coping, and avoidance, respectively.

The Optimism–Pessimism Scale (OPS) measures the expectancy of positive and negative outcomes in different situations as two separate dimensions.[31] The OPS has been previously adapted and validated in a Croatian sample with good internal consistency.[32] The scale consists of two subscales: six items measuring optimism and eight items measuring pessimism. Items are rated on a scale from 1 to 5, resulting in two scores: an optimism subscale score and a pessimism subscale score. Optimism has been shown to be related to self-esteem and life satisfaction, whereas pessimism as a negative expectancy toward future events is related to anxiety.[33] The Cronbach α in the current study was 0.72 and 0.88 for optimism and pessimism, respectively.

Statistical analysis

Chi-square (χ^2) and *t*-tests were used to examine the differences between the amniocentesis and ultrasound groups in the main demographic variables, where appropriate. Data distributions for all psychological measures were inspected and proven to be normal. A two-way ANOVA was used to examine changes in anxiety level, as it was related to the invasiveness of the procedure (amniocentesis and ultrasound) and time (before and after the procedure). Pearson's product–moment correlation coefficients were used to test the associations between anxiety level and different demographic and psychological variables. Hierarchical regression analysis was performed to establish the best predictors of state anxiety before the diagnostic procedure. In all analyses, the *P* value was set to $p < 0.05$. Sample size calculation determined that 29 participants in each group would be sufficient to detect a significant difference on the STAI-S, when the mean of STAI-S was set at 42 in amniocentesis group[34] and at 33 in ultrasound group,[20] with a standard deviation of 12 points, a power of 80%, and a significance level of 5%. This number has been increased to 40 per group (total of 80), in case of dropout. All statistical analysis was performed using the SPSS 20.0.0 software (IBM Corp., Armonk, NY, USA).

RESULTS

The groups of women who underwent amniocentesis and ultrasound did not differ in the main demographic variables, with the exception of age as can be seen in Table 1. Here, the mean age in the amniocentesis group was 5 years greater than that in the ultrasound group.

Table 1 Sample characteristics of main demographic and obstetrical variables in a group of women undergoing amniocentesis and ultrasound. Number (%) or mean (standard deviation)

Sample characteristics	Amniocentesis ($n=37$)	Ultrasound ($n=37$)	*p*-value
Age (years)	35.9 ± 3.3	30.8 ± 3.9	<0.001
Gestational age (weeks)	17.2 ± 0.9	18.7 ± 4.2	0.11
Marital status			0.60
Married	26 (70.3)	28 (75.7)	
Living with partner	11 (29.7)	9 (24.3)	
Education			0.24
Secondary school	24 (64.9)	19 (51.4)	
University	13 (35.1)	18 (48.6)	
Employment			0.50
Employed	33 (89.2)	31 (83.8)	
Unemployed	4 (10.8)	6 (16.2)	
Place of residence			0.60
Rural	11 (29.7)	9 (24.3)	
Urban	26 (70.3)	28 (75.7)	
Number of children			0.31
None	14 (37.8)	17 (46.0)	
One	14 (37.8)	16 (43.2)	
Two or more	9 (24.4)	4 (10.8)	
Previous miscarriage			0.80
Yes	13 (35.1)	11 (29.7)	
No	24 (64.9)	26 (70.3)	

Descriptive statistics for anxiety and other psychological measures are presented in Table 2. In comparison to norms for the general female population, state anxiety before and after the procedure were significantly greater among women participating in this study (35.7 ± 10.4)[26] ($t\,(272) = 1.52$, $p < 0.05$).

Table 2 Scores on psychological measures in pregnant women ($N=74$)

	Mean ± *SD*	Median (range)
Trait anxiety (STAI-T)	38.5 ± 9.2	39 (20–80)
State anxiety (STAI-S) before the procedure	41.4 ± 12.1	41 (20–80)
State anxiety (STAI-S) after the procedure	39.6 ± 13.0	37 (20–80)
COPE – problem-focused coping	22.9 ± 2.8	23 (6–30)
COPE – emotion-focused coping	10.9 ± 2.5	11 (3–15)
COPE – avoidance	8.1 ± 2.4	8 (4–20)
Optimism (OPS-O)	22.7 ± 3.8	23 (6–30)
Pessimism (OPS-P)	18.6 ± 6.8	18 (8–40)
Affect intensity measure (AIM)	145.2 ± 17.7	148 (40–240)

