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Original Article

The effects of multimedia education on anxiety and physiological status among patients with cerebral angiography: A randomized controlled clinical trial

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ABSTRACT

Background &Aim: Cerebral angiography is a diagnostic procedure for cerebral disorders, particularly the disorders of cerebral blood vessels. However, as an invasive procedure, it can cause patients anxiety and physiological instability. This study aimed to evaluate the effects of multimedia education on anxiety and physiological status among patients with cerebral angiography.

Methods & Materials: This randomized controlled clinical trial was conducted from October 2017 to January 2018 in the angiography unit of a university hospital in Tehran, Iran. Participants were 88 candidates for cerebral angiography who were randomly allocated either to an intervention (n = 44) or a control (n= 44) group. Patients in the intervention group were provided with at least thirty-minute multimedia education consisted of video-based education, verbal education, written materials (an educational booklet), and question and answer. Data on participants' personal characteristics were collected before the intervention, while their state anxiety was assessed before multimedia education and after cerebral angiography via Spielberger State Anxiety Inventory. Moreover, participants' physiological parameters were measured and documented in a data sheet before and every two hours after angiography up to their discharge from the angiography unit. The independent-sample *t*, Chi-square, and McNemar's tests and the Generalized Estimation Equation were used for data analysis.

Results: After the intervention, 95.5% of patients in the intervention group and 86.4% in the control group had low level of anxiety; however, the between-group difference was not statistically significant (P > 0.05). Moreover, anxiety level changed significantly neither in the intervention (P > 0.05) nor in the control (P > 0.05) group. In addition, after adjusting the effects of participants' age, there were no significant between-group differences respecting the means of systolic blood pressure, the means of body temperature, peripheral oxygen saturation, and respiratory rate. However, the means of diastolic blood pressure and heart rate in the intervention group were significantly lower than the control group, irrespective of the effects of participants' age.

Conclusion: Multimedia education has no significant effects on state anxiety but has significant effects on diastolic blood pressure and heart rate among patients with cerebral angiography.

Introduction

Cerebral angiography is a standard invasive surveillance and diagnostic procedure with great sensitivity. It is commonly used for the diagnosis of a wide range of cerebral problems including cerebral artery stenosis, cerebral aneurysm, cerebral arteriovenous malformations, intracerebral hemorrhage, subarachnoid hemorrhage, ischemic stroke, and brain tumors (1).

Invasive procedures are associated with different levels of anxiety for patients. Previous studies reported varying levels of anxiety among patients with cerebral angiography (2) and cardiac catheterization (3). The major factors behind such anxiety

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are unfamiliarity with healthcare providers, healthcare settings, medical equipment, and diagnostic procedures as well as fear over the unknown (4-7).

Anxiety activates the sympathetic nervous system and thereby, causes discomfort, restlessness, concern, panic, perspiration, alterations in vital signs, palpitation, tremor, dyspnea, chest pain, stomach pain, and hypertension (8-10). It can also negatively affect patients' collaboration with healthcare providers during procedures, increase the duration of procedures, cause difficulties in the implementation of procedures (9, 10), and eventually make patients refrain from undergoing the procedures (6,11).

There are a wide variety of pharmacological therapies for anxiety management. However, these therapies not only have short-term therapeutic effects, but also are associated with different side effects (10). Thus, non-pharmacological therapies for anxiety management have recently attracted considerable attention (12). The common non-pharmacological therapies for anxiety are relaxation techniques, music, and patient education (9, 10, 13).

Education, either verbal, written, or multimedia-assisted, is among the most commonly used for anxiety management (9, 11, 14). Multimedia education incorporates different methods of education, including education through written materials, pictures, voice, and video. Accordingly, it enhances the clarity of educations, makes educational materials simpler and more attractive, broadens patients' understanding, improves learning retention, promotes patients' participation in learning, provides them with feedbacks, and facilitates learning (14, 15). Previous studies evaluated the effects of different types of education on anxiety and physiological status among patients undergoing cataract surgery (15), chemotherapy (16), cardiac surgery (17), and cardiac catheterization (18-20). However, there is a paucity of studies into the effects of non-pharmacological therapies on anxiety among patients with cerebrovascular angiography.

Moreover, two earlier studies in this area reported that music (21) and information provision (2) had no significant effects on anxiety. Therefore, previous studies recommended further investigations into the effects of different types of education on anxiety among patients who undergo invasive procedures (15, 18). This study aimed to evaluate the effects of multimedia education on anxiety and physiological status among patients with cerebral angiography.

