Profile on personality types and cortisol in polycystic ovarian syndrome

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Abstract

Objective: To understand the profile of personality types and cortisol in patients with polycystic ovarian syndrome (PCOS).

Methods: Cross-sectional study conducted in Infertility Polyclinic of Dr. Cipto Mangunkusumo General Hospital and Immunoendocrinology Integrated Makmal, Faculty of Medicine University of Indonesia (FKUI). Polycystic ovarian syndrome diagnosed based on Rotterdam consensus 2003. Blood samples were taken to examine cortisol and other hormones level. Personality profile was assessed using Minnesota Multiphasic Personality Inventory (MMPI).

Results: We divided 36 cases of polycystic ovarian syndrome into 3 types of personality, i.e.: normal personality in 5 (14%) cases, neurotically inclined personality in 23 (64%) cases, and in psychotically inclined personality in 8 (22%) cases. Cortisol levels in the group of normal personality (8.4 ± 1.05 μg/dL) were higher than those in the group of neurotically inclined personality (10.7 ± 10.86 μg/dL) and psychotically inclined personality (10.2 ± 2.18 μg/dL) as well as in all cases or when they were separated from the group with positive insulin resistance.

Conclusion: There was a weak, positive relationship between personality type and cortisol in polycystic ovarian syndrome, and the cortisol level was found to be higher in neurotically inclined and psychotically inclined personalities than in normal personalities with PCOS.

Keywords: Polycystic ovarian syndrome, Personality type, Cortisol, Insulin resistance.

Original Article

1. Introduction

15–25% women of the reproductive age would undergo an anovulated cycle [1]. As high as 75% of the anovulated cycles would develop into chronic anovulation. It has been shown that 80% of polycystic ovaries clinically appeared as polycystic ovarian disease (PCOD) [2]. In 5–10% of women at reproductive age, this polycystic ovarian disease would have complete symptoms as polycystic ovarian syndrome (PCOS) [2].

In Indonesia, study that conducted in 2000, it was projected that polycystic ovarian syndromes would be encountered in 7,419,468 Indonesian women [3].

The basic pathophysiology of polycystic ovary was not yet been revealed; however, it was commonly agreed that insulin resistance, excessive androgen hormone and gonadotropin hormonal abnormality, as well as neuroendocrine disorders were implicated in this condition [4,5]. Lobo [6] and Dunaif [7] have demonstrated a relationship between insulin resistance and decreased level of sex hormone-binding globulin (SHBG) serum and increased level of luteinizing hormone (LH). In his study, Lobo [6] showed that 80% of PCOS were due to insulin resistance. On the other hand, Muharam et al. [8] found insulin resistance in only 64.8% of PCOS cases. The effect of insulin resistance in the long term could generate other metabolic disorders, such as dyslipidemia, hypertension, and risk of coronary heart disease.

A number of studies on PCOS in certain ethnic showed a genetic relationship which was passed down in autosomal-dominant way, such that hyperinsulinemia condition occurring in PCOS was suspected to be influenced by genetic abnormalities [9]. By contrast, the study conducted by Rasgon [10] and Weiner [11] showed the presence of mood disorder in patients with PCOS.

Kalantarindou [12] and Kirschbaum [13] suggested that Hypothalamus-Hypophysis-Adrenal (HHA) system which would become active when one was depressed would generate suppressive effect on the women’s reproductive system.

Arterial wall thickening, elevated diastolic blood pressure, dyslipidemia, and an increased risk of cardiovascular disease.

Peer review under responsibility of Middle East Fertility Society.

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Corticotropin-releasing hormone (CRH) would suppress the secretion of Gonadotropin-releasing hormone (GnRH).

Kondoh [14] and Tsilchorozidou [15], who performed evaluation in women with polycystic ovarian syndrome found the level of adrenocorticotropic hormone plasma (ACTH) and cortisol to be higher in PCOS patients than in healthy women, due to ACTH stimulation in adrenal gland resulting in increased cortisol level. They also studied the relationship of cortisol level in PCOS, and found that there was an increased level of cortisol and androgen in lean women with PCOS.

