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The effect of video-based multimedia information before amniocentesis on pain, anxiety, and pregnancy outcomes

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Amniocentesis is the most commonly used invasive prenatal diagnostic test. This study aimed to investigate the effect of video-based multimedia information *(MMI)* on the anxiety and pain levels of patients undergoing amniocentesis. This randomized controlled study included all consecutive women aged 18–45 years scheduled for amniocentesis. Subjects were assigned to receive video-based MMI or standard written information. Anxiety levels were assessed pre-procedure and post-procedure using the State and Trait Anxiety Inventory-State (STAI-S). All patients underwent standard amniocentesis by the same perinatologists. After amniocentesis, Likert scale was used to evaluate the ease of the procedure and patient satisfaction, and a visual analog scale was used to evaluate pain. Pregnancy results and amniocentesis results were noted. Eighty-four patients were randomized to receive video-based MMI, and 76 were randomized to receive written information. The post-procedure STAI-S score was significantly lower in both the video group and the control group compared to the pre-procedure STAI-S score *(47.8 ± 5.23 vs. 45.86 ± 5.02, 95% CI: [2.38–1.52], p < 0.001, and 46.75 ± 7.35 vs. 44.82 ± 6.85, 95% CI: [2.33–1.51], p < 0.001)*. The satisfaction rate of the video group was significantly higher than controls *(69.05% vs. 48.68%, p = 0.01)*. Procedure pain, ease of procedure, and pregnancy outcomes were similar for both groups *(p > 0.05)*. Performing video-based MMI before the amniocentesis procedure is associated with higher patient satisfaction than standard written information. Video-based MMI was not associated with reductions in pain and anxiety in patients undergoing amniocentesis.

Keywords Amniocentesis, Anxiety, Pain, Satisfaction, Video-imaging

Introduction

Genetics pioneered the development of prenatal genetic tests to assess fetal health through diagnostic procedures such as cordocentesis, amniocentesis, and chorionic villus sampling. Invasive diagnostic techniques are now an established part of pregnancy care. Amniocentesis is the most commonly used invasive prenatal diagnostic test[1]. However, pregnant women often fear the procedure because of the risk to the fetus and the fact that the procedure will be painful[2]. In a recent study (2023) by Akkus et al.[3], it was reported that video information may be more effective in reducing pre-amniocentesis anxiety levels than verbal information in a study of 94 pregnant women scheduled for amniocentesis. Therefore, amniocentesis is a worrying and painful procedure for pregnant women. To minimize stress and anxiety levels, necessary information should be provided before undergoing this medical intervention. Anxiety levels in families naturally increase while waiting for prenatal invasive test results or when a fetal anomaly is detected[4].

Couples need access to sufficient and transparent information about the planned tests, their benefits and complications, and the possible long-term consequences of their decisions. This information can be provided as written text, through audio methods *(e.g., phone calls)*, or animated videos[5]. Cognitive multimedia learning theory suggests that multimedia instructional messages can facilitate learning if they are short, visually informative, and reduce the amount of information irrelevant to the topic[6].

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Fear of procedure pain or stress is an obstacle to choosing diagnostic and therapeutic tools in hospitals and health centers. Many women may not choose amniocentesis for a definitive diagnosis of genetic diseases due to fear of pain and stress during this procedure. Within the scope of this research, we aimed to elucidate the effects of different patient education techniques and information methods on the anxiety and pain levels of patients undergoing amniocentesis.

Materials and methods

Patient selection

This randomized clinical study included women aged 18 to 45 who agreed to undergo amniocentesis between December 2023 and August 2024. The study was approved by the İstanbul Çam and Sakura City Hospital Clinical Research Ethics Committee *(ethics no 2023 – 571). It was conducted per the latest version of the Declaration of Helsinki (2019/92)*. Written informed consent was obtained from all participants. This study was registered with ClinicalTrials.gov, number NCT06555653 *(29.07.2024)*.

Inclusion criteria

Turkish-speaking native citizens with gestational ages between 16 and 24 weeks were included.