Methods

Design

This randomized controlled clinical trial was conducted from October 2017 to January 2018.

Participants and setting

This study was conducted in the twelve-bed angiography unit of a university hospital in Tehran, Iran.

This study was approved by the Research Ethics Boards in July 30, 2017, at the Tehran University of Medical Sciences, Tehran, Iran (approval code: IR.TUMS.FNM.REC.1396.2995). This clinical trial was registered in 2017 in the Iranian Registry of Clinical Trials (registration code: IRCT2017080335479N1).

Patients were hospitalized in this unit for at most fourteen hours before angiography to receive pre- and post-angiography care. Eligibility criteria were an age of at least sixteen years, non-emergency cerebral angiography for the first time, ability to speak, read, and write in Persian, no previous history of intravascular catheterization, no employment in healthcare settings, no familiarity with cerebral angiography, no use of psychoactive, anxiolytic, steroid, or opioid medications, and no affliction by cognitive, hearing, or auditory disorders, chronic diseases, life-threatening conditions, and the disorders of the thyroid, adrenal, or pituitary glands. Eligibility criteria were assessed based on the data retrieved from participants or their medical records. Participants were

excluded if they received sedative agents during angiography, voluntarily withdrew from the study, or experienced serious complications such as intracerebral hemorrhage or death during angiography.

Intervention

Participants were randomly assigned to a control or an intervention group. Study intervention was a multimedia education program. Patients in the intervention group were admitted to hospital at 07:00–08:00 and received bedside multimedia education at 08:00–10:00. The multimedia education program lasted at least thirty minutes and consisted of video-based education, verbal education, written materials (an educational booklet), and question and answer. The educational video contained information about cerebral blood vessels, the necessity of cerebral angiography, the process and the steps of the procedure, pre-, intra-, and post-angiography preparations and care, and post-discharge care. The content of the video was developed based on the textbooks and the standards for cerebral angiography while the video was created using the Adobe Premiere software. The video was played for each participant using a 20 inch laptop. The educational booklet contained a summary of the materials of the video. The same content was also verbally provided to participants. Before the intervention, the content validity of the educational video and booklet was assessed and confirmed by ten neurologists and nursing faculty members. Patients in the control group just received the routine care services of the angiography unit which were also similarly provided to patients in the intervention group. The study intervention was implemented by the fourth author.

Randomization

To prevent information leakage, the weeks of the sampling period were allocated either to the intervention or the control groups. All eligible cerebral angiography candidates who were admitted to the study setting during the intervention weeks were allocated to the intervention group, while all eligible patients who were admitted during the control weeks were allocated to the control group (Table 1).

Table 1. Week allocation to the intervention or the control treatments

Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Group	**Control**	**Intervention**	**Control**	**Intervention**	**Control**	**Intervention**	**Intervention**	**Intervention**	**Control**	**Control**	**Intervention**	**Control**
Total admissions	34	39	24	10	25	—	30	25	—	14	41	50
Recruited	7	12	6	2	9	—	7	8	—	4	15	18

Allocation sequence was generated by the third author and announced to the forth author at the end of each week during the study.

In other words, the fourth author, who implemented the intervention, was unaware of the allocation of each week until a day before. Sampling was continued until 44 participants were recruited to each study group.

Outcomes and data collection

The primary outcomes of the study were anxiety and physiological parameters. Initially, at the time of admission to the angiography unit, data on participants'

personal characteristics (namely age, gender, marital and employment status, educational level, cigarette smoking, history of serious diseases, and history of hospitalization) were collected based on their self-report or medical records. Anxiety was measured using Spielberger State Anxiety Inventory (STAI). This part of STAI assesses state anxiety, which is a transient emotional state experienced in stressful conditions such as an imminent surgery or invasive procedure. The STAI includes twenty items scored from 1 (no anxiety) to 4 (considerable anxiety). Thus, the total score of the inventory may range from 20 to 80. An earlier study reported that the alpha coefficients value of the inventory varies from 0.83 to 0.94(22).

This inventory was completed for each participant once before multimedia education and once after cerebral angiography. Physiological parameters were measured before multimedia education, before angiography, and every two hours after angiography up to patient discharge from the angiography unit. These parameters included systolic blood pressures (SBP) and diastolic blood pressures (DBP), heart rate (HR), respiratory rate (RR), body temperature (BT), and peripheral oxygen saturation (SpO2). Bedside vital signs monitoring systems were used for physiological status assessment. The accurate functioning of each system was assessed and approved by the medical engineering unit of the study setting. Moreover, we compared the functioning of the systems with each other to ensure their accuracy.

