A study on changes and clinical significance of blood glucose, blood lipid and inflammation in patients with ovarian cancer

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Summary

Purpose: To investigate the changes in blood glucose, blood lipid and inflammation in patients with ovarian cancer and their clinical significance.

Methods: 67 patients diagnosed with ovarian cancer and treated in our hospital from January 2018 to December 2018 constituted the observation group. Fifty healthy women in the corresponding time period were enrolled as the control group. The levels of blood glucose, blood lipid and inflammation were compared between the two groups, and then the changes in those levels in ovarian cancer patients in different clinical stages were analyzed.

Results: The levels of fasting blood glucose and 2-h postprandial blood glucose of the observation group were significantly higher than those of the control group, and they were also significantly higher in patients in stage III-IV than those in stage I-II (p<0.05). In the observation group, the levels of total cholesterol (TC) and high-density lipoprotein cholesterol (HDL-C) were lower than those in the control group. Compared with the patients in stage I-II, the patients in stage III-IV had remarkably lower levels of TC and HDL-C (p<0.05). The levels of C-reactive protein (CRP), tumor necrosis factor-alpha (TNF-a) and interleukin-6 (IL-6) in the observation group were evidently higher than those in the control group, and they were markedly higher in patients in stage III-IV than those in stage I-II (p<0.05).

Conclusions: Both the metabolism disorders of blood lipid and blood glucose and inflammatory response are more obvious in ovarian cancer patients, indicating that these indicators have a place for early screening and clinical treatment of ovarian cancer.

Key words: ovarian cancer, blood glucose, blood lipid, inflammation, clinical diagnosis

Introduction

Ovarian cancer, characterized by high morbidity and mortality rates, is a common malignant tumor in women, which seriously endangers their life and health [1,2]. The incidence of ovarian cancer is gradually increasing along with the increase of global environmental pollution and changes in people's lifestyles, reaching about 5%, and showing a youth-oriented trend [3,4]. The ovarian cancer in the early stages does not have apparent symptoms, and the location *in vivo* and biological characteristics of the ovary make it difficult to be diagnosed in early stage. Ovarian cancer is generally in the intermediate and advanced stages once diagnosed, most of which spreads to the uterine appendages, greater omentum and uterus. On this occasion, the treatment is much more difficult and the patient's prognosis is poor, with a 5-year survival rate of stage III and IV patients not higher than 35% [5,6]. Therefore, seeking for diagnostic indicators related to early ovarian cancer could have very posi-

tive significance for the diagnosis, treatment and prognosis of the patients. At present, many clinical studies focus on the effect of glycolipid metabolism on ovarian cancer [7]. Inflammation plays a critical role in the occurrence and development of malignant tumors [8]. In this study, the changes in blood glucose, blood lipid and inflammation in patients with ovarian cancer were analyzed, hoping to provide a scientific basis for the clinical diagnosis and treatment of this disease.

Methods

General information

A total of 67 patients with ovarian cancer admitted to our hospital from January 2018 to December 2018 comprised the observation group. *Inclusion criteria:* (1) patients meeting the diagnostic standards of ovarian cancer; (2) those with complete case information; and (3) those who signed the informed consent. *Exclusion criteria:* (1) patients complicated with other malignant tumors; (2) those with autoimmune dysfunction; or (3) those complicated with diabetes. Meanwhile, 50 healthy women in the corresponding time period were enrolled as the control group. There was no statistically significant difference in the general information between the two groups (p>0.05) (Table 1).

Detection of blood lipid level

Fasting venous blood (5 mL) was drawn from each subject in the morning and centrifuged at 3000 r/min for 15 min. The supernatant (1.5 mL) was taken into a centrifuge tube, labeled and then preserved in a refrigerator at

Table 1. Baseline data of the two groups of subjects

Item	Observation group (n=67)	Control group (n=50)	t/x^2	p
Age (years old)	30-60	32-65		
Average age (years old)	49.38±6.46	49.46±6.67	0.326	0.729
BMI (kg/m²)	24.13±1.45	24.16±1.38	0.417	0.658
Clinical stage (n, %)				
Stage I-II	37 (55.22)	-	-	-
Stage III-IV	30 (44.78)	-	-	-

Table 2. Blood glucose levels of the two groups (mmol/L)

Group	n	Fasting blood glucose	2-h postprandial blood glucose
Observation group	67	7.62±0.75	11.63±0.78
Control group	50	5.83±0.56	7.24±0.54
t		9.286	14.835
p		<0.001	<0.001