Exclusion criteria

Pregnancy achieved via assisted reproductive techniques, individuals with a history of amniocentesis, the presence of significant fetal anomaly on ultrasound, drug-alcohol-psychotropic drug-substance use and abuse in pregnancy and psychotic disorders, having a history of severe psychiatric disorders including bipolar disorder and depression and having any identified psychological disorder requiring medication were excluded. Individuals with a disease requiring systemic drug use, such as benzodiazepines, tranquilizers, narcotics, or analgesics, were not included in the study because they changed the pain score. Patients who did not have at least a primary education diploma (inability to read the written material) were excluded.

All participants presenting for amniocentesis were asked to complete the State and Trait Anxiety Inventory-State *(STAI-S)* 24 h before the procedure[7]. STAI-S is an indicator of the anxiety people experience during unavoidable stressors. It contains 20 statements that evaluate a person's feelings when the test is taken. Items are scored on a 5-point Likert-type scale ranging from 1 *(not at all)* to 4 *(very much)*. Total scores range from 20 to 80. The higher the test result score, the more anxiety it indicates.

Participants were assigned to one of the video or control groups using random assignment software *(*www.randomization.com*)*. One hundred seventy patients were initially assigned to the study. One participant in the video group refused to participate and was excluded from the study. In the control group, 5 patients *(2 with depression and 3 with panic attack disorder)* were excluded from the study because they did not meet the inclusion criteria and 4 patients refused to participate (Fig. 1). While the video group was given standard written information and an MMI video explaining the process in detail, the control group was given only standard written information. The perinatologist who performed the procedure and the person who measured anxiety and pain levels were unaware of the group the patient was in.

The video group was shown a 5-minute informational video before the amniocentesis. In the video, the definition of the diagnostic method of amniocentesis, how amniocentesis is performed, and its indications, the amniocentesis room, the purpose of the procedure, procedural steps, possible complications following amniocentesis, and how to deal with them were explained. Twenty-four hours after the information, the STAI-S questionnaire was administered to all participants before the amniocentesis procedure (*pre-procedure STAI-S*).

No analgesics were used before and during the procedure. The procedure area was disinfected. The same perinatologists performed amniocentesis by entering the amniotic cavity with a 15 cm long, 20-gauge non-heparinized spinal needle under ultrasound guidance. 30 cc of aspiration fluid was obtained and sent to the genetics laboratory. Pain was assessed with VAS 10 min after amniocentesis was completed *(0; no pain*, *10; worst imaginable pain)*. STAI-S (*post- procedure STAI-S*) was repeated 30 min after the procedure, and a 4-point Likert scale *(0; dissatisfied*, *1; slightly satisfied*, *2; satisfied*, *3; very satisfied)* was administered to the patients. A Likert scale score ≥ 2 was accepted as satisfaction.

Perinatologists evaluated the procedure's ease using a 5-point Likert scale *(very easy = 1*, *easy = 2*, *medium = 3*, *difficult = 4*, *very difficult = 5)*. Complications occurring within 7 days after amniocentesis were considered procedure-related, and the group complication rates were compared. Both groups were compared regarding pregnancy outcomes, birth week, and amniocentesis results.

We determined the minimum sample size at a 95% confidence level and 80% test power. Assuming that the effect of video watching on the state anxiety of pregnant women should be 2.5 units less than the control group (average 5% of instrument score) to be considered statistically significant, the minimum sample size required in each group was calculated to be 69 people using the formula for the sample size calculation for two independent groups.

Primary and secondary outcomes

The anxiety levels of patients in both groups before amniocentesis were the primary outcome measure of this study. Secondary outcome measures were the differences between groups in post-procedure pain, satisfaction rate, and ease of procedure.

