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

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ABSTRACT

ACTH is secreted in a pulsatile manner, so it is unclear if increased ACTH secretion occurs in depression and if there are changes in the pulsatile components of ACTH secretion. Ten minutes sampling for ACTH was performed for 24 hr in 25 premenopausal depressed women whose age and menstrual cycle day matched control women found in pulsatile components of ACTH secretion between patients and matched controls. This paper is applied to Optimal time T, Minimal Repair δ and Random Lead Time g to minimize the ACTH level*

Key Words: Depression, ACTH, minimal repair, Repair cost limit function.

I.INTRODUCTION

Dysregulation of HPA axis is one of the most common findings present 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 [6, 9]. In depressed patients abnormalities in circadian regulation of the HPA axis have been proposed. Hormone pulsatility [4] 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. The current studies is evaluating ACTH pulsatility in 25 women with major depression and a control group of 25 women matched for age and menstrual cycle day[5,8]. This paper is concerned minimal repair of ACTH level due to depression.

NOTATIONS

x_j = time between the successive ACTH level [j = 1,2,…….n], r.v.

y_j = amount of damage to the ACTH level due to depression[j = 1,2,…….n], r.v.

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

g(x) – pdf of lead time

δ(y) - Repair cost limit function of ACTH level

T^* - optimal time

C_1 – cost interms of ACTH 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 ACTH 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 ACTH is secreted in pulses. Hormone pulsatility [4,5] is another critical aspect of endocrine secretion. The current studies are evaluating ACTH pulsatility in 25 women with major depression and a control group of 25 women matched for age and menstural cycle day.

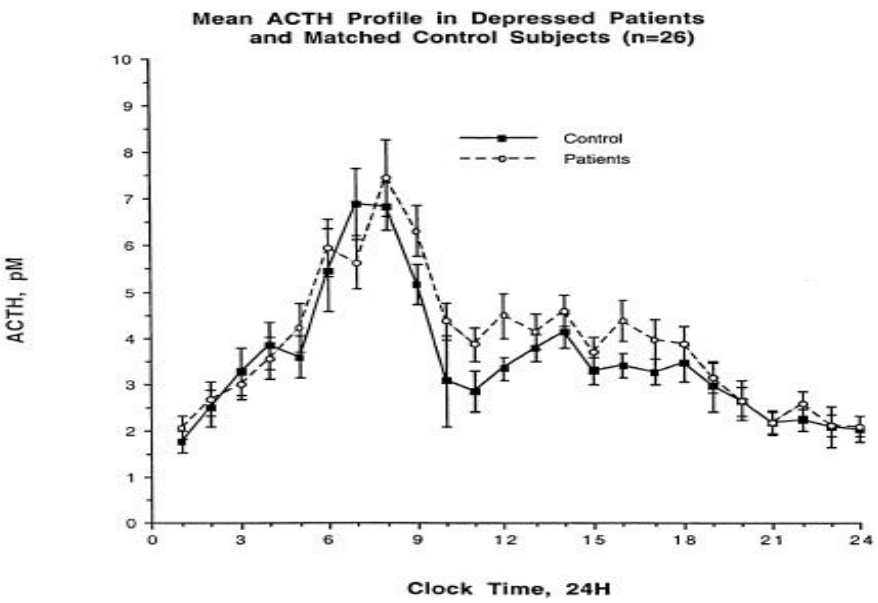


Figure 1. Twenty-four-hour ACTH profile in 26 depressed women and 26 age matched control

women. The data are expressed as the mean of hourly blocks (6 samples) across subjects. There is no significant increase in ACTH.

II.METHOD

All subjects were premenopausal women who ranged in age from 20-50 years .Also the subjects were medically healthy and untreated for the current episode at the time of study. All were free of psychotropics and any other medications except for non-prescription pain medications, for more than three months. All subjects underwent a screening physical exam, blood work and urine drug screen. All controls were individually matched to each patient and matched on age and menstrual cycle day and length.

III.MATHEMATICAL MODEL

Consider the system with a weibull 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 $\beta = 1.487$; $\theta = 5.329$

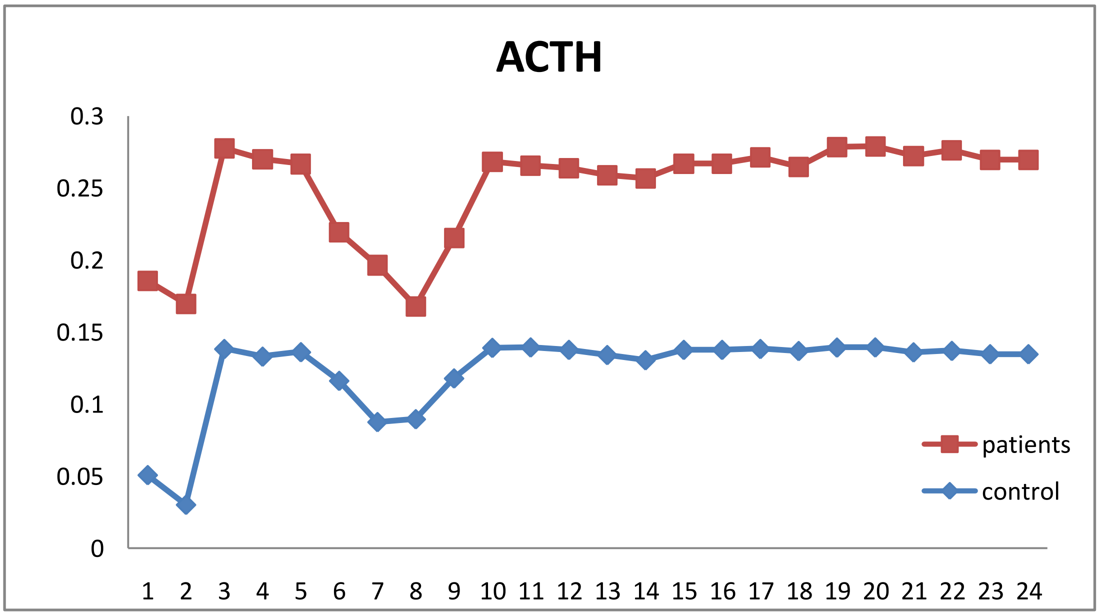
The pdf of the random lead time[1,2,3] of an order is,

$g(x) = \frac{1}{\mu} \exp(-x/\mu)$, $x > 0$, $\mu > 0$. Where $\mu = 4.6375$

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

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

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



Now, The optimal time T* which minimizes $C_1(T)$ is,

$C_1(T^*) = \lambda C_1 (1-g(x)) e^{-\lambda(1-g(x))T^*}$ (7)

When C_1=6.1

λ=0.216

g(x)=0.1231

T*= 2.6 then $C_1 (T^*)$ = 0.0196

CONCLUSION:

ACTH is secreted in a pulsatile manner, so it is unclear if increased ACTH secretion occurs in depression and if there are changes in the pulsatile components of ACTH secretion. There were no differences between patients and controls in pulse number of ACTH. Also found Optimal time T*, Minimal Repair and Random Lead Time to minimize the ACTH level

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