Sample size calculation and statistical analysis

Based on the effect size calculation method introduced by Cohen (23) and with a large effects size of 0.70, sample size was determined to be 44 per group.

The independent-sample *t* test was conducted to compare the groups with each other respecting participants' age, SBP, DBP, BT, and SpO2, while the Chi-square test was used to compare the groups respecting participants' gender, marital status, educational level, cigarette smoking, hospitalization history, pretest and posttest anxiety, HR and RR. Within-group comparisons respecting anxiety were also performed via McNamara's test. As the length of patient hospital stay after angiography varied from eight to fourteen hours, we were unable to monitor all patients' physiological parameters up to fourteen hours after angiography. Thus, we used the Generalized Estimation Equation in order to simultaneously evaluate the effects of group and time on the outcome variables. All analyses were performed at a significance level of less than 0.05.

Results

Participants' flow

During the twelve-week course of the study, 292 patients were admitted to the study setting for cerebral angiography—147 patients in the control weeks and 145 in the intervention weeks. However, 204 patients were ineligible for the study. All of the remaining 88 patients were included in the study and all of them completed the study (Figure 1).

Baseline data

The groups did not significantly differ from each other respecting participants' baseline personal characteristics, anxiety level, and physiological parameters ($P > 0.05$), except for their age ($P < 0.001$; Table 2).

Main outcomes

The number of patients with low anxiety level in the control and the intervention groups increased from respectively 33 (75%) and 37 (84.1%) at pretest to 38 (86.4%) and 42 (95.5%) at

posttest. However, none of the increases was statistically significant (P > 0.05). The between-group differences respecting anxiety level were also insignificant both at pretest and posttest (Table 3).

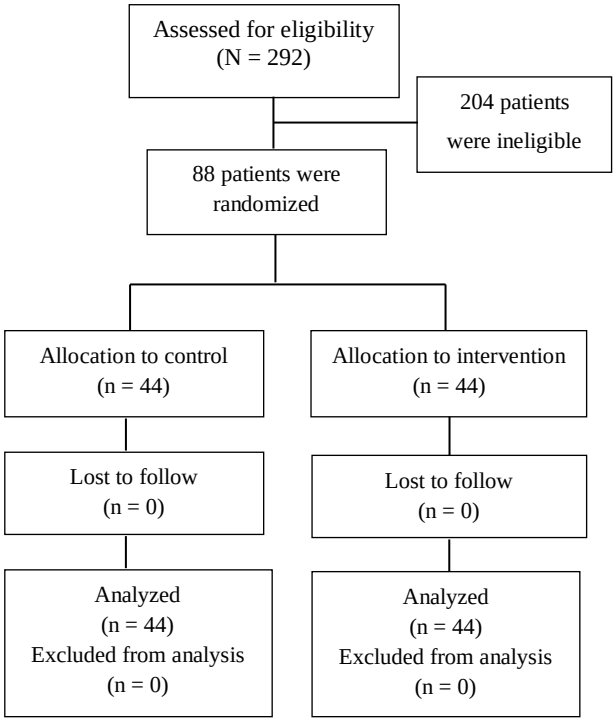

Figure 1. Flow diagram of the study

SBP in the intervention group was by 4.21 points less than the control group, though the difference was not statistically significant. One point increase in measurement time (i.e. two hours) was associated with a 0.44-point statistically insignificant decrease in SBP in the intervention group. Each one point increase in participants' age was associated with a 0.25-point statistically significant increase in SBP (Table 4).

DBP in the intervention group was significantly less than the control group by 3.87 points. One point increase in measurement time (i.e. two hours) was associated with a 0.87-point statistically significant decrease in DBP in the intervention group. Moreover, each one year increase in participants' age was associated with a 0.21-point statistically significant increase in DBP (Table 4).

The mean of BT in the intervention group was insignificantly greater than the control group by 0.18 point.

One point increase in measurement time (i.e. two hours) was associated with a 0.01-point decrease in BT, though the difference was not statistically significant. Each one point increase in participants' age was not associated with any significant change in BT (Table 4).

The mean of SpO2 in the intervention group was significantly greater than the control group by 0.71 point. One point increase in measurement time (i.e. two hours) was associated with a 0.13-point insignificant decrease in the mean score of oxygen saturation in the intervention group, with no statistically significant between-group difference. In addition, each one point increase in participants' age was associated with no significant change in oxygen saturation in the intervention group (Table 4).

The mean of HR in the intervention group was insignificantly greater than the control group by 1.24 points. One point increase in measurement time (i.e. two hours) was associated with a 0.79-point decrease in hear rate in the intervention group.