Statistical analysis

All data were analyzed using the SPSS for Windows statistical software package *(SPSS 29.0*, *SPSS Inc.*, *Chicago)*. All continuous variables were tested to determine whether they satisfied the normality assumption using the *Kolmogrov-Smirnov test*. Comparison of both groups regarding sociodemographic and clinical characteristics

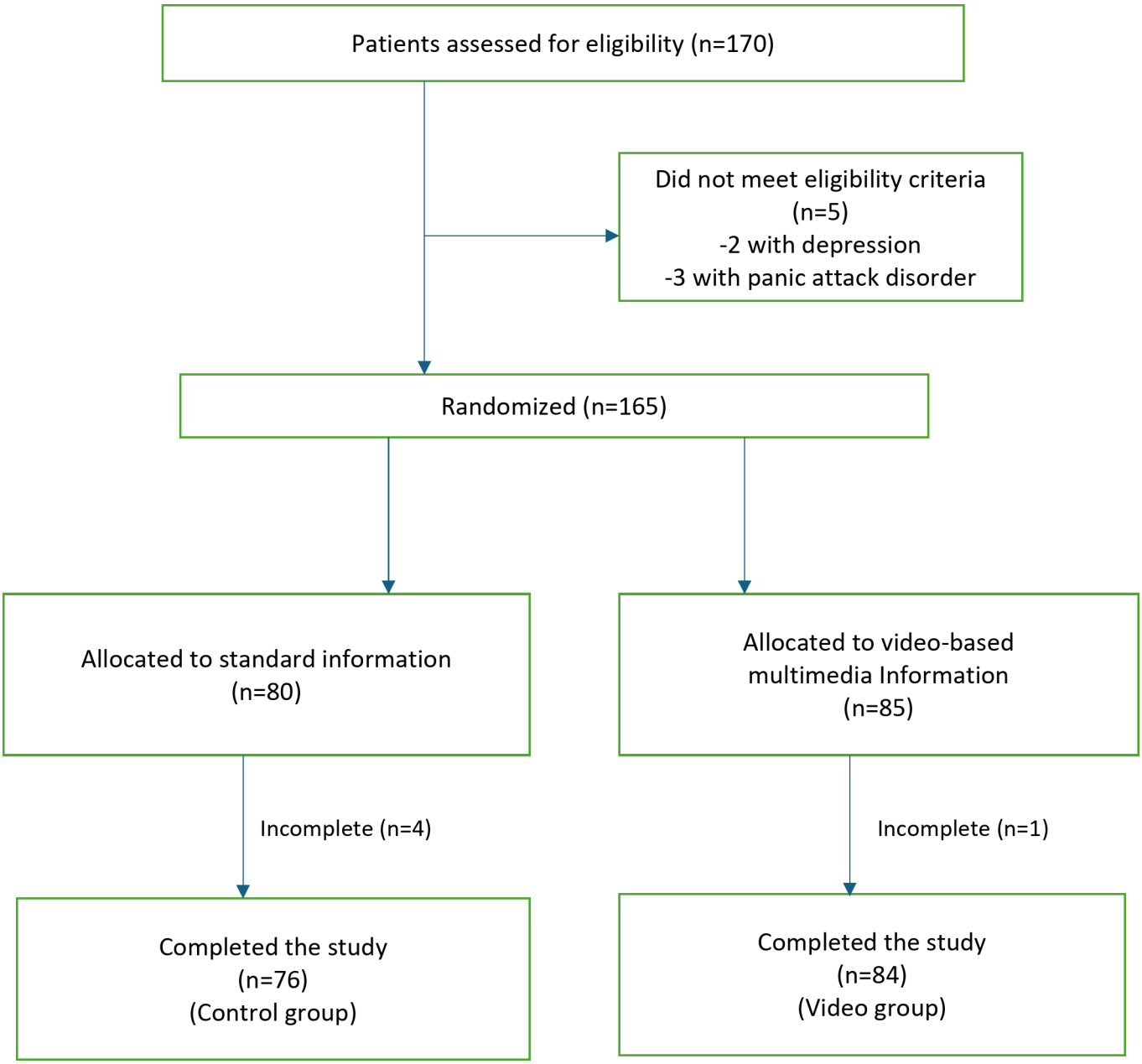

Fig. 1. Flowchart demonstrating subject enrollment. Incomplete ($n=4$) Incomplete ($n=1$).

was made using the *Chi-square test*, Fisher exact test *(for categorical data)*, and the Mann-Whitney U test *(for continuous data)* as appropriate. Pre- and post-procedure STAI comparisons were made in each group using the Wilcoxon signed-ranks test *(the non-parametric equivalent of the paired t-test)*. We calculated the differences in the mean values pre and post-procedure STAI-S using the Mann-Whitney U test to establish if the mean values were statistically significant between the video and the control groups. Results are presented as means and standard deviations and medians and interquartile ranges *(IQRs)* for continuous variables and as frequencies and percentages for categorical variables.