Weiner found PCOS women with testosterone free of 10–26 pg/ml to be more depressive than women without PCOS or PCOS women with testosterone free greater than 26 pg/ml [11]. There are certain personalities that are more likely to experience stress. They had led some investigators to associate polycystic ovarian syndrome with stressed condition [10,11,14].

State of hypercortisolemia has been studied that it influences metabolism and anti-inflammatory reaction, which affects neurotransmission processes and neuron survivals [16]. Excessive glucocorticoids is associated with hippocampal atrophy and this condition may induced learning ability and memory, after producing symptoms of depression [17]. Changes in hippocampus and neurons in frontal lobes which highly reactive toward glucocorticoid resulted in HPA reactivity [18]. Abnormal HPA function and automatic glucocorticoid abnormality portrays fragile genetic factors that may persuade and exaggerate trail of mood disorder [19].

The goal of this research is to understand profiles of personality type and cortisol in patients with polycystic ovarian syndrome (PCOS), and specifically to evaluate the effects of personality type and cortisol in patients with polycystic ovarian syndrome (PCOS) androgen-secreting tumor, Cushing syndrome, thyroid disease, hyper-prolactinemia); and presence of polycystic ovaries at ultrasonographic examination.

The presence of polycystic ovaries at ultrasonographic examination was confirmed by these one of these indicators: transvaginal USG showed at least 15 follicles with a diameter of 2–10 mm and/or ovarian volume >10 ml on one field; or transabdominal USG showed at least 16 follicles with a diameter of 2–8 mm on one field, peripherals were formed around the thickening ovarian stroma and/or ovarian volume >10 ml.

Further screening was performed to ascertain whether or not subjects of the study were eligible for the research, which included MMPI test to classify subjects into 3 groups of personality type: normal; neurotically inclined; psychotically inclined.

Blood samples were taken to examine cortisol, testosterone, SHBG, DHEA in 10 ml at Integrated Makmal of Immunoendocrinology, Faculty of Medicine University of Indonesia.

Data of the study which were obtained were recorded in a special form and processed electronically using software designed to calculate statistically with SPSS 20.

2. Material and methods

This research was an observational study with cross-sectional survey to examine the effects of personality type on cortisol in polycystic ovarian syndrome (PCOS). We conducted this research at both Dr. Cipto Mangunkusumo General Hospital’s Department of Obstetrics and Gynecology, specifically the Reproductive Immuno-endocrinology’s Infertility Policlinic, and Integrated Makmal of Immunoendocrinology, Faculty of Medicine University of Indonesia.

Study samples were taken from all female patients with polycystic ovarian syndrome (PCOS) aged 20–35 years old. All subjects who met the inclusion criteria were included in the study up until the number of subject was adequate.

Inclusion criteria includes the following: women of reproductive age (20–35 years); developed polycystic ovarian syndrome; did not take medications, such as contraceptive pills, prednisone, herbal medication, anti-diabetic medication, hormonal acnemedication; and willing to participate in the study. Exclusion criteria comprises of: hypertension; diabetes mellitus; congenital adrenal hyperplasia; and refusing to participate in the study.