A two-way 2 (procedure: amniocentesis/ultrasound) × 2 (time: before/after the procedure) ANOVA was conducted on the anxiety level. This revealed a significant main effect of procedure (F (1, 72) = 3.96, p = 0.042), indicating that anxiety was significantly higher in amniocentesis group. A main effect of time was not significant (F (1, 72) = 1.87, p = 0.18). However, the procedure × time interaction was significant (F (1, 72) = 5.01, p = 0.028), indicating that change in anxiety after the procedure was present in the ultrasound but not the amniocentesis group (Figure 1). *Post hoc* Fisher's least significant difference test revealed that there was no difference in anxiety between amniocentesis and ultrasound group pre-procedure. Still, the anxiety level in the amniocentesis group was above the proposed cut-off score of 40 on the STAI.[27]

Correlations between anxiety and other psychological variables are presented in Table 3. No significant correlations were found between state anxiety, both before and after the procedure, and any demographic variables. Conversely, state anxiety was related to trait anxiety, affect intensity, and some coping styles. Specifically, pre-procedure anxiety was related to problem-focused coping and pessimism, whereas post-procedure anxiety was negatively correlated to problem-focused coping and optimism, and positively associated with avoidance and pessimism.

To establish the predictors of state anxiety, the variables that were significantly related to anxiety before the procedure were entered into a hierarchical regression analysis. Given the sample size, and in view of the consideration that 15 subjects per predictor is sufficient for the estimation of a model,[35] no more than five predictors were entered into the regression. After controlling for trait anxiety, which explained 31.7% of the variance of state anxiety, procedure (amniocentesis or ultrasound) explained an additional 6.4%, which qualifies as a significant contribution (Table 4). In the final step, affect intensity and coping styles were entered but did not explain any additional variance. Moreover, because the procedure was not correlated with the anxiety level (r = −0.16, p > 0.05), but was a significant predictor of anxiety level when combined with trait anxiety, this means that type of procedure was a suppressor variable.[36]

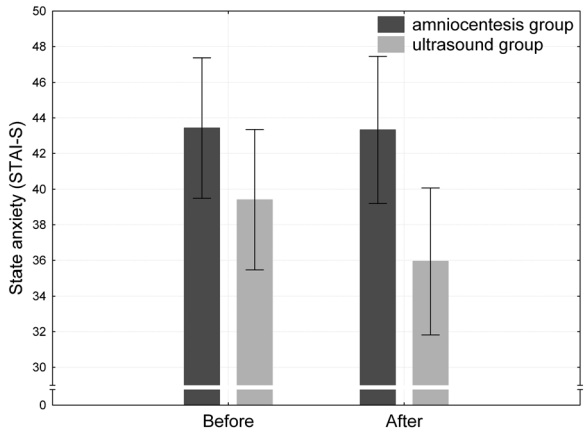

Figure 1 Anxiety level before and after the procedure in women undergoing amniocentesis or ultrasound. The histograms represent mean, and bars represent ±95% confidence interval

Table 3 Correlations between anxiety level and demographic and psychological measures (N = 74)

	STAI-T	STAI-S before	STAI-S after
Demographics			
Age	0.23	0.04	0.09
Gestational week	−0.04	−0.02	−0.23
Marital status	−0.07	−0.11	−0.07
Number of children	−0.24*	−0.05	−0.11
Education level	−0.26*	−0.14	−0.16
Employment	0.02	−0.03	−0.03
Place of residence	−0.10	−0.11	−0.02
Psychological variables			
Trait anxiety (STAI-T)	—	0.59**	0.41**
State anxiety (STAI-S) before the procedure	0.59**	—	0.60**
State anxiety (STAI-S) after the procedure	0.41**	0.60**	—
Affect Intensity Measure (AIM)	0.32**	0.34**	0.34**
Problem-focused coping (COPE)	−0.52**	−0.26*	−0.37**
Emotion-focused coping (COPE)	0.05	0.05	0.04
Avoidance (COPE)	0.24*	0.15	0.36**
Optimism (OPS-O)	−0.43**	−0.20	−0.31**
Pessimism (OPS-P)	0.54**	0.43**	0.34**

*p < 0.05.
**p < 0.01.