Results

A total of 160 participants were enrolled in this single-blind, randomized, controlled trial. Eighty-four patients were randomized to the video group, and 76 were randomized to the control group. There were no statistically significant differences between the groups regarding maternal age, gravidity, parity, education, indications, fetal abnormalities, smoking status, concomitant disease status, and gestational week *($p > 0.05$*, Table 1*)*.

The pre-procedure and post- procedure STAI-S score was similar for both groups. The post-procedure STAI-S score was significantly lower in both the video group and the control group compared to the pre-procedure STAI-S score *(47.82 ± 5.23 vs. 45.86 ± 5.02, 95% CI: [2.38–1.52], $p < 0.001$ and 46.75 ± 7.35 vs. 44.82 ± 6.85, 95%*

Variables	Video group ($n=84$)	Control group ($n=76$)	p-value
Age	32.92 ± 6.98	31.79 ± 6.38	0.243*
Gravidity ††	2,5 (2–3)	3 (2–3,25)	0,55*
Parity ††	1 (1–2)	1 (1–2)	0,1969*
Education			
Elementary	24 (28.6%)	21 (27.6%)	0.920**
High School	33 (39.3%)	28 (36.8%)	
University or Graduate Studies	27 (32.1%)	27 (35.6%)	
Indication			
Fetal abnormalities	34 (40.4%)	33 (43.4%)	0.913†
Abnormal NIPT	4 (4.8%)	3 (3.9%)	
Positive DS screening	32 (38.1%)	29 (38.2%)	
Family history of genetic disease	10 (11.9%)	6 (7.9%)	
Maternal age	4 (4.8%)	5 (6.6%)	
Smoking			
No	81 (96.4%)	74 (97.4%)	0.547†
Yes	3 (3.6%)	2 (2.6%)	
Concomitant disease			
No	63 (75.0%)	62(81.6%)	0.315**
Yes	21 (25.0%)	14 (18.4%)	
Gestational week	19.10 ± 2.57	19.58 ± 2.58	0.259*

Table 1. Comparison of the descriptive and clinical features of the participants according to their educational video viewing status. Data given as mean ± SD and percentage. †† Median- interquartile range (IQR). $^{*}p<0.05$. *Mann-Whitney U test, **Chi-square test, † Fisher's exact test.

STAİ-S	Video group ($n=84$)	Control group ($n=76$)	p-value**
Pre-procedure	47.82 ± 5.23	46.75 ± 7.35	0.224
Post-procedure	45.86 ± 5.02	44.82 ± 6.85	0.209
p-value*	< 0.0001	< 0.0001	

Table 2. Comparison of STAI-S score before and after in the two groups. Data are given as mean ± standard deviation. STAI-S: State-trait anxiety index-state. $^{*}p<0.05$. **P-value derived from the comparison of video and control groups *p-value derived from the comparison of the pre and post information on STAI score.

Variables	Video group ($n=84$)	Control group ($n=76$)	p-value*
Vas score	5.15 ± 1.39	5.34 ± 1.63	0.564
Ease of the procedure	2.52 ± 0.69	2.36 ± 0.84	0.206
Satisfaction	58 (69.05)	37 (48.68)	0.010**

Table 3. Procedural pain, ease of the procedure and satisfaction scores of the two groups. Data are given as mean ± standard deviation. $^{*}p<0.05$. *Mann-Whitney U test **Chi-square test.

*CI: [2.33–1.51], $p<0.001$) (*Table 2*).* Both interventions *(video and written)* significantly reduced anxiety. The type of information delivery *(video vs. written)* does not appear to influence anxiety reduction more than the other.

