

# Variations of blood glucose level in non-diabetic patients before and after Electroconvulsive Therapy

M. Vatankhah<sup>1</sup> H. Jarineshin<sup>1</sup> F. Fekrat<sup>2</sup> S. Kashani<sup>1</sup> M. Malekshoar<sup>1</sup> M. Kamali<sup>2</sup> H. Zomorredian<sup>3</sup>

Assistant Professor Department of Anesthesiology<sup>1</sup>, Anesthesiologist<sup>2</sup>, General Practitioner<sup>3</sup>, Critical Care and Pain Management Research Center, Hormozgan University of Medical Sciences, Bandar Abbas, Iran.

(Received 22 Feb, 2014)

Accepted 30 Jun, 2014)

## Original Article

### Abstract

**Introduction:** Application of electroconvulsive therapy (ECT) for the induction of generalized seizure was first introduced in 1938. It is applied for disorders as severe depression particularly for cases which do not respond to drug therapy, or during pregnancy when medication is detrimental to the fetus. The debate on the effect of ECT on blood glucose level is still contradictory. However, studies show improvement of glycemic control in insulin-independent diabetes and also hyperglycemia in insulin dependent diabetes. This study was carried out to compare blood glucose level before and after ECT in patients with psychiatric disorders.

**Methods:** This descriptive cross-sectional study was conducted on patients assessed as class one and class two according to ASA physical status classification system at Ebne-sina hospital in Bandar Abbas, Iran. The study included 80 patients – suffering from psychiatric disorders including major depression, bipolar mood disorder and schizophrenia – as candidates for ECT. Blood glucose level was measured by Richter Glucometer at 10 min before and 20 min after ECT. Anesthesia was administered through intravenous injection of Atropine, Thiopental sodium and Succinylcholine. The data were analyzed by SPSS 16 statistical package using t-test and linear regression.

**Results:** There was no significant relationship between the changes of blood glucose before and after ECT in non-diabetic patients. No significant relationship was observed between the changes of blood glucose before and after ECT in non-diabetic patients based on sex. There was no significant relationship between the changes of blood glucose before and after ECT in non-diabetic patients based on type of disorder.

**Conclusion:** ECT did not affect on blood glucose level changes.

**Key words:** Electroconvulsive Therapy - Blood Glucose - Patients

**Citation:** Vatankhah M, Jarineshin H, Fekrat F, Kashani S, Malekshoar M, Kamali M, Zomorredian H. Variations of blood glucose level in non-diabetic patients before and after Electroconvulsive Therapy Iranian young population. Hormozgan Medical Journal 2014;18(6):448-453.

## Introduction:

Using Electroconvulsive Therapy (ECT) for the induction of generalized seizures was for the first time introduced in 1938. It was employed without anesthesia for almost 30 years (1). At present, the numbers of ECTs performed under anesthesia in the US exceeds the numbers of operations for coronary artery and appendectomy (2,3).

In recent years, ECT has been used for a wide range of cases including some of mental disorders such as severe depression particularly the cases which did not respond to drug therapy (4-5); pregnant women (6,7) due to the complications of the drugs; cases in which there are possibilities of hurting others and self-injury by a mental patient where necessitates the patient to get rid of the condition (4, 8-12); and for drug-resistant cases.

In acute cases, ECT is usually employed three times a week for 6 to 12 weeks. Initial clinical improvement usually occurs after 3 to 5 weeks (13). Psychiatric use ECT for a lot of mental disorders. Contrary to what public think, ECT is safe and mortality due to ECT is rare. For example, Kramer reported just 2 cases of death in 100'000 therapy from 1977 to 1983 (14). Brichello et al showed that one or more episodes of ECT increases oxidative damages to the cortex of brain while it decreases oxidative damage to hippocampus, striatum and cerebellum (15). ECT increases oxidative damage in type-II diabetic patients with no complication due to the disease (16), and also increases neurotransmitters, hormones and neuropeptides in brain (17). Moreover, thyroid stimulating hormone increases after ECT (18).

ECT increases the level of prolactin and cortisol in plasma, as well. Cortisol and norepinephrine have a role in blood glucose adjustment at the time stress though increased gluconeogenesis. However, there is still controversy over the effect of ECT on the level of plasma noradrenalin (19).

Kelly et al showed that ECT reduced the level of noradrenalin plasma in patients with melancholic depression while it increased the level of noradrenalin in patients with non-melancholic depression (20). Moreover, ECT increased the plasma level of norepinephrine (NE) and the blood pressure (21). However, another study reported that ECT reduced the plasma level of noradrenalin (22).

