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MINIMAL REPAIR TIME, LEAD TIME AND REPAIR COST LIMIT FUNCTION OF CORTISOL IN DEPRESSED WOMEN

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ABSTRACT

Increased cortisol level is a renowned finding in patients even it is present in only 25-30% of subjects with major depression. However cortisol is secreted in a pulsatile manner ten minute sampling for cortisol is performed for 24 hr in 25 premenopausal depressed women whose age and menstrual cycle day matched control women. Pulse analyses revealed similar number of secretory bursts in patients and control. This paper is applied to Optimal time T, Minimal Repair δ and Random Lead Time g to mi minimize the cortisol level*

Key Words: Depression, Cortisol, Repair cost limit function, HPA axis

Introduction

Dysregulation of HPA axis is one of the usual findings presents in individuals suffering from major depression. The central nervous system controls a number of hormone rhythms that include pulsatile rhythms, circadian rhythms and ultradian rhythms. However cortisol is secreted in a pulsatile manner ten minute sampling for cortisol is performed for 24 hr in 25 premenopausal depressed women whose age and menstrual cycle day matched control women.[4,5,6]. In depressed patients abnormalities in circadian regulation of the HPA axis have been proposed. Hormone pulsalitility is another critical aspect of endocrine secretion. In the HPG axis pulse frequency is a critical factor beyond mean hormone levels in regulating the axis. This paper is concerned minimal repair of cortisol level due to depression.

Notations

x_j = time between the successive cortisol level

y_j = amount of damage to the cortisol level due to depression

f(y) – pdf of time to damage of cortisol level

g(x) – pdf of lead time

$\delta(y)$ - Repair cost limit function of cortisol level

T^* - optimal time

C_1 – cost interms of cortisol level

Assumption

This model has random leadtime & minimal repair.

- Two types of failure occur
  1. Type-I : with probability q(y) and is corrected with minimal repair
  2. Type-II : with probability p(y) = 1-q(y) and followed by unit replacement

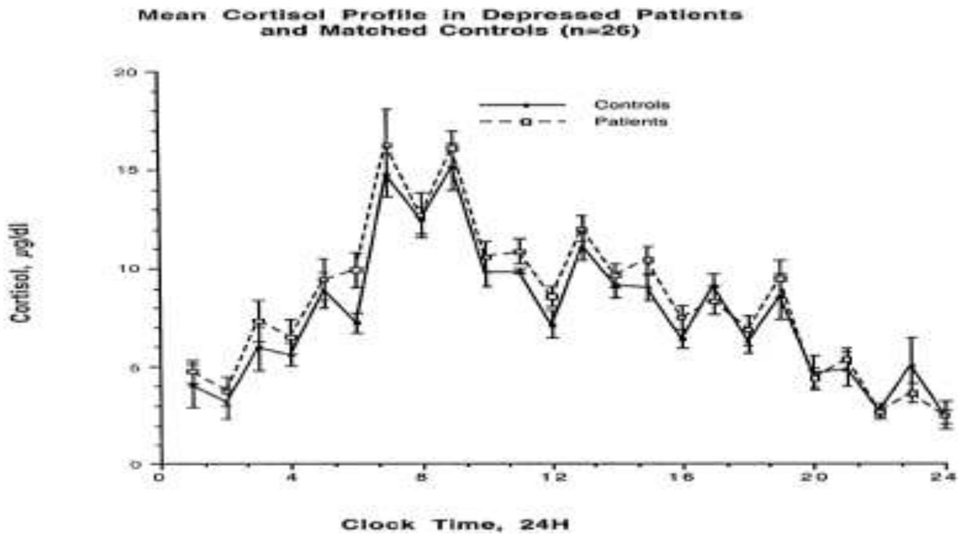
Application

About 30% of patients with major depression demonstrate hyper cortisolemia, while 66% of melancholic depressed subjects show non-supression of cortisol to dexamethasone. In addition to mean hormone levels, the central nervous system controls a number of other hormone rhythms that include pulsatile rhythms and circadian and ultradian rhythms. it is known that cortisol is secreted in pulses. Hormone pulsatility is another critical aspect of endocrine secretion. The current studies are evaluating cortisol pulsatility in 25 women with major depression and a control group of 25 women matched for age and menstural cycle day.

Method

All subjects were premenopausal women who ranged in age from 20-50 years. All subjects were medically healthy and untreated for the current episode at the time of study. Also, they were free of psychotropics pain medications, for more than three months. No subject engaged in shift work or travelled across more than 3 time zones within the 3 months prior to study. Subjects were studied on the general medical clinical Research center (CRC) where they were admitted for 26 hrs

All subjects underwent a screaming physical exam, blood work and mine drug screen. All controls were individually matched to each patient and matched on age and menstrual cycle day and length.