We provided the subjects with explanations on the objectives and purposes of the study to the subjects of the study. After the subjects had understood and consented, they would provide a written consent in the informed consent form. Subjects were also informed that any data obtained from examinations would be recorded in a study questionnaire sheet (subjective complaints, database of physical examinations, risk factors, and examination of hormonal analysis). Diagnosis of polycystic ovarian syndrome was then performed based on Rotterdam Consensus 2003, i.e. confirmed diagnosis of polycystic ovarian syndrome must be supported by the following 3 criteria: oligo-anovulation; clinical signs and biochemical signs of hyperandrogenemia (ruling out other signs of hirsutism, such as congenital adrenal hyperplasia,

3. Results

3.1. Characteristics of study cases

During the study conducted we found 36 PCOS cases, with mean age of responders is 28 ± 4 years. In this study, there were 31 (86%) cases with primary infertility, 3 (8%) cases with secondary infertility, and 2 (6%) non-infertility cases, but with menstrual disorder of oligomenorrhea (Fig. 1). Moreover, the profile of obesity cases with PCOS consists of 16 (44%) cases with obesity and 20 (56%) non-obese cases (Fig. 2), followed by the cases with insulin resistance, there were 16 (44%) without insulin resistance cases and 20 (56%) with insulin resistance cases (Fig. 3).

As shown in Table 1, ratio level of LH/FSH was 2.2 ± 0.32, with LH level of 2.2 ± 0.32 mU/ml higher than FSH level of 6.4 ± 0.29 mU/ml. In addition, testosterone level was 0.72 ± 0.14 ng/ml, and cortisol level 1038 ± 0.80 μg/dl.

3.2. Profile of personality type in relation to PCOS

Fig. 4 shows that 36 cases with polycystic ovarian syndrome could be divided into 3 personality types, i.e., normal personality in 5 (14%) cases, neurotically inclined personality in 23 (64%) cases, psychotically inclined personality in 22% cases.
3.3. Hormonal profile in relation to personality type in PCOS cases

Table 2 shows that LH level in the group of neurotically inclined personality was 11.2 ± 1.79 mU/ml, which was lower than that in psychotically inclined personality, i.e. 14.1 ± 4.90 mU/ml. Furthermore, LH levels in both groups were lower than that in normal personality, i.e. 17.4 ± 4.66 mU/ml, although no significant difference was found (p > .05). This condition set the ratio of LH/FSH of the group of neurotically inclined personality lower than that of the psychotically inclined personality group, and the ratio of LH/FSH of both groups was lower than that of the group of normal personality, although no significant difference was found.

In contrast, cortisol levels in both the group of neurotically inclined personality, i.e. 10.7 ± 0.86 μg/dl, and the group of psychotically inclined personality, i.e. 10.2 ± 2.18 μg/dl, were higher than that in group of normal personality, i.e. 8.4 ± 1.05 μg/dl, although no significant difference was found (p > .05). On correlation test (Pearson) we found a weak correlation (r = 0.32) between personality type and cortisol.

As shown by Table 3, in the group of insulin resistance (–) LH level in the group of neurotically inclined personality (11.6 ± 1.72 mU/ml) appeared to be lower than that in the group of psychotically inclined personality (20.8 ± 13.12 mU/ml), and LH levels in both groups were lower than that in the group of normal personality (25.3 ± 8.13 mU/ml), although no significant difference was found (p > .05).

Similarly, as shown by Table 4, ratio of LH/FSH in the group of neurotically inclined personality in insulin resistance (–), i.e. 1.7 ± 0.31, was lower than that in the group of psychotically inclined personality, i.e. 3.13 ± 1.89, and ratios of LH/FSH in both groups were lower than that in the group of normal personality, i.e. 6 ± 3.53, although no significant difference was found (p > .05).

3.4. Cortisol level in PCOS in relation to personality type

As shown by Table 5, in the group of insulin resistance, cortisol levels in neurotically inclined personality and psychotically inclined personality were higher than that in normal personality, although no significant difference was found (p > .05).

