Effects of Biofeedback-Assisted Relaxation on Preeclampsia

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ABSTRACT

This study was performed to examine the effect of biofeedback-assisted relaxation on preeclampsia. Thirty five preeclamptic women from the Inpatient Obstetrics Department at Kasr Aini Hospital were participated in this study. They were divided randomly into two groups, (Group I) included 20 preeclamptic women whom had been treated with relaxation training in the form of autogenic training assisted by galvanic skin response biofeedback device and antihypertensive drug (Methyledopa) for 6 weeks (3 sessions per week) and (Group II) which included 15 preeclamptic women whom had been treated with the antihypertensive drug (Methyldopa) only. Evaluations of all women in both groups (I & II) were done before and after the end of treatment period (6 weeks) through measuring the systolic and diastolic blood pressures (SBP & DBP), heart rate (HR), proteinuria and the daily doses of antihypertensive drug used. The results of the study revealed that; in Group I (Relaxation group) the SBP, DBP, HR, proteinuria and the daily antihypertensive drug doses showed a statistically highly significant reduction ($P<0.001$) while, for Group II (control group) the SBP, DBP, HR and proteinuria showed a statistically significant reduction ($P<0.05$) whereas, the daily antihypertensive drug doses showed a statistically significant increase ($P<0.01$). So, it can be concluded that biofeedback-assisted relaxation can be used as an effective complementary treatment for pre-eclamptic women.

Key words: *Biofeedback-assisted relaxation, preeclampsia, blood pressure, proteinuria, antihypertensive drug.*

INTRODUCTION

Hypertensive disorders are the most common medical complications of pregnancy[4]. Hypertension in pregnancy is associated with increased maternal and foetal mortality. The most common complications occur to the mother are eclampsia, accidental haemorrhage and acute left ventricular failure with pulmonary edema, while the most common foetal complications include intrauterine growth retardation (IUGR), prematurity, acute and chronic foetal distress[5].

About 13% of all maternal deaths are due to hypertensive disorders of pregnancy particularly eclampsia[7]. The most dependable warning sign in pre-eclampsia (PE) is the increase in blood pressure for at least 140/90 mmHg or an increase of 30 mmHg systolic or 15 mmHg diastolic over baseline values on two occasions at least six or more hours apart[20].

Antihypertensive drugs were found to increase uterine muscle tone causing IUGR which resulted in neonatal respiratory depression, bradycardia and hypoglycemia[26]. Additionally, they cause maternal lethargy, drowsiness, depression, headaches, palpitation, tachycardia, drug induced hepatitis and ability to cause a rapid fall in blood pressure[22].

So, interest has increased not only in drug treatment but also, in non-pharmacological approaches[9]. One of the non-pharmacological approaches used for the treatment of hypertension is relaxation

therapy, which involves teaching the patient to accomplish a state of both muscular and mental deactivation[14]. The use of relaxation is associated with equivalent reduction in blood pressure, respiratory rate, heart rate, oxygen consumption, carbon dioxide elimination, minute ventilation and cardiac output (C.O.P.)[19].

One of the methods of relaxation is the autogenic training (AT) which helps the subject to gain relaxation and encouraging her to think in a certain way in which a particular phrases are learned with repetition that results in physical changes. Learning is progressive and should be supervised by a trained practitioner to gain effective change until it is practiced alone[15]. AT is thought to exert a direct influence on autonomic nervous system, reducing levels of physiological arousal through re-establishing a balance between the sympathetic and parasympathetic nervous system[13].

Biofeedback is defined as a group of non-pharmacological therapeutic procedures that use electronic instruments to measure process and provide information to patients regarding their neuromuscular and autonomic nervous system activity in the form of analogue and visual as well as auditory signals. A recent technical improvement in blood pressure monitoring and data processing makes biofeedback more reliable and comfortable to apply for the treatment of hypertension[24].

The interaction between biofeedback and relaxation techniques seems to be important, since it is known that relaxation itself has beneficial effects on lowering blood pressure in hypertensive patients[8] and according to the relaxation theory of Benson et al. (1974)[3] the generation of the integrated relaxation response, works when the subject focuses on a mental device like a sound at an object and returns to the focus when interrupting thoughts occur. Thus, it is possible that biofeedback effects can be attributed to this general relaxation response and strengthened by relaxation training.