Mathematical Model

Consider the system with a weibul distribution. The pdf of the weibull distribution with parameters β and θ is given by

$f(y) = \beta/ \theta\ (y/ \theta)^{\beta-1} \exp(-y/ \theta)^{\beta}$, $y > 0$, $\beta, \theta > 0$ where $\beta = 1.430$; $\theta = 4.949$

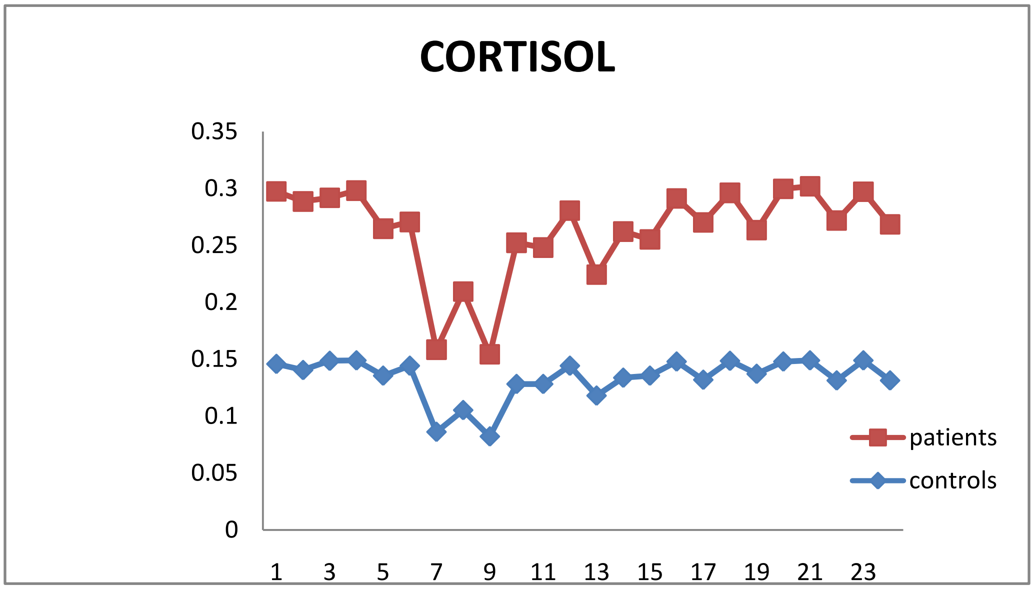
The pdf of the random leadtime of an order is,

$g(x) = \frac{1}{\mu} \exp(-x/\mu)$, $x > 0$, $\mu > 0$. Where $\mu = 4.2750$

Suppose the random repair cost [1, 2, 3] is ω, If $\omega \leq \delta(y).c_\infty$ ($c_\infty \equiv$ the constant cost) then there is a minimal repair.

If δ(y).can be explained as a fraction of the constant cost, $c_{\infty,}$ at age y and $0 \leq \delta(y) \leq 1$.

Let $\delta(y) \equiv \delta\ (\exp\ (-\lambda, y))$ with $0 \leq \delta(y) \leq 1$ & $\lambda \geq 0$.



The optimal time T* [7, 8] which minimizes $C_1(T)$ is, $C_1(T^*) = \lambda\, C_1\, (1\text{-}g(x))\, e^{-\lambda(1-g(x))T^*}$

When C_1=1.6

λ=0.234

g(x)=0.2181

T*=0.3 then C1 (T*) =0.0673

Conclusion:

Increased Cortisol level is a renowned finding in patients with major depression. Pulse analyses revealed similar number of secretory events and similar amplitudes for cortisol secretary bursts in patients and control. Also found Optimal time T*, Minimal Repair and Random Lead Time g to minimize the cortisol level

References

1. Berg.M and Cleroux.R, "A marginal cost analysis for an age replacement policy with minimal repair", vol.20, 258-263, 1982.
2. Block H.W, Borges.W.S and Savits.T.H, ''Age dependent minimal repair", J.Applied probability, Vol.22, pp370-385, Jun 1985
3. Cleroux.R; Dubuc.S , Tilquin.C, " The age replacement problem with minimal repair and random repair cost", operations Research', Vol;27, PP 1158-1167, Nov-Dec 1979
4. Carrot BJ, Curtis GC, Mendels J (1976 b) Neuroendocrine regulation in depression II. Discrimination of depressed from non depressed patients Rich Gen psychiatry 33; 1051-1058
5. Deuschle M, Schweiger, Weber.B, Golthardet U , Karner A, Schmider J, standhardt H, Lammers C-H, Heuser I (1997) : Diurnal activity and pulsatility of the hypothalamus – Pitutary-adrenal systm in male depressed patients and healthy controls J clin Endocrinology Metabolism 82; 234-238
6. Elizabeth A.Young, Nichole E , Canlson M.S, "Twenty-four-Hour Acth and Cortisol pulsatility in Depressed Women", Neuro psychophamacology 2001-Vol 25, No.2, PP 267-276
7. Lakshmi.S and Geetha.T,"Cumulative damage model with quick recoupment at failure due to stress effect ", Bulletin of pure and applied sciences. Vol.27 (No.2) 2008;PP 341-347.
8. Nakagawa.T and Kowada.M, "Analysis of a system with minimal repair and its application to replacement policy', European J.Operational Research, Vol.12, PP 176-182. 1983