

Alterations of Estrogen, Calcium, and Membrane Potential in Uterine Fibroid Patients

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ABSTRACT

Aim: This study is aimed at evaluating the level of estrogen, calcium, and membrane potential in women with the uterine fibroid (UF). **Materials and Methods:** The study was conducted at the Federal Medical Centre, Owerri, Imo state. A total of 50 subjects were recruited for the study, of which 30 are subjects suffering from UF, while 20 are healthy subjects (controls). Blood sample was collected from the subjects the parameters evaluated using standard laboratory procedures. The result gotten was analyzed using SPSS version 21, and the value of significance was set at $P < 0.05$. **Results:** Estrogen concentration was statistically significantly increased ($P < 0.05$) in UF patient when compared with the control subjects. There was no statistically significant difference ($P > 0.05$) in the mean value of calcium concentration in UF when