ECT reduces the metabolism of glucose in the frontal lobe, although the reduction is not associated with the changes in the Hamilton rating Scale for depression (6).

There is still controversy over the effect of ECT on the level of blood glucose. A study showed that ECT increased blood glucose level 20 minutes after ECT in 8 patients suffering from severe depression and diabetes type II (23). Another study on non-diabetic patients showed that ECT not only did not increase blood glucose level but also likely to reduced response to insulin (24). Furthermore, severe increased blood glucose was also reported after ECT.

Since candidates for ECT require general anesthesia and must be fasting for 8 hours prior to the procedure, stress and the afore-mentioned hormonal changes may result in blood glucose level changes. Hence, measuring blood glucose before and after ECT turns to be of high importance. The present study was conducted based on the above mentioned information as well as the contradictory reports over the potential effects of ECT on the blood glucose in patients with psychological disorders.

## Methods:

This descriptive cross-sectional study was conducted on patients assessed as class I and class II according to ASA physical status classification system at Ebne-sina hospital in Bandar Abbas, Iran in 2012. The study included 80 non-diabetic patients – suffering from psychological disorders including major depression, bipolar mood disorder and schizophrenia. They all were candidates for ECT.

All the patients were visited step-by-step and based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) by a psychiatrist and then enrolled for the study.

Patients with hypothyroidism, hyperthyroidism, epilepsy, diabetes and severe cardiovascular diseases were excluded from study.

For all patients, routine laboratory tests of blood and urine as well as ECG were taken before ECT.

Informed patient consent was obtained from all participants. The consent for the patients suffered from schizophrenia, psychosis and emotional

disorders with psychotic symptoms was obtained from their legal guardians.

The candidates underwent ECT using "Somatics, LLC, Lake Bluff, III" based on "Thymatron System IV" at psychiatric ward in the morning after fasting for 8 hours. The minimum time length of seizures was 20 seconds.

The blood glucose was tested using Richter glucometer 10 minutes before and 20 minutes after ECT.

Patients were anesthetized by Atropine 0.5 mg, Thiopental 3 mg/Kg of body weight and Succinylcholine 0.5 mg/Kg intravenously by an anesthesiologist. The anesthesiologist was not aware of the study. An anesthesiology staff – unaware of the study – collected blood samples for blood sugar. The data were analyzed by SPSS (version 16) using descriptive statistical testes as well as dependent t-test and linear regression.

## Results:

There were 41 (51.3%) male and 39 (48.7%) female in the study. The participating cases were suffering from the following psychological disorders: 10 (12.5%) with major depression, 52 (65%) with bipolar mood disorder and 18 (22.5%) cases with schizophrenia (Figure 1).

Mean age of the participants was  $25.8 \pm 10.3$  years old, and the average weight was  $61.3 \pm 14.9$  Kg. The average weight of patients with major depression, bipolar mood disorder and schizophrenia was  $69.3 \pm 14.8$ ,  $60.8 \pm 15$  and  $58.2 \pm 14.7$  Kg respectively. There was no significant relationship between weight and blood glucose before and after ECT.

Mean age of patients with major depression, bipolar disorder, and schizophrenia was  $34.9 \pm 10.2$ ,  $25.6 \pm 10$  and  $21 \pm 10.4$  years old, respectively. No significant relationship was observed between age and blood glucose before and after ECT.

The mean of blood glucose before and after ECT was  $88.2 \pm 13.8$  and  $86 \pm 17.9$  mg/dl, respectively. It did not show any significant relationship. The mean of blood glucose before ECT in major depression, bipolar disorder and schizophrenia was  $86 \pm 13.9$ ,  $90 \pm 14$  and  $83 \pm 13.6$  mg/dl respectively. The mean of blood glucose after ECT in major depression, bipolar disorder and schizophrenia was  $79 \pm 18$ ,  $88 \pm 17.8$  and  $84 \pm 17.9$  mg/dl respectively. No significant relationship was observed between pre and post ECT and the type of psychological disorders (Table 1).