So this study was conducted to investigate the influence of biofeedback-assisted relaxation in the form of autogenic training (AT) assisted by Galvanic skin response (GSR) Biofeedback in the management of pre-eclampsia (PE).

SUBJECTS, MATERIALS AND METHODS

Subjects

This study was carried out on thirty-five mild preeclamptic patients from the Inpatient Department of Obstetrics at Kasr Aini Hospital. Their age ranged from 25-35 years old, their gestational age was exceeding 20 weeks' gestation and their body mass index (BMI) did not exceed 35 kg/m^2.

A pre-test post-test (2X2) design was used in this study. The preeclamptic women were randomly assigned into two groups as follow:

Group (I) (Relaxation group): They were given relaxation training in the form of autogenic training assisted by Galvanic skin response (GSR) biofeedback device (3 sessions per week for 6 weeks) plus their regular antihypertensie drug.

Group (II) (Control group): They were given only the same regular antihypertensive drug as in group (I).

The antihypertensive drug which was given for both groups (I) and (II) all through the study period (6 weeks) was Methyldopa.

Informed consent form were signed by each subject before starting the treatment.

Instrumentation

1- Mercury sphygmomanometer and stethoscope were used to measure the arterial blood pressure for each preeclamptic woman in this study.
2- Pulsimeter (Tunturi TPM 400 DC.6V) was used to measure pulse rate for each preeclamptic woman in this study.
3- Weight-height scale was used to measure the body weight and height for each preeclamptic woman in this study.
4- Ultrasonographic machine was used to detect and calculate the gestational age of each preeclamptic woman as well as to exclude any congenital anomalies before starting of this study.
5- Galvanic Skin Response (GSR) Biofeedback Device was used for biofeedback assisted relaxation training in group (I), it is a small, handheld and self-contained GSR monitoring device for biofeedback training. The device precisely monitors stress levels by translating tiny tension-related changes in skin pores. The device measures the increase and the decrease in the autonomic nervous system by measuring subtle changes in the moisture on the palm of the hand and feedback to the mother through a meter (Dual sensitivity meter), allowing her to learn effectively the whole body relaxation. The device included GSR monitor, body sensors for hands-free use and dual-sensitivity meter for visual feedback.

Procedures

Evaluation Procedures

1- Measurement of arterial blood pressure: In both groups (I) and (II), arterial blood pressure was measured from right arm while the preeclamptic woman was in half lying position, three trials for measurement of the blood pressure were taken then the mean was calculated before and after the end of the treatment (6 weeks).
2- Measurement of heart rate: From half lying position the ear sensor of the pulse meter was attached to the patient's ear lobe, to count the heart rate /minute for each preeclamptic woman in both groups (I) and (II) which was done before and after the end of the treatment (6 weeks).
3- Measurement of proteinuria: Each preeclamptic woman in both groups (I) and (II) was asked to collect a 24-hour urine sample after cleaning the vulva with current water in a sterilized glass bottles for measurement of protein level in urine before and after the end of the treatment (6 weeks). Samples were analyzed at Kasr Aini Hospital laboratory.
4- The doses of the drug used: The doses of antihypertensive drug (Methyldopa) in milligrams which was taken daily by each preeclamptic woman in both groups (I) and (II) was recorded before and after the end of the treatment (6 weeks) as an indicator for the improvement in the blood pressure.

Treatment Procedures

Group (I) was subjected to relaxation training in the form of AT assisted by GSR biofeedback device (3 sessions per week) for 6 weeks plus their regular antihypertensive treatment (Methyldopa), while group (II) was receiving only the same antihypertensive treatment as in group (I) all through the study period (6 weeks).

The session began with a few minutes of mental relaxation as the patient was asked to imagine herself in a lovely place that makes her relaxed. Each session included 18 exercises; each exercise was in the form of a group of phrases. Each phrase was recited by the physical therapist in a slow calm and soothing tone and then repeated, mentally or vocally, by the learner while she was holding

the GSR biofeedback device with her right hand, resting her two fingers on the sensory plates as well as looking at the dual sensitivity meter to give her a visual feedback about her relaxation state. About 30 seconds was allowed for each exercise and a further 30-40 seconds was allowed for continuing attention focusing by the patient.