DISCUSSION

This study examined maternal anxiety due to prenatal diagnostic procedures, as it was related to the invasiveness of the procedure. The key findings of the study were as follows: (1) women waiting for ultrasound experienced comparable levels of anxiety to those waiting for amniocentesis; (2) a difference between groups was evident only after the procedure, when anxiety decreased significantly in women who underwent ultrasound, but not in women who underwent amniocentesis; and (3) although coping styles and affect intensity were related to anxiety, they were not significant predictors when controlling for trait anxiety and procedure type.

To date, studies have demonstrated that anxiety levels before prenatal diagnostic procedures are higher in amniocentesis than in ultrasound[8–10,37] or control groups.[38] In contrast, the findings of the current study indicate that women undergoing amniocentesis or ultrasound experience similar levels of anxiety prior to the procedure. Also, anxiety in both groups were significantly higher than in the general female population,[26] suggesting that ultrasound, despite being a noninvasive procedure, does induce a substantial level of anxiety in pregnant women. While ultrasonography does not carry the same risk of complications for the mother and fetus as amniocentesis, it can potentially indicate developmental

Table 4 Hierarchical regression analysis testing predictors of anxiety level (STAI-S) before the procedure ($N=74$)

	b	*SE b*	*β*	R^2
Step 1				
Constant	13.62	4.96		
Trait anxiety (STAI-T)	0.72	0.13	0.56**	$R^2=0.317$**
Step 2				
Constant	20.50	5.42		
Trait anxiety (STAI-T)	0.77	0.12	0.61**	$R^2=0.381$**
Procedure	−5.96	2.24	−0.26**	$\Delta R^2=0.064$**
Step 3				
Constant	−5.95	18.78		
Trait anxiety (STAI-T)	0.69	0.16	0.54**	
Procedure	−5.84	2.27	−0.25*	
Affect intensity measure (AIM)	0.13	0.07	0.20	
Problem-focused coping (COPE)	0.33	0.48	0.08	$R^2=0.423$*
Pessimism (OPS)	0.14	0.20	0.08	$\Delta R^2=0.042$

b, unstandardized regression coefficient; *SE b*, standard error of *b*; *β*, standardized regression coefficient; R^2, multiple correlation coefficient; ΔR^2, change in R^2.
*$p<0.05$.
**$p<0.01$.

aberrations and, as a result, induces a certain worry amongst pregnant women.

The anxiety level in women undergoing amniocentesis was above the proposed cut-off score[27] and, as such, could be characterized as clinically significant anxiety. Weinmann and Johnston identify two stressful aspects related to amniocentesis,[19] where the first aspect is related to the invasiveness of the procedure and the second is related to the fear of an abnormal result. Consistent with this distinction, we expected the anxiety level in the amniocentesis group to decrease at least somewhat immediately after the procedure. However, contrary to the hypothesis, anxiety significantly decreased immediately after the procedure only in women who underwent ultrasound. Arguably, for women who underwent amniocentesis, a longer period following the procedure is needed for anxiety to subside. In previous studies, anxiety was demonstrated to decrease a few weeks after undergoing amniocentesis and to decline even further after receiving the amniocentesis results.[9,22] Interestingly, women were less anxious after receiving amniocentesis results than women not having the procedure.[37] Together, these findings suggest that amniocentesis might be beneficial for the maternal adaptation to pregnancy. Namely, anxiety during pregnancy differs from general anxiety and comprises several pregnancy-specific aspects, one of which is the fear that the baby might be physically or mentally handicapped.[39,40] As such, women who undergo some form of prenatal diagnostic procedure and receive normal results might be more relaxed as the pregnancy progresses because they feel more reassured about their baby's health.