In evaluating the relative risk ratio of cortisol in neurotically inclined personality in relation to normal personality, we found the ratio to be 1.204 (p = .68, CI (0.7072–2.0664), which means that an increase of 1 cortisol unit contributed to an increase in mild neurotic personality by 20%, or increased 1.20 times for the formation of neurotically inclined personality. On the other hand, in evaluating the relative risk ratio of cortisol in psychotically inclined personality in relation to normal personality, we found the ratio to be 1.1705 (p = .578, CI (0.6725–2.0376), which means that an increase by 1 cortisol unit contributed to an increase in neurotically inclined personality by 17%, or increased 1.17 times for the formation of psychotically inclined personality. Yet, although cortisol may contribute to the formation of neurotic and psychotic personalities, it has not yet contributed significantly in both groups, since both groups had p > .5.

3.5. Androgen level in PCOS in relation to personality type

As shown by Table 6, testosterone and DHEA levels in neurotically inclined personality and psychotically inclined personality were higher than that in normal personality, although no significant difference was found (p > .05).

In evaluating the relative risk ratio of testosterone in neurotically inclined personality toward normal personality, we found the ratio to be 3.316 (p = .517, CI (0.0883–124.5102). On the other hand, in evaluating the relative risk ratio of testosterone in psychotically inclined personality toward normal personality, we
found a ratio of 2.622 (p = .612, CI (0.634–108.326). Although testosterone may contribute to the formation of neurotic and psychotic personalities, it has not yet contributed significantly, since both groups had p > .05.

As shown by Table 7, in the group of insulin resistance (–) testosterone levels in neurotically inclined personality and psychotically inclined personality were higher than that in normal personality, although no significant difference was found (p > .05).

4. Discussion

PCOS is a host of symptoms and signs that occur as a result of hyper-androgenism and ovulation dysfunction without congenital adrenal hyperplasia, hyperprolactinemia, or androgen-secreting neoplasm [4,5]. There are several theories implying the relationship between PCOS and psychosomatic disorders or behavioral syndrome associated with physiologic disorder and physical factor [10–12].

This study divided PCOS cases into 3 personality types, i.e. normal personality in 5 (14%) cases, neurotically inclined personality in 23 (64%) cases, and psychotically inclined personality in 8 (22%) cases. This finding was consistent with Rasgon [20] and Weiner [11] who demonstrated the presence of mood disturbances in PCOS patients.

4.1. Effect of personality type on cortisol in PCOS

In evaluating the relative risk ratio of cortisol in neurotically inclined personality toward normal personality, we found a ratio of 1.204 (p = .68, CI (0.702–2.066), where cortisol increased 1.2 times for the formation of neurotically inclined personality. In contrast, the relative risk ratio of cortisol in psychotically inclined personality toward normal personality we found a ratio of 1.1705 (p = .578, CI (0.672–2.037), to which cortisol increased 1.17 times for the formation of psychotically inclined personality.

Table 2
Hormonal profile in relation to personality type in PCOS.

<table>
<thead>
<tr>
<th>Type of examination</th>
<th>Normal (mean)</th>
<th>Neurotically inclined (mean)</th>
<th>Psychotically inclined (mean)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSH (mIU/ml)</td>
<td>6.5 ± 0.97</td>
<td>6.6 ± 0.33</td>
<td>5.5 ± 0.71</td>
<td>0.226</td>
</tr>
<tr>
<td>LH (mIU/ml)</td>
<td>17.4 ± 4.66</td>
<td>11.2 ± 1.79</td>
<td>14.1 ± 4.90</td>
<td>0.734</td>
</tr>
<tr>
<td>Ratio LH/FSH</td>
<td>3.4 ± 1.56</td>
<td>1.8 ± 0.28</td>
<td>2.6 ± 0.70</td>
<td>0.731</td>
</tr>
<tr>
<td>Estradiol (pg/ml)</td>
<td>50.1 ± 7.67</td>
<td>60.3 ± 0.77</td>
<td>57.3 ± 12.38</td>
<td>0.819</td>
</tr>
<tr>
<td>Prolactin (ng/ml)</td>
<td>15.6 ± 2.14</td>
<td>14.3 ± 0.01</td>
<td>12.5 ± 1.77</td>
<td>0.233</td>
</tr>
<tr>
<td>Cortisol (µg/dl)</td>
<td>8.4 ± 1.05</td>
<td>10.7 ± 0.86</td>
<td>10.2 ± 2.18</td>
<td>0.868</td>
</tr>
</tbody>
</table>

Table 3
LH profile in personality type in relation to insulin resistance.