**Table 1. The frequency of data based on the type of psychological disorder**

Disease	Major Depression	Bipolar Disorder	Schizophrenia
Female	(n=2) 20%	(n=31) 59.6%	(n=6) 33.3%
Male	(n=8) 80%	(n=21) 40.4%	(n=12) 66.7%
Average weight (Kg)	$69.3 \pm 14.8$	$60.8 \pm 15$	$58.2 \pm 14.7$
Mean age (years)	$34.9 \pm 10.2$	$25.6 \pm 10$	$21 \pm 10.4$
Mean of blood glucose before ECT (mg/dl)	$86 \pm 13.9$	$90 \pm 14$	$83 \pm 13.6$
Mean of blood glucose after ECT (mg/dl)	$79 \pm 18$	$88 \pm 17.8$	$84 \pm 17.9$

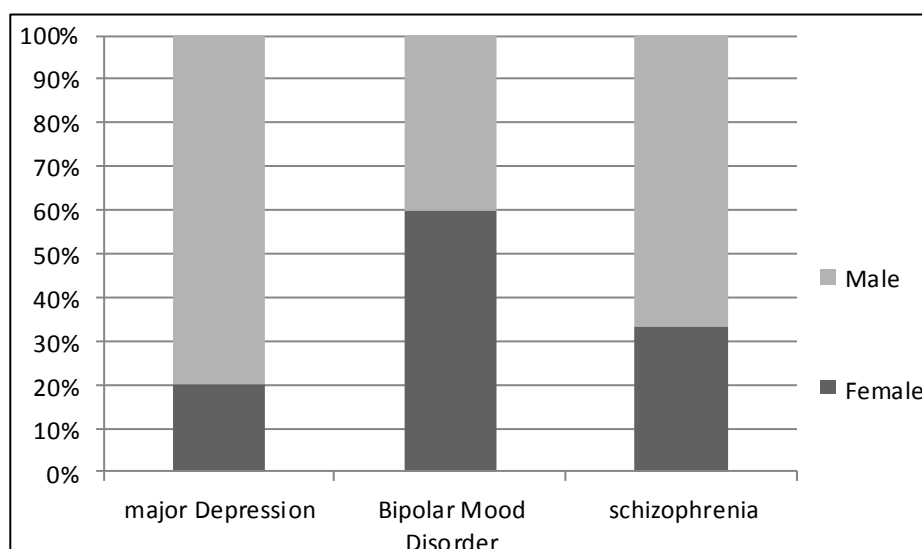


Figure 1: The sex distribution of the patients based on the type of psychological disorder

### Conclusion:

The present research compared the changes of blood glucose before and after ECT in non-diabetic patients to study the safety of ECT through measuring blood glucose using a glucometer 10 minutes before and 20 minutes after ECT. In this study no significant relationship was observed before and after ECT.

Soltani et al (2012) in a study on 70 cases whose blood glucose and serum electrolytes were compared before and after ECT reported a significant relationship between blood glucose levels before and after ECT (23).

Ghanizadeh et al reported that blood glucose and cholesterol increased significantly after ECT. It seems that the increase is independent of the psychological disorders (24). Therefore, it is different from our study.

Ramussen et al (2006) reported that there was no significant relationship and also clinical findings between the blood glucose before and 20 minutes after ECT in type II diabetic patients suffered from depression who were candidates for ECT(6). Ramussen and Rayan (2005) studied non-diabetic patients before and after ECT. They found that ECT clinically had no effect on the glucose level of non-diabetic patients (7). This finding was similar to our study.

Fakhri et al who employed ECT on 15 diabetic patients found that 8 of them had no symptoms of

diabetes after 2 episodes of ECT (9). This study is different from our study.

In our study, there was not a significant difference between men and women before and after ECT while Soltani et al reported a significant difference between men and women (23). This may be due to different sex distribution in the current study. Potential severe effects of ECT on blood glucose in patients with diabetes mellitus. This is also different from our study.

The present study showed that there are not remarkable changes of blood glucose before and after ECT. It also showed that there was no significant relationship between blood glucose before and after ECT and the type of psychological disorders. Therefore, it may be concluded that application of ECT does not have any undesirable effects on non-diabetic patients.

### References:

1. Khan A, Mirolo MH, Hughes D, Bierut L. Electroconvulsive therapy. *Psychiatr Clin North Am.* 1993;16:497-513.
2. Thompson JW, Weiner RD, My2qers CP. Use of ECT in the United States in 1975, 1980 and 1986. *Am J Psychiatry.* 1994;151:1657-1661.
3. American Psychiatric Association Committee on Electroconvulsive Therapy. The practice of electroconvulsive therapy: recommendations for treatment, training, and privileging. 2<sup>nd</sup> ed.