The between-group difference was statistically significant. Each one point increase in participants' age was also associated with a 0.07-point insignificant increase in HR (Table 4).

RR in the intervention group was insignificantly less than the control group by 0.76 point. One point increase in measurement time (i.e. two hours) was associated with a 0.09-point increase in RR, though the between-group difference was not statistically significant. Besides, each one point increase in participants' age was associated with a 0.02-point insignificant decrease in RR (Table 4).

Table 2. Between-group comparisons respecting participants' baseline characteristics and physiological parameters

Characteristics	Groups	Intervention (N = 44)	Control (N = 44)	P value
Age (Years)*		48.18±17.28	35.23±11.47	< 0.001
Gender	Male	25 (56.8)	26 (59.1)	0.829
	Female	19 (43.2)	18 (40.9)	
Marital status	Single	8(18.2)	17(38.6)	0.116
	Married	35(79.5)	25(56.8)	
Educational level	University	7(15.9)	24(54.5)	0.222
	Diploma	23(52.3)	15(34.1)	
	Below diploma	14(31.8)	5(11.4)	
Smoking	Yes	14(31.8)	9 (20.5)	0.225
	No	30 (68.2)	35 (79.5)	
Employment status	Employed	17(38.7)	15(56.8)	0.222
	Unemployed	27(61.3)	19(43.2)	
Disease history	Yes	27(61.4)	24(54.5)	0.517
	No	17 (38.6)	20(45.5)	
Hospitalization history	Yes	19(43.2)	15(34.1)	0.381
	No	25(56.8)	29(65.9)	
Baseline Anxiety	Low	37(84.1)	33(75)	0.29
	High	7(15.9)	11(25)	
SBP (mm Hg)*		128.18(17.76)	123.34(14.39)	0.164
DBP (mm Hg)*		80.2(12.64)	76.95(10.06)	0.186
BT (°C)*		37.12(0.20)	37.10(0.16)	0.649
HR	≤ 80	19(43.2)	26(59.1)	0.135
	≥ 81	25(56.8)	18(40.9)	
RR	12–17	17(38.6)	15(34.1)	0.658
	18–25	27(61.4)	29(65.9)	
SPO_2 (%)*		98.11±2.12	98.11±1.26	1

Table 3. Between- and within-group comparisons respecting anxiety level

Time	Group / Anxiety	Intervention N (%)	Control N (%)	P value*
Before	**Low**	37 (84.1)	33 (75)	P = 0.29
	High	7 (15.9)	11 (25)	
After	**Low**	42 (95.5)	38 (86.4)	P = 0.266
	High	2 (4.5)	6 (13.6)	
P value^		P = 0.125	P = 0.18	—

^: The results of McNemar's test; *: The results of the Chi-square test

Discussion

This randomized controlled clinical trial aimed to evaluate the effects of multimedia education on anxiety and physiological status among patients with cerebral angiography.

Findings revealed no significant reduction in the level of participants' anxiety after the intervention. This finding may be due to the low power of the study due to its sample size calculation with a large effect size. Despite the significant difference between the groups respecting participants' age, there were no between-group significant differences respecting participants' SBP, RR, BT, and oxygen saturation. Thus, it is unknown whether multimedia education can be beneficial for the management of procedural anxiety among the candidates for cerebral angiography.

Table 4. Estimation of the Generalized Estimation Equation parameters for physiological parameters in both groups

Physiological parameters		The Generalized Estimation Equation parameters				
		Coefficient	Mean difference	95% confidence interval		P value
SBP (mm Hg)	Intercept	118.87	3.65	111.72	126.02	< 0.000
	Intervention to control	–4.21	2.70	–9.51	1.08	0.119
	Time	–0.44	0.34	–1.11	0.23	0.200
	Age	0.25	0.10	0.06	0.44	0.009
DBP (mm Hg)	Intercept	72.33	2.59	67.26	77.39	< 0.000
	Intervention to control	–3.87	1.67	–7.14	–0.61	0.020
	Time	–0.87	0.35	–1.54	–0.19	0.012
	Age	0.21	0.07	0.07	0.35	0.004
BT (°C)	Intercept	36.87	0.27	36.34	37.39	< 0.001
	Intervention to control	0.18	0.16	–0.14	0.49	0.266
	Time	–0.01	0.02	–0.04	0.02	0.668
	Age	0.00	0.00	0.00	0.01	0.464
HR	Intercept	77.88	2.79	72.41	83.35	< 0.001
	Intervention to control	1.24	2.31	–3.27	5.76	0.590
	Time	–0.79	0.30	–1.38	–0.21	0.008
	Age	0.07	0.06	–0.06	0.20	0.270
RR	Intercept	19.13	0.83	17.52	20.75	< 0.001
	Intervention to control	–0.76	0.62	–1.98	0.45	0.218
	Time	0.09	0.12	–0.15	0.33	0.458
	Age	–0.02	0.02	–0.05	0.02	0.310
SPO_2 (%)	Intercept	97.69	0.44	96.82	98.56	< 0.001
	Intervention to control	0.71	0.26	0.19	1.23	0.007
	Time	–0.13	0.08	–0.29	0.03	0.101
	Age	0.00	0.01	–0.02	0.01	0.672