Additionally, the satisfaction rate of the video group was significantly higher than the controls (69.05% vs. 48.68%, $p=0.01$). Pain intensity and ease of procedure were similar for both groups ($p>0.05$, Table 3).

A complication was observed in one patient after the procedure. All other pregnant women *(159/160, 99.3%)* were given a genetic report. A total of 113 *(113/160, 70.6%)* pregnancies resulted in live birth, 12 *(12/160, 7.5%)* were medically terminated, 5 *(5/160, 3.1%)* fetuses died in utero, and 30 *(30/160, 18.7%)* lost to follow-up. Pathogenic outcomes were reported in 23 of 160 pregnancies *(23/160, 14.3%)* examined in the study. When the pregnancy results *(live birth/termination of pregnancy/intrauterine death/unknown)*, birth week, and amniocentesis results *(normal or abnormal)* of the two groups were compared, no significant differences were found between the groups *($p>0.05$* Table 4*).*

Variables	Video group ($n=84$)	Control group ($n=76$)	p-value
Pregnancy outcome			
Live birth	62 (54.9%)	51 (45.1%)	0.640†
Termination of pregnancy	7 (58.3%)	5 (41.7%)	
Intra-uterine death	2 (40.0%)	3 (60.0%)	0.1043
Unknown	13 (43.3%)	17 (56.7%)	
Birth week	38.01 ± 1.99	37.08 ± 3.52	0.104*
Amniocentesis result			
Normal	71 (52.8%)	66 (47.2%)	0.822**
Abnormal	13 (51.4%)	10 (48.6%)	

Table 4. Comparison of the two groups in terms of the pregnancy outcome, birth week and amniocentesis result. Data given as mean ± SD and percentage. $^{*}p<0.05$. *Mann-Whitney U test, **Chi-square test.

Discussion

This study showed that pre-procedural video-based MMI is a practical approach associated with higher patient satisfaction. Our findings also revealed that the group that received MMI before amniocentesis experienced no changes in anxiety levels, pain intensity, ease of procedure, and pregnancy outcomes compared with the group that received written information only.

Anxiety has been a problem for patients and healthcare professionals during surgical procedures, as it can harm hemodynamics during the procedure and subsequent recovery[8]. One study reported that 24% of individuals who were candidates for amniocentesis experienced moderate-to-high levels of anxiety[9]. In procedures performed using multimedia approaches, providing appropriate information about the procedure and satisfactory answers to questions can reduce the patient's anxiety. Preoperative MMI can facilitate the education of patients thanks to the advantages of visual perception in informing and understanding[10].

In a study by *Mojahed et al.*. involving 80 pregnant women, it was found that education before invasive screening for fetal abnormalities *(amniocentesis)* reduced anxiety in pregnant women before and after amniocentesis[11]. *Balci et al.*., in their study on 240 pregnant women in Turkey *(2011)*, evaluated the effect of pre-amniocentesis counseling on the mother with a three-stage measurement. It was observed that counseling before amniocentesis did not significantly reduce anxiety levels and pain[12]. In a recent study involving 100 women undergoing amniocentesis, it was shown that watching an informational video before the procedure provided a significant decrease in post-procedure anxiety compared with pre-procedure anxiety[13]. Unlike the studies reviewed, our study evaluated anxiety before and after the training. It was observed that the post-procedure STAI-S scores of both groups were significantly lower than the pre-procedure STAI-S scores.

Evaluation of the effect of education on the anxiety of mother candidates for amniocentesis has been an emerging issue. Some studies even investigate only perceived stress rather than overall anxiety[3,14]. Malakouti and colleagues (2023) stated that training had a positive short-term effect on perceived stress, state anxiety, and trait anxiety[15]. Similar outcomes were also reported by *Kandemir et al. (2024)*, claiming that video-based education more effectively reduces anxiety and stress levels compared to traditional methods, potentially enhancing patient satisfaction[16]. *Bayat et al.*[17] elaborated that cognitive-behavioral training reduced the anxiety of pregnant women with positive screening results for chromosomal disorders in a randomized controlled trial of 92 patients. This research is one of the few studies elaborating on the significance of pre-procedural training on the anxiety levels of patients in both groups before amniocentesis. As a significant decrease in anxiety was detected in both groups, we concluded that MMI did not have an anxiety-reducing effect. An interesting area for future research could be whether MMI versus written information can impact whether patients agree to schedule the procedure at all, and whether anxiety levels are a mediating variable. In addition, we recommend assessing anxiety in three stages: pre-training, post-training, and post-processing. The other significant result of the study was that there was no difference in pain during the procedure between the video and the control groups.