Table 3. Comparison of blood lipid metabolism between the two groups (mmol/L)

Group	n	TG	TC	LDL-C	HDL-C
Observation group	67	1.15±0.47	4.12±0.87	2.72±0.78	0.92±0.42
Control group	50	1.13±0.46	3.16±0.76	2.68±0.75	1.39±0.45
t		0.085	6.406	0.194	7.316
p		0.825	<0.001	0.645	<0.001

For abbreviations, see text

Table 4. Comparison of inflammation level between the two groups

Group	n	IL-6 (pg/mL)	CRP (mg/L)	TNF-a (ng/mL)
Observation group	67	47.85±3.63	12.95±3.37	17.57±3.48
Control group	50	6.09±1.16	2.86±0.73	3.48±0.27
t		48.472	26.428	18.027
p		<0.001	<0.001	<0.001

For abbreviations, see text

-20°C. Fasting blood-glucose and 2-h postprandial blood glucose were measured by glucose oxidase assay. The blood lipid level was detected using a BS-800 automatic biochemical analyzer (Roche). Total cholesterol (TG) and triglyceride (TC) in the serum were determined *via* oxidase method, and the levels of high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C) were determined using homogeneous enzyme colorimetry.

Detection of inflammation level

Interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α) were detected *via* the enzyme-linked immunosorbent assay (ELISA) according to the instructions of relevant kits (Shanghai Yiji Biotechnology Co., Ltd., Shanghai, China). The optical density (OD) value at the wavelength of 450 nm was read using a microplate reader, and the concentrations of IL-6 and TNF-α were calculated. C-reactive protein (CRP) level was determined by immune scattered turbidimetry in strict accordance with the instructions of relevant kit (Siemens, Germany).

Statistics

SPSS 22.0 software (SPSS Inc., Chicago, IL, USA) was used for data processing. The measurement data were expressed as mean ± standard deviation (x±s), and *t*-test was used for data analysis between the observation and the control group. The counting data was expressed in rates, and x^2 test was used for comparison of clinical stage in baseline data. P<0.05 suggested that the difference was statistically significant.

Results

Blood glucose level of the two groups

The levels of fasting blood glucose and 2-h postprandial blood glucose of the observation group were significantly higher than those of the control group (p<0.05;Table 2).

Blood lipid metabolism of the two groups

The levels of serum TC and HDL-C of the observation group were significantly lower than those of the control group (p<0.05;Table 3).

Level of inflammation in the two groups

The levels of CRP, TNF-α and IL-6 in the observation group were remarkably higher than those in the control group (p<0.05;Table 4).

Blood glucose levels in patients in different clinical stages

The levels of fasting blood glucose and 2-h postprandial blood glucose in patients in stage III-

Table 5. Blood glucose levels in patients in different clinical stages (mmol/L)

Clinical stage	n	Fasting blood glucose	2-h postprandial blood glucose
Stage I-II	37	6.95±0.68	10.38±0.76
Stage III-IV	30	7.93±0.67	11.89±0.84
t		6.285	7.864
p		<0.001	<0.001

Table 6. Blood lipid levels in patients in different clinical stages (mmol/L)

Clinical stage	n	TG	TC	LDL-C	HDL-C
Stage I-II	37	1.14±0.43	3.76±0.63	2.74±0.67	1.02±0.43
Stage III-IV	30	1.12±0.45	2.98±0.57	2.71±0.64	0.81±0.32
t		0.283	6.203	0.291	5.315
p		0.778	<0.001	0.772	<0.001

For abbreviations, see text

Table 7. The inflammation levels in patients in different clinical stages

Clinical stage	n	IL-6 (pg/mL)	CRP (mg/L)	TNF-α (ng/mL)
Stage I-II	37	27.14±3.28	6.37±1.42	8.53±1.48
Stage III-IV	30	56.23±3.64	16.84±3.75	26.67±3.73
t		18.415	16.611	19.025
p		<0.001	<0.001	0.002

For abbreviations, see text

IV were markedly increased compared with those in stage I-II (p<0.05;Table 5).

Blood lipid metabolism in patients in different clinical stages

The patients in stage III-IV manifested evidently lower levels of TC and HDL-C than those in stage I-II (p<0.05;Table 6).

Changes in inflammation level in patients in different clinical stages

The levels of CRP, TNF-α, IL-6 in patients in stage III-IV declined significantly in comparison with those in stage I-II (p<0.05;Table 7).