<table>
<thead>
<tr>
<th>Insulin Resistance</th>
<th>Normal (mIU/ml)</th>
<th>Neurotically inclined (mIU/ml)</th>
<th>Psychotically inclined (mIU/ml)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>12.2 ± 4.05</td>
<td>10.8 ± 3.13</td>
<td>10.1 ± 2.14</td>
<td>0.759</td>
</tr>
<tr>
<td>Negative</td>
<td>25.3 ± 8.13</td>
<td>11.6 ± 1.72</td>
<td>20.8 ± 13.12</td>
<td>0.211</td>
</tr>
</tbody>
</table>

Table 4
LH/FSH ratios in personality type in relation to insulin resistance.

<table>
<thead>
<tr>
<th>Insulin Resistance</th>
<th>Normal (mean)</th>
<th>Neurotically inclined (mean)</th>
<th>Psychotically inclined (mean)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>1.6 ± 0.30</td>
<td>1.8 ± 0.47</td>
<td>2.3 ± 0.48</td>
<td>0.348</td>
</tr>
<tr>
<td>Negative</td>
<td>6 ± 3.53</td>
<td>1.7 ± 0.31</td>
<td>3.13 ± 1.89</td>
<td>0.202</td>
</tr>
</tbody>
</table>

Table 5
Cortisol profile in personality type in relation to insulin resistance.

<table>
<thead>
<tr>
<th>Insulin Resistance</th>
<th>Normal (µg/ml)</th>
<th>Neurotically inclined (µg/ml)</th>
<th>Psychotically inclined (µg/ml)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>9.4</td>
<td>10.8 ± 1.49</td>
<td>9.5 ± 2.34</td>
<td>0.472</td>
</tr>
<tr>
<td>Negative</td>
<td>7.3</td>
<td>10.6 ± 1.03</td>
<td>11.2 ± 5.02</td>
<td>0.444</td>
</tr>
</tbody>
</table>

Table 6
Hormonal profile in relation to personality type in PCOS.

<table>
<thead>
<tr>
<th>Type of examination</th>
<th>Normal (mean)</th>
<th>Neurotically inclined (mean)</th>
<th>Psychotically inclined (mean)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testosterone (ng/ml)</td>
<td>0.5 ± 0.07</td>
<td>0.8 ± 0.21</td>
<td>0.7 ± 0.17</td>
<td>0.912</td>
</tr>
<tr>
<td>DHEA (µg/dl)</td>
<td>111.5 ± 35.21</td>
<td>159.8 ± 14.35</td>
<td>126.7 ± 35.86</td>
<td>0.924</td>
</tr>
<tr>
<td>SHBG (nmol/L)</td>
<td>61.2 ± 30.45</td>
<td>40.2 ± 4.40</td>
<td>32.2 ± 10.95</td>
<td>0.141</td>
</tr>
</tbody>
</table>

Table 7
Testosterone profile in personality type in relation to insulin resistance.

<table>
<thead>
<tr>
<th>Insulin Resistance</th>
<th>Normal (ng/ml)</th>
<th>Neurotically inclined (ng/ml)</th>
<th>Psychotically inclined (ng/ml)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>0.6 ± 0.30</td>
<td>0.6 ± 0.10</td>
<td>0.8 ± 0.25</td>
<td>0.827</td>
</tr>
<tr>
<td>Negative</td>
<td>0.3</td>
<td>1 ± 0.41</td>
<td>0.4 ± 0.09</td>
<td>0.288</td>
</tr>
</tbody>
</table>
Although cortisol may contribute to the formation of neurotic and psychotic personality, it has not yet contributed significantly.