Strengths

Although this study was conducted in a single center, the design of the study prevented the leakage of information from participants in the intervention group to their counterparts in the control group.

Limitations

This study was conducted only in a single angiography unit and with a large effect size.

Comparison to the existing literature

Findings revealed that although anxiety level decreased in both groups, the decreases were not statistically significant. Moreover, although the amount of decrease in anxiety level in the intervention group was greater than the control group, the difference was not statistically significant. Previous studies reported contradictory results respecting the effects of multimedia and video-based educations. Some studies reported the significant effects of education (18), video-based education (24-25), and multimedia education (7-26) on anxiety among patients who had undergone invasive procedures, while some other studies reported the ineffectiveness of such interventions (12,21,27). The insignificant decrease in state anxiety level in both groups of the present study after cerebral angiography is attributable to the removal of the stressor, i.e. cerebral angiography.

State anxiety happens due to a stressful situation and is alleviated after the situation does not exist. Moreover, waiting for an invasive procedure is associated with stress and hence, after the situation, the waiting anxiety is alleviated (3, 28). Other reasons

behind anxiety reduction after angiography may be patients' feelings of care and control as well as their improved confidence in healthcare provider (3).

We also found that after adjusting the confounding effects of participants' age, there were no significant differences between the groups respecting BT, SpO2, RR, and SBP. However findings revealed the significant contribution of the variable of age to the insignificant difference between the groups respecting SBP. In other words, the greater SBP in the intervention group might have been due to the significantly greater mean age in that group.

Other findings of the present study were the significantly lower DBP and HR in the intervention group compared with the control group irrespective of the effects of participants' age during the time. these findings denote the effectiveness of multimedia education in significantly lowering DBP and HR among patients with cerebral angiography. The results of previous studies regarding the effects of educational interventions on physiological status are contradictory, so that some studies reported their effectiveness in lowering blood pressure, HR (20), mean arterial pressure, and SpO2 (29), while a study reported the ineffectiveness of such interventions in improving physiological status (18).

One factor behind the insignificant effects of our multimedia education intervention on anxiety and some physiological parameters may be its relatively short course.

Our intervention was implemented at patient bedside and during a short period of time, i.e. around thirty minutes. Previous studies that reported the significant effects of education on anxiety and physiological status had provided education in a private room equipped for holding educational sessions (18, 26) or had provided education through the peer-facilitated technique (25). Other factors which can contribute to the effects of education on procedural anxiety include the procedure environment, healthcare providers' conduct, and post-procedure pain and discomfort (3).

This study evaluated anxiety before the educational intervention and after cerebral angiography. Future studies into the effects of multimedia education on anxiety are recommended to evaluate anxiety at different time points, including immediately after the intervention and before and after the procedure. The present study was done on a small sample of patients recruited from a single angiography unit. Moreover, the duration of the study intervention was around thirty minutes. Thus, multicenter studies are necessary to assess the effects of longer educational interventions on larger samples of patients.

Our intervention was not effective in reducing procedural anxiety. Therefore, interdisciplinary approach to education is recommended to improve the effectiveness of education. Besides, studies are needed to evaluate the effects of multimedia education, environmental factors, and interpersonal relationships between patients and healthcare providers on procedural anxiety.

Conclusion

This randomized controlled clinical trial showed the insignificant effects of multimedia education on anxiety and physiological status among patients with cerebral angiography. Further studies on larger samples of patients recruited from different healthcare settings are recommended to provide firmer evidence.

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Conflict of interests

The authors declare that they have no competing interests.

Author contributions

LS and SV conceived the trial, contributed to its design, made necessary arrangements, and helped draft the manuscript. EF contributed to the design of the study, developed its methods, and performed statistical data analysis. ZA also contributed to the design of the study, interpretation of the results, and drafting of the manuscript. All authors read and approved the final manuscript.

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