- Washington. DC: American Psychiatric Association Press; 2001:497-512.
4. Muller PS, Albin SM, Barnes RD, Rasmussen KG jr. Safety of Electroconvulsive therapy in patients with unrepaired abdominal aortic aneurism: report of 8 patients. *J ECT*. 2009;25:165-169.
  5. Masachetts RL, Fiore La, Peluso MA, Rignonatti SP. Safety and efficacy of ECT in mental disorders associated with epilepsy: report of 3 cases. *J ECT*. 2003;19:173-176.
  6. Ramussen KG, Rayan DA, Mueller PS. Blood Glucose before & after ECT treatments in type 2 diabetic patients. *J ECT*. 2006;2:124-126.
  7. Ramussen KG, Rayan DA. The effect of electroconvulsive therapy treatment on blood suger non diabetic patients. *J ECT*. 2005;21:23-24.
  8. Ferrill MJ, Kehoe WA, Jacisin JJ. ECT during pregnancy: physiologic and pharmacologic considerations. *Convuls Ther*. 1992;8:186-200.
  9. Fakhri O, Fadli AA, El Rawi RM. Effect of electroconvulsive therapy on diabetics mellitus. *Lancet*. 1980;2:775-777.
  10. Teh SP, Helmes E, Drake DG. A western Australian Surtvey on Public Attitudes Toward and Knowledge of Electroconvulsive therapy. *Int J Soc Psychiatry*. 2007;53:247-273.
  11. SOLOMONT EB. Shock Therapy Emerges As detail in therapist killing. New York: Christofer Futherty Press; 2008:4-13.
  12. Abrams R, Coelho P. Electroconvulsivetherapy, London: Oxford University of Press: 2002:978-982.
  13. Segman RH, Shapira B, Gorfine M, Lerer B. Onset and time course of antidepressant action: psychopharmacological implications of a controlled trial of electroconvulsive therapy. *Psychopharmacology*. 2005;119:440-448.
  14. Kramer BA. Use of ECT in California, 1977-1983. *Am J Psychiatry*. 1985;142:1190-1192.
  15. Barichello T, Bonatto F, Ayostinho FR, Reinke A, Moreira JC, Dal-Pizzol F, et al. Structure-related oxidative damage in rat brain after acute and chronic electroshock. *Neurochem Res*. 2004;29:1749-1753.
  16. Savu O, Ionescu-Tirgoviste C, Atanasiu V, Gaman L, papacocea R, Stoian I. Increase in total antioxidant capacity of plasma despite high levels of oxidative stress in uncomplicated type 2 diabetes mellitus. *J Int Med Res*. 2012;40:709-716.
  17. Wahlund B, von Rosen D. ECT of major depressed patients in relation to biological and clinical variables: a brief overview. *Neuropsychopharmacology*. 2003;28:21-26.
  18. Esel E, Kose K, Hacimusalar Y, Ozsoy S, kula M, Candan Z, Turan T. The effects of electroconvulsive therapy on GABAergic function in major depressive patients. *J ECT*. 2008;24:224-228.
  19. Mommsen TP, Vijayan MM, Thomas WM. Cortisol in teleosts: dynamics, mechanisms of action, and metabolic regulation. *Rev Fish Biol Fish*. 1999;9:211-268.
  20. Kelly CB, Cooper SJ. Plasma noradrenaline response to electroconvulsive therapy in depressive illness. *Br J Psychiat*. 1997;171:182-186.
  21. Werstiuk ES, Coote M, Griffith L, Shannon H, Steiner M. Effects of electroconvulsive therapy on peripheral adrenoceptors, plasma, noradrenaline, MHPG and cortisol in depressed patients. *Br J Psychiat*. 1996;169:758-765.
  22. Yatham LN, Clark CC, Zis AP. A preliminary study of the effects of electroconvulsive therapy on regional brain glucose metabolism in patients with major depression. *J ECT*. 2000;16:171-176.
  23. Soltani A, Maleki A, Goodarzi M. The evaluation of blood glucose and serum electrolyte changes before and after electroconvulsive therapy under gener anesthesia. *Anesthesiology and Pain Official Journal of ISRAPM*. 2011;2:4-6. [Persian]
  24. Ghanizadeh A. The effect of electroconvulsive therapy on blood glucose, creatinine levels, and lipid profile and its association with the type of psychiatric disorders. *Neurochem Int*. 2012;61:1007-1010.