The repetition of relaxation-inducing phrases based on six central themes:

- Heaviness in the arms and legs.
- Warmth in arms and legs.
- Calm and regular heartbeats, calm breathing, warm solar plexus.
- Cool forehead.

Data Analysis

The data of this study was statistically analyzed by using the descriptive statistics including the mean, standard deviation (SD) and percentage and t-test for the comparison between before and after the treatment and also between the two groups. Alpha level at (0.05) was used for significance.

RESULTS

The results of the study revealed that; in Group I (Relaxation group) the systolic blood pressure, diastolic blood pressure, heart rate, proteinuria and the daily antihypertensive drug doses showed a statistically highly significant reduction ($P<0.001$) while, for Group II (control group) the systolic blood pressure, diastolic blood pressure, heart rate and proteinuria showed a statistically significant reduction ($P<0.05$) whereas, the daily antihypertensive drug doses showed a statistically significant increase ($P<0.01$) (Tables 1 & 2) and (Figures 1 & 2).

Comparison between group (I) and group (II) of systolic blood pressure, diastolic blood pressure, heart rate, proteinuria and daily drug doses showed a statistically non significant differences ($P>0.05$) before treatment, where after 6 weeks of treatment there was a statistically highly significant differences ($P<0.001$), ($P<0.001$), ($P<0.002$) and ($P<0.004$) respectively in systolic blood pressure, daily doses of antihypertensive drug, diastolic blood pressure and heart rate respectively while in the proteinuria, there was a statistically significant difference ($P<0.05$).

Table (1): Mean values of systolic blood pressure and diastolic blood pressure for both groups (I & II).

		Systolic blood pressure (mmHg)		Diastolic blood pressure (mmHg)	
		Before treatment	After 6 weeks of treatment	Before treatment	After 6 weeks of treatment
Group (I)	X±SD	149.5±8.09	130±2.8	103.75±6.46	90±3.62
	MD	19.5		13.75	
	% of changes	13%		13.25%	
	t-value	10.77		9.8	
	Level of significance	< 0.001		< 0.001	
Group (II)	X±SD	148.66±9.34	137.66±5.62	104.66±5.81	95.66±6.51
	MD	11		9	
	% of changes	7.4%		8.59%	
	t-value	6.2		9	
	Level of significance	< 0.01		< 0.01	

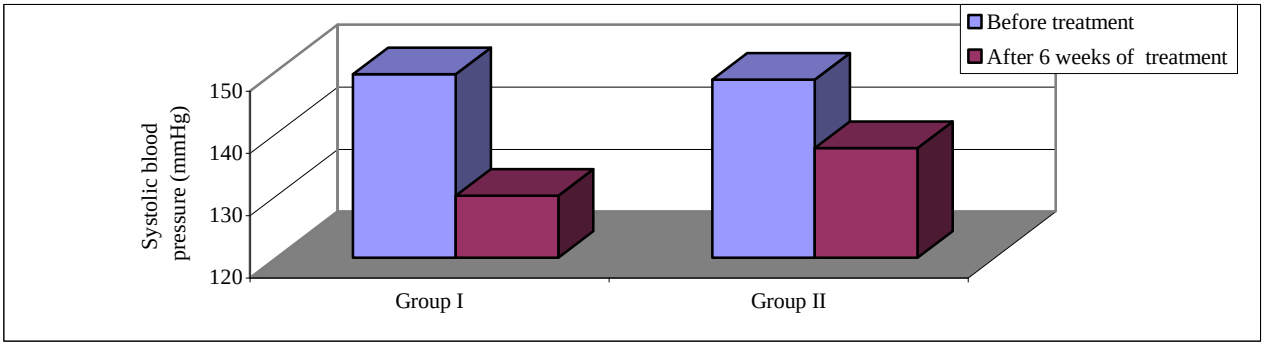

Fig.(1a): Mean values of Systolic blood pressure for both groups.