Increase in cortisol level in the group of PCOS, disruption of cortisol metabolism due to inactivation of 5α-reductase (5α-R), or disruption of 11β-hydroxysteroid dehydrogenase type 1 (11β-HSD1) will reduce negative feedback in ACTH secretion, such that an increase in cortisol will ensue [15].

4.2. Effect of personality type on androgen in PCOS

This study confirmed that adrenocorticotropic hormones (ACTH) stimulation increases production of dehydroepiandrosterone (DHEA), where the DHEAS/cortisol ratios during stress were significantly higher in patients with low disassociation disorder and in those who were introduced into military, and DHEAS level also increased in acute stress in healthy human beings [11].

Increase in testosterone level in the group of PCOS was due to the increased production of androgen in ovaries as a result of hyperinsulinemia, and extra gonad caused by ACTH stimulation, and SHBG decrease in the liver. This condition caused a decreased binding to testosterone, such that free testosterone level was greater.

Weiner et al. [11] stated that more PCOS patients were found to be exposed to the acute and prolonged depressive condition than were normal women, i.e. in acute anxiety and prolonged anxiety. Increase in free testosterone did not correlate with mild depression.

Moreover, Weiner and Rasgon [11,20] demonstrated an increase in androgen in PCOS patients which had some impact on increased depression rate, and in PCOS treatment the improvement of depression could be achieved by reducing testosterone level. In addition to stress, endocrine disorder and endocrine abnormality may also disrupt mental and emotional condition.

4.3. Effect of personality type on obesity and insulin resistance

Insulin resistance has strong correlation in pathophysiology of PCOS [6,8]. It is provoked by the presence of obesity, although insulin resistance could be found in thin or normal people [10]. Dunafy found cases of insulin resistance in 30% of thin patients, and 75% in obese patients while in this study we found 57% of PCOS patients with obesity and 43% with non-obesity [7]. With respect to insulin resistance, we found positive insulin resistance in 52.2% and negative in 47.8% of PCOS patients. On the other hand, in their study Muharam [8] and Lobo [6] found 68.4–80% of PCOS were based on positive insulin resistance. Insulin could increase production of ovarian androgen in PCOS through stimulation in theca cell [20,21]. Rasgon et al. demonstrated that depressive patients would suffer from disorder of insulin sensitivity with hyperinsulinemia [17].

Increase in cortisol level due to activation of HPA axis could reduce glucose tolerance. Cortisol could induce insulin resistance by enhancing production of liver glucose and impeding insulin secretion [22].

Obesity, as a form of stress in body, is evident from the increased level of β endorphin, leading to an increase in cortisol level and ACTH, particularly in obese patients with PCOS. This was demonstrated by Guido et al., who administered naloxone to PCOS patients resulting in increased level of ACTH and more responsive and higher adrenal cortisol than in adrenal abnormalities [23]. On the contrary, Andrew et al. found cortisol metabolism and tissue sensitivity toward abnormal cortisol in intolerance to glucose due to alteration of 11β hydroxysteroid type 1 (11β-HSD 1) enzyme [24].

5. Conclusions

There was a weak correlation between personality type and cortisol in polycystic ovarian syndrome. In the group of PCOS, cortisol level tended to be higher in neurotically and psychologically inclined personalities than in normal personality, whereas LH level in the group of normal personality tended to be higher than in the group of neurotically and psychologically inclined personalities. Both testosterone and DHEA level tended to be higher in the group of neurotically inclined personality with PCOS than in the group of normal personality, with DHEA also being higher in the group of psychotically inclined personalities.

Disclosure

Funding: This study did not receive any grant nor funded by other party.

Conflict of Interest: The authors declare that they have no conflict of interest.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

Acknowledgements

The authors thank Muhammad Ikhsan and Herdinda Erudite Rizkinya for manuscript preparation and publication assistance.

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