Discussion

Ovarian cancer is a common tumor with high malignant potential. Relevant statistics have shown that ovarian cancer is one of the five major malignant tumors leading to death of patients, and its mortality rate is higher than that of uterine cancer [10,11]. There are many risk factors for development of ovarian cancer, including obesity, diet, delayed menopause, premature menarche, endometriosis and heredity [12]. Epithelial ovarian cancer accounts for 80-90% of ovarian malignancies. Due to its atypical symptoms in the early stage and the unsatisfactory early screening methods at present, the patients are often in the advanced stage when definitely diagnosed. In such a situation, even with standard treatment, the recurrence rate is very high, and the prognosis of the patients is extremely poor [13]. The traditional diagnostic indicators, including various tumor markers, are not highly specific for early gynecological tumors. Once notably elevated, they indicate that the tumors have developed significantly. Therefore, early effective diagnostic indicators are of great significance for the diagnosis and treatment of ovarian cancer.

Obesity, characterized by hyperglycemia, is an independent risk factor for ovarian cancer, and high blood glucose levels can increase the risk of this disease [14]. In this study, it was shown that the levels of fasting blood glucose and 2-h postprandial blood glucose of the observation group were significantly higher than those of the control group, and compared with those in stage I-II, those levels in patients in stage III-IV were markedly elevated (p<0.05). This is because glucose can provide more metabolic energy for tumor cells, meeting the needs of anabolism, keeping the tumor cells in an active state, thus

promoting their rapid growth. Cascades can be produced under a hyperglycemic environment *via* regulating insulin-like growth factor-1, thus activating the PI3K/AKT/mTOR signaling pathway and promoting the occurrence and development of ovarian cancer.

The blood lipid level is often used to describe the blood lipid metabolism state in the body, and metabolism disorders of blood lipids can serve as a predisposing cause of various diseases [15]. Relevant studies have confirmed that the blood lipid level is closely related to the occurrence and development of tumors. The lipids can provide the nutrients and energy required for the rapid growth of tumor cells [16]. The results of the present study indicated that the levels of serum TC and HDL-C of the observation group were lower than those of the control group, and they were notably lower in patients in stage III-IV than those in stage I-II (p<0.05). The reason is that the growth of ovarian cancer cells needs a large amount of energy, thus increasing the energy metabolism consumption and decreasing TC level. Cholesterol can provide nutrients for the synthesis of new cell membrane, and HDL-C can maintain the intracellular cholesterol level, which has a selective promoting effect on the efflux of excess cholesterol in the cells. During the development of ovarian cancer, the HDL-C receptor signaling pathway is activated, thus preventing the accumulation of intracellular cholesterol and resulting in a decrease of serum HDL-C level.

Inflammatory response is an important defense mechanism of the body. Relevant studies have proven that about 15% of malignant tumors are associated with chronic inflammation, and the inflammatory response plays an important role in the occurrence and development of malignant tumors [17]. TNF-α is a soluble peptide cytokine that can promote the occurrence and development of ovarian cancer, initiate the inflammatory responses and trigger the cascades [18]. CRP is an acute-phase reaction protein which can not only reflect the inflammation level in the body but also stimulate cell activation and enhance leukocyte phagocytosis. Its level is elevated during the onset of tumors, which can increase the risk of early tumor and have close correlations with the development and metastasis of tumor [19]. IL-6 is a dual-function cytokine that plays an important role in the occurrence and development of tumors [20]. The levels of CRP, TNF-α and IL-6 in the observation group and in patients in stage III-IV disease were obviously higher than those in the control group and those in stage I-II,

respectively (p<0.05). This is because TNF-α induces the proliferation of ovarian cancer as well as the expression of VEGF, stimulating the formation of new blood vessels and promoting the spread of ovarian cancer cells. When stimulated by external factors, the ovarian tissue is damaged and transformed into malignant tumor, where the microcirculation is damaged and the ovarian antigen-handling capacity is strongly decreased. Necrotic tissues or tumor cells will stimulate the release of large amounts of CRP and IL-6, promoting the infiltrative growth and metastasis of ovarian cancer.

Conclusions

In summary, the blood glucose, blood lipid and inflammation indicators in the ovarian cancer patients have important clinical significance for the diagnosis. The symptoms of advanced ovarian cancer can be eliminated or alleviated by targeted therapies using these cytokines, and the quality of life and survival of the patients can be improved.

Conflict of interests

The authors declare no conflict of interests.

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