The other significant result of the study was that there was no difference in pain during the procedure between the groups. Although amniocentesis is generally well tolerated, it can be painful for some pregnant women. Needle entry and movements during amniocentesis may cause pain. The literature shows many methods to reduce pain in amniocentesis[18–22]. In their study where van *Schoubroeck et al.*. used subcutaneous 1% lignocaine injection as local anesthesia, no effect was found on the pain experienced during amniocentesis between the non-anesthetized and local anesthesia groups. They also stated that mid-trimester amniocentesis was not a painful procedure[18]. In a meta-analysis, there was no significant change in the mother's pain perception between the group in which subcutaneous lidocaine injections were used as local anesthesia and the group without anesthesia[19]. In their study including 240 pregnant women, *Tuaktaew et al.*. showed that oral paracetamol premedication taken before the procedure was effective in reducing pain in women during and within 2 h after amniocentesis[20]. However, there is still no consensus on using pharmacologic analgesics before and during the procedure. *Benchahong et al.*. reported that cold therapy applied before and after amniocentesis procedures effectively reduced pain[21]. *Ferber et al.*., in their study involving 183 women who underwent genetic amniocentesis, reported that the only variable associated with reducing felt pain and anxiety was previous amniocentesis history[22]. In their study involving 120 women who underwent amniocentesis, *Harris et al.* reported that increased pain increased maternal anxiety and was associated with a history of menstrual pain *(dysmenorrhea)* and previous amniocentesis. We increased the

reliability of our study by excluding patients with a history of amniocentesis to avoid affecting pain and anxiety levels[23].

Our study showed that the satisfaction rates of patients who received MMI before amniocentesis were significantly higher than the controls. *Marom et al.* showed that watching an informational video before amniocentesis did not change satisfaction[13]. It has been demonstrated in the literature that video-based training reduces anxiety levels and increases patient satisfaction before many interventional procedures are performed in clinics. These procedures include tooth extraction, dilatation and curettage, and cardiac catheterization[10,24,25]. As previously mentioned *Akkus et al.*[3]. , reported that video information may be more effective in reducing pre-amniocentesis anxiety levels than verbal information in a study of 94 pregnant women scheduled for amniocentesis similar to our outcomes. We hypothesized that the difference in satisfaction levels of the studies may be due to different amniocentesis indications. We think that future studies including the same amniocentesis indications will ensure standardization.

In addition, it was determined that video-based MMI did not impact procedural ease for physicians performing amniocentesis. A recent study reported that video-based MMI before office-based hysteroscopy did not provide procedural ease for the physician. Still, it shortened the cervical canal passage time and reduced pain[26].

The study's main limitation was excluding illiterate women who could benefit most from MMI. Its strengths are its prospective design, including more than one amniocentesis indication, the procedure's performance by the same perinatology physicians, and the detailed evaluation of physiologic parameters. Future randomized controlled trials with a larger number of patients should be conducted to determine the benefits of pre-procedural education, cognitive behavioral therapy, and MMI.

Conclusion

Viewing video-based MMI before amniocentesis resulted in higher patient satisfaction than standard written information. However, video-based MMI is not associated with reductions in pain and anxiety in patients undergoing amniocentesis.

Data availability

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Author contributions

Author contributions N.Ç.: Project development and manuscript writing/editing. ZK. and G.T.: Data collection and analysis, and manuscript writing. The authors read and approved the final manuscript.G.T. prepared Tables 1, 2, 3 and 4.

Declarations

Competing interests

The authors declare no competing interests.

Additional information

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