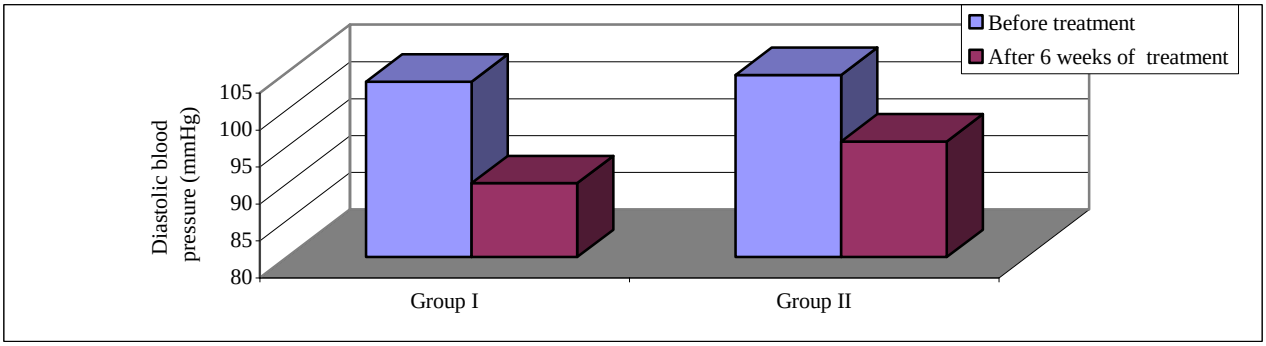

Fig.(1b) Mean values of diastolic blood pressure for both groups.

Fig. (1): Mean values of systolic and diastolic blood pressures for both groups (I &II).

Table (2): Mean values of heart rate, proteinuria and daily doses of the drug used for both groups (I & II).

			Before treatment	After 6 weeks of treatment
Heart rate (Beats/minute)	Group (I)	X±SD	94.55±8.78	83.1±4.93
		MD	11.45	
		% of changes	12 %	
		t-value	8.04	
		Level of significance	<0.001	
	Group (II)	X±SD	95.2±5.42	88.26±4.87
		MD	6.94	
		% of changes	7.28%	
		t-value	3.8	
		Level of significance	<0.02	
Proteinuria (g/24 hours)	Group (I)	X±SD	2.29±0.91	1.52±0.96
		MD	0.77	
		% of changes	33.6%	
		t-value	17.3	
		Level of significance	<0.001	
	Group (II)	X±SD	2.59±1	2.16±0.91
		MD	0.43	
		% of changes	16.6%	
		t-value	3.7	
		Level of significance	<0.02	
Daily drug doses (mg) per day	Group (I)	X±SD	1287.5±474.86	1087.5±356.1
		MD	200	
		% of changes	15.6%	
		t-value	3.1	
		Level of significance	<0.001	
	Group (II)	X±SD	1283.33±451.84	1666.66±243.97
		MD	-383.33	
		% of changes	29.86%	
		t-value	4.38	
		Level of significance	<0.01	

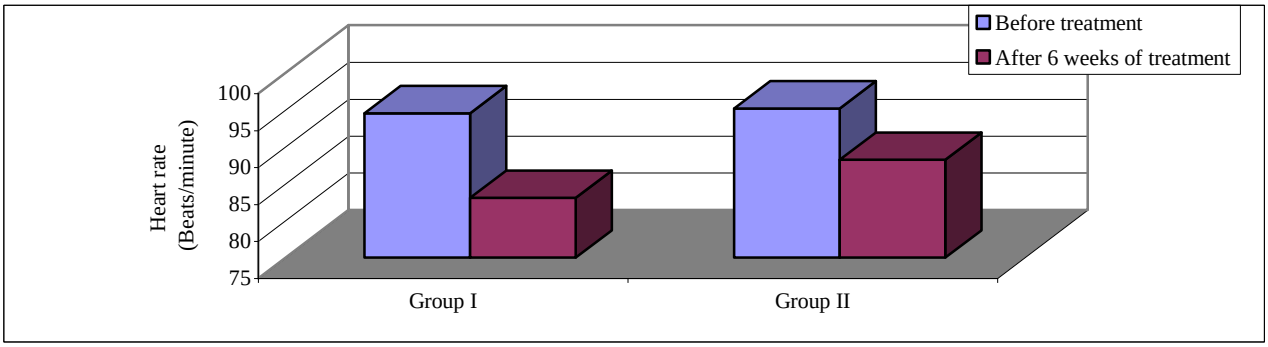

Fig. (2_a) Mean values of heart rate for both groups (I & II).

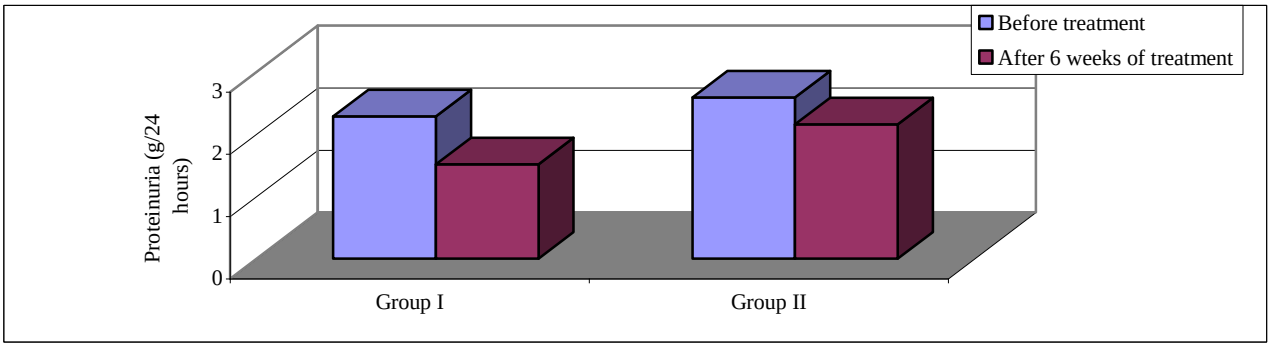

Fig. (2_b) Mean values of proteinuria for both groups (I & II).

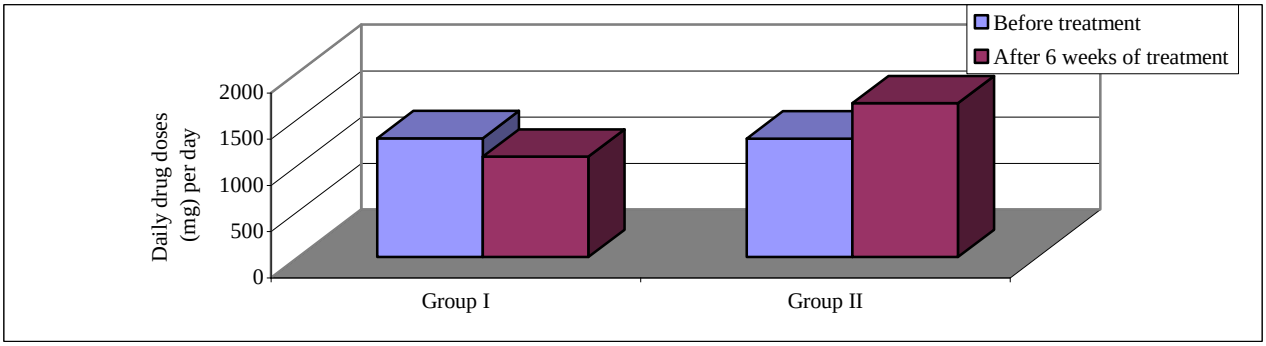

Fig. (2_c): Mean values of daily drug doses for both groups (I & II).
Fig. (2): Mean values of heart rate, proteinuria and daily doses of the drug used for both groups (I & II).

DISCUSSION

PE is considered one of the commonest causes of maternal and perinatal morbidity worldwide[16]. It also results in foetal growth retardation, premature delivery, perinatal asphyxia and increases maternal risk for abruptio placenta, convulsions, intra cerebral haemorrhage, hepatic and renal failure[10].

Patients with mild PE are admitted to the hospital and placed to bed rest for the duration of pregnancy in addition to the use of

hypotensive agents, which leads to pancreatitis and intestinal ileus[21]. There is still some doubt about the use of the antihypertensive drugs during pregnancy as they may adversely affect the foetal wellbeing[25].

So, there is a great need for a non-pharmacological treatment as an alternative or even complementary to the pharmacological treatment to reduce or stop the use of antihypertensive drugs. The present study was conducted to investigate the effect of biofeedback assisted relaxation on PE. Thus, thirty-five mild cases of PE after 20 weeks of gestation were selected from the Inpatient Department of Obstetrics at Kasr Aini Hospital to participate in this study and they were divided randomly into two groups Group I (Relaxation group) consisted of 20 patients and Group II (Control group) consisted of 15 patients.

Assessment of systolic and diastolic blood pressures, heart rate, proteinuria and the daily doses of the antihypertensive drug used were performed to each woman before starting and after the end of the study period (6 weeks).

Concerning the changes occurred in systolic blood pressure, in group (I) which was treated with AT assisted by GSR biofeedback and methyldopa, the mean difference in systolic blood pressure was 19.5 mmHg decrease than baseline of 149.5±8.09 mmHg which was considered statistically as a highly significant decrease ($P< 0.001$) and concerning to the changes occurred in diastolic blood pressure the mean difference was 13.75 mmHg decrease than baseline of 103.75 ±6.46 mmHg which was considered a statistical highly significant decrease ($P< 0.001$).

While in group (II) which was treated with methyldopa only and was considered as a control group, the results showed a mean difference of 11 mmHg decrease in systolic blood pressure than baseline of 148.66±9.34 mmHg which was considered a statistical significant decrease ($P<0.01$). Concerning the changes occurred in diastolic blood pressure the mean difference was 9 mmHg decrease than baseline of 104.66 ±5.81 mmHg which was considered statistically as a significant decrease ($P< 0.01$).

This results confirmed with Youssef et al. (1999)[27] who determined that relaxation in the form of Mitchell's simple physiological relaxation technique was effective in treating mild hypertensive pregnant women who continued receiving their antihypertensive drug (Methyldopa) all through the study. They reported a statistical significant decrease in systolic and diastolic blood pressures which equals a reduction of 14.3 % and 7.85 % respectively between before and after four weeks of treatment.

Also this results come in agreement with the study of Nashed, (2000)[17] which stated that there was a highly significant reductions in systolic and diastolic blood pressures in pregnant women with mild PE who received relaxation in the form of breathing exercise plus methyldopa.

Accordingly, have proved the efficacy of relaxation techniques on reducing hypertension (systolic and diastolic blood pressures), heart rate and respiratory rate especially if it's accompanied by a biofeedback method that helps the patient in more motivation, relaxation and greater reduction in the blood pressure[1,23,24].

The results of this study come in agreement with studies performed by Paran et al. (1996)[18] and Golubev et al. (1998)[11] as they used the biofeedback-assisted relaxation for the treatment of hypertensive patients and reported a significant reduction in blood pressure.

The effect of biofeedback-assisted relaxation in reducing blood pressure could be

attributed to lowering in the sympathetic responsiveness of the hypothalamus which was expected to lower the blood pressure. Profound relaxation of the skeletal muscles obtained by relaxation techniques would elicit relaxation response as it was proposed that the release of tension in the skeletal musculature had an effect for calming the mind, increasing peripheral blood flow, lowering heart rate and blood pressure and leads to slower and deeper breathing. Also relaxation response countered the effects of sympathetic activity by promoting the action of parasympathetic nervous system, thereby exploiting the reciprocal nature of the two parts of the autonomic nervous system, the sympathetic nervous system is one of the controlling factors of renin angiotensin aldosterone system which is one of the regulators of the blood pressure. When there is lowering in the sympathetic activity, there is a reduction in plasma renin activity and aldosterone concentration and this leads to lowering in blood pressure[2,6].

Concerning heart rate, the results of this study showed a highly significant decrease (P<0.001), with 11.45 beats/minute less than baseline of 94.55±8.78 beats/minute in group (I), while in group (II) the results showed a significant decrease (P <0.02), with 6.94 beats/minute less than baseline of 95.2±5.42 beats/minute.

So, the decrease in heart rate after practicing biofeedback-assisted relaxation technique in this study was in agreement with the results of Salt and Kerr, (1997)[23], who reported a significant reduction in heart rate after using relaxation training in the treatment of hypertensive patients. The results also agree with the results of Youssef et al. (1999)[27] and Nashed, (2000)[17] in which the different relaxation techniques resulted in a highly significant reduction in heart rate in preeclamptic women. However, the decrease in heart rate could be attributed to the effect of relaxation in promoting parasympathetic action.

In the present study, the level of proteinuria in group (I) showed a highly significant decrease (P<0.001), with 0.77 g/24 hours less than baseline of 2.29±0.91 g/24 hours, while in group (II) it showed a significant decrease (P<0.02), with 0.43 g/24 hours less than baseline of 2.59±1 g/ 24 hours.

These results agree with the results of Youssef et al. (1999)[27] and Nashed, (2000)[17] in which different relaxation techniques resulted in highly significant reduction in the level of proteinuria in preeclamptic women.

This decrease may be attributed to the relation between the blood pressure and proteinuria in PE (Halligan et al., 1997)[12], the obvious decline of proteinuria in group (I) could be attributed to the very highly significant decrease that occurred in systolic blood pressure and diastolic blood pressures in this group.

Concerning the daily doses of the antihypertensie drug used, it was found that the results of this study showed a statistically highly significant decrease (P <0.001) in group (I), with 200 mg less than baseline of 1287.5 ±474.86 mg/day, while in group (II) the results showed a statistically significant increase (P <0.01) with 383.33 mg more than baseline of 1283.33±451.84 mg/day.

So, the decrease in drug doses after practicing biofeedback-assisted relaxation technique in this study was in agreement with the results of Paran et al. (1996)[18] and Golubev et al. (1998)[11].

Finally, in this study biofeedback-assisted relaxation showed a statistically highly significant reduction in systolic and diastolic blood pressures, heart rate and daily

drug doses also it showed a statistically significant reduction in proteinuria level.

So that, biofeedback-assisted relaxation seemed to be an effective method in treating preeclamptic patients.

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الملخص العربي

تأثير الاسترخاء المساعد بالتغذية الرجعية الحيوية في حالات تسمم الحمل

الهدف من الدراسة هو معرفة تأثير الاسترخاء المساعد بالتغذية الرجعية الحيوية في حالات تسمم الحمل ، أجريت هذه الدراسة على خمسة وثلاثون مريضة تم اختيارهن من مستشفي قصر عيني وقد تم تقسيمهن عشوائياً إلى مجموعتين ، مجموعة (١) مكونه من (٢٠) مريضة قد تم علاجهن بتدريبات الاسترخاء المساعد بالتغذية الرجعية الحيوية بالإضافة إلى دواء "ميثيل دوبا" ، ومجموعة (٢) المكونة من (١٥) مريضة قد تم علاجهن بدواء "ميثيل دوبا" فقط . وقد تم التقييم لجميع الحالات في المجموعتين بواسطة قياس ضغط الدم، معدل ضربات القلب ، مستوي الزلال في البول وجرعة الدواء اليومي المستخدم "ميثيل دوبا" قبل وبعد ا لانتهاء من برنامج العلاج (٦أسابيع) . وقد أثبتت النتائج الآتـي : بالنسبة للمجموعة (١) (مجموعة الاسترخاء) هناك انخفاض ذو دلاله معنوية عالية فـ ي ضغط الدم الإنبساطى والانقباضي ، معدل ضربات القلب ، مستوى الزلال فـ ي البول و جرعه الدواء اليوم ي المستخدم . أما بالنسبة للمجموعة (٢) (مجموعة ضابطة) أثبتت النتائج انخفاض ذو دلاله معنوية في ضغط الدم الانبساطي والانقباضي ، معدل ضربات القلب ومستوى الزلال فـ ي البول و زيادة ذات دلاله معنوية في جرعه الدواء اليومي المستخدم . وقد أظهر ضغط الدم الانبساطي والإنقباضي ، معدل ضربات القلب ، وجرعه الدواء اليومي المستخدم نقص ذو دلالة معنوية عالية وأظهر مستوى الزلال فـ ي البول نقص ذو دلالة معنوية في المجموعة (١) عنه في المجموعة (٢) بعد ٦ أسابيع من العلاج . ومن هنا يمكن أن نستخلص أن الاسترخاء المساعد بالتغذية الرجعية الحيوية يمكن أن يستخدم كعلاج مساعد و فعال في علاج حالات تسمم الحمل .

كلمات دالة : الاسترخاء المساعد بالتغذية الرجعية الحيوية- تسمم الحمل- ضغط الدم - زلال البول- دواء خافض لضغط الدم المرتفع .