## مقایسه تغییرات قند خون قبل و بعد از الکتروشوک درمانی در بیماران غیر دیابتی

مجید وطن خواه<sup>۱</sup>، هاشم جری نشین<sup>۱</sup>، فریدون فکرت<sup>۲</sup>، سعید کاشانی<sup>۱</sup>، مهرداد ملک‌الشعار<sup>۱</sup>، منوچهر کمالی<sup>۲</sup>، حمید زمردیان<sup>۳</sup>  
<sup>۱</sup> استادیار، گروه بیهوشی، <sup>۲</sup> متخصص، بیهوشی، <sup>۳</sup> پزشک عمومی، مرکز تحقیقات بیهوشی، مراقبت‌های ویژه و کنترل درد، دانشگاه علوم پزشکی هرمزگان، بندرعباس، ایران.

مجله پزشکی هرمزگان سال هجدهم شماره ششم ۹۳ صفحات ۴۵۳-۴۴۸

### چکیده

**مقدمه:** استفاده از الکتروشوک درمانی (ECT) برای تحریک صرع سراسری برای اولین بار در سال ۱۹۳۸ تعریف شد و در بیماری‌هایی نظیر افسردگی شدید به ویژه در مواردی که بیمار به دارو پاسخ مناسب نمی‌دهد یا در حاملگی که دارو برای جنین زیان‌آور است، به کار برده می‌شود. بحث در مورد تأثیر ECT بر روی سطح قندخون همچنان متفاوت و متغیر است. به طوری که بهبود کنترل قندخون در دیابت غیروابسته به انسولین و افزایش قندخون در دیابت وابسته به انسولین دیده شده است.

**روش کار:** این مطالعه توصیفی - مقطعی بر روی بیماران با کلاس یک و دو بر اساس طبقه‌بندی وضعیت فیزیکی بیماران از نظر انجمن متخصصین بیهوشی آمریکا (ASA) در بیمارستان ابن سینا بندرعباس صورت گرفت. تعداد ۸۰ بیمار با بیماری‌های روانی شامل بیماران مبتلا به اختلال افسردگی ماژور، اختلال خلقی دوقطبی و شیذوفرنیا که کاندید دریافت ECT بودند، وارد مطالعه شدند. قندخون بیماران به وسیله گلوکومتر ریشتر ۱۰ دقیقه قبل ECT و ۲۰ دقیقه بعد از دریافت ECT چک شد و بیهوشی با استفاده از آتروپین، تیوپنتال سدیم و سوکسینیل کولین تزریقی انجام شد. داده‌ها با استفاده از نرم‌افزار SPSS 16 آزمون t و رگرسیون خطی مورد تجزیه و تحلیل قرار گرفتند.

**نتایج:** بین تغییرات قندخون قبل و بعد از الکتروشوک درمانی (ECT) در بیماران غیردیابتی رابطه معنی‌داری وجود نداشت. بین تغییرات قندخون قبل و بعد از الکتروشوک درمانی (ECT) در بیماران غیردیابتی بر اساس جنس رابطه معنی‌داری وجود نداشت. بین تغییرات قندخون قبل و بعد از الکتروشوک درمانی (ECT) در بیماران غیردیابتی بر اساس نوع اختلال نیز رابطه معنی‌داری وجود نداشت.

**نتیجه‌گیری:** الکتروشوک درمانی (ECT) در تغییرات قندخون تأثیر ندارد.

**کلیدواژه‌ها:** الکتروشوک درمانی - قندخون - بیماران

نویسنده مسئول:

دکتر جری نشین

مرکز تحقیقات بیهوشی، مراقبت‌های

ویژه و کنترل درد بیمارستان

شیپیمحمدی دانشگاه علوم پزشکی

هرمزگان

بندرعباس - ایران

تلفن: ۹۱۷۳۶۱۳۴۶۴ +۹۸

پست الکترونیکی:

hjarineshin@yahoo.com

نوع مقاله: پژوهشی

دریافت مقاله: ۹۲/۱۲/۳ اصلاح نهایی: ۹۳/۳/۱۲ پذیرش مقاله: ۹۳/۴/۹

ارجاع: وطن خواه مجید، جری نشین هاشم، فکرت فریدون، کاشانی سعید، ملک‌الشعار مهرداد، کمالی منوچهر، زمردیان حمید. مقایسه تغییرات قند خون قبل و بعد از الکتروشوک درمانی در بیماران غیر دیابتی. مجله پزشکی هرمزگان ۱۳۹۳؛ ۱۸(۶): ۴۴۸-۴۴۸.