Given that the results of the current study did not show a change in anxiety immediately after amniocentesis, it might be argued that the fear of pain due to amniocentesis is not as significant a contributor to anxiety as has been previously emphasized. These findings are consistent with some previous studies showing that the pain and anxiety experienced during amniocentesis is often significantly lower than what women expected.[41] The majority of women described the pain during amniocentesis as a mild or reported no pain.[42]

The final findings of the current study relate to the correlates of anxiety before prenatal diagnostic procedures. Anxiety was not related to any general demographics, a finding consistent to those from another study in Croatian couples undergoing amniocentesis.[34] Because coping has been emphasized as an important construct for the outcome in stressful situations,[21] we expected coping styles to be significant predictors of anxiety. In addition, affect intensity and pessimism have also been previously demonstrated to be related to anxiety.[28,33] The results of the current study demonstrated that coping styles, affect intensity, and optimism/pessimism were related to anxiety. Women who were less prone to use problem-focused coping and who exhibited higher pessimism and affect intensity also had higher anxiety before the procedure. Nevertheless, these variables were not significant predictors of pre-procedure anxiety when controlling for trait anxiety and type of procedure. Consistent with this finding are the results of another study demonstrating the limited role of coping styles in the anxiety experienced as a result of amniocentesis.[22] It may be that coping styles are more important for the mood state of women undergoing amniocentesis than anxiety itself.[23] So, trait anxiety seems to explain the variance in anxiety scores far better than coping styles and emotional reactivity. Furthermore, the type of procedure also explained a small proportion of anxiety variance (6.4%) but acted as a suppressor variable. This effect happened because suppressor variable (procedure) was related to other predictors and therefore explained the part of predictor variance that was irrelevant.[36] This result, together with the lack of difference in pre-procedure anxiety between the two groups, suggests that the invasiveness of the prenatal procedure itself might not be as important as previously described.[18]

Instead, increased risk of miscarriage, waiting for test results and the related uncertainty might be key reasons for the

anxiety that continues after the procedure. As such, special attention should be paid to women waiting for amniocentesis results. Several steps can be taken before and after the procedure to diminish anxiety. First, counseling prior to the procedure affects women's attitudes toward amniocentesis[43] and reduces anxiety by providing all necessary information.[9] Women appreciate information about the possible risks of amniocentesis, as well as advice on how to deal with the emotional difficulties related to undergoing the procedure.[44] Because women with previous experience with prenatal diagnostic testing had elevated anxiety[22] or experienced more pain during amniocentesis,[42] special attention should be paid to these women.

There are several limitations to the current study. First, even though the study used a convenience sample that was large enough to detect hypothesized differences between amniocentesis and ultrasound group, the results should be confirmed using a larger sample. The only difference between amniocentesis and ultrasound group was in age and not in other demographic variables. However, these groups might differ in other aspects. Although ultrasound is a routinely procedure, amniocentesis is performed only on basis of certain indications and in women who accept possible risks of such procedure. In other words, the group of women who undergo amniocentesis is self-selected. In addition, following women through later phases of pregnancy is necessary to examine the manner in which anxiety level changes after receiving the amniocentesis results. It would also be interesting to examine whether anxiety levels during late pregnancy are lower among women who underwent amniocentesis and received decisive results compared to women who had undergone only routine ultrasound, as has been previously suggested.[45,46]

Despite these limitations, the current study offers a unique contribution to current understanding of womens emotional reactions to prenatal diagnostic procedures. The results suggest that noninvasive procedures such as ultrasound induce the same level of pre-procedure anxiety as the invasive amniocentesis procedure. Therefore, pregnant women undergoing ultrasound should be similarly approached with considerate support and care. Furthermore, because anxiety in women undergoing amniocentesis is not so transient, specific procedures based on the proposed recommendations should be applied to ease women's adaptation to pregnancy.

WHAT'S ALREADY KNOWN ABOUT THIS TOPIC?

- Amniocentesis is an invasive prenatal diagnostic procedure accompanied by high maternal anxiety. Stress induced by amniocentesis can be characterized as fear of pain from the procedure and fear of abnormal results.

WHAT DOES THIS STUDY ADD?

- Noninvasive procedures such as ultrasound induce the same pre-procedure anxiety as amniocentesis. However, only after ultrasound do anxiety levels decline, likely because results are received immediately.
- The fear of pain is not as prominent a contributor to anxiety as previously thought. Instead, the fear of abnormal results and possible complications seems a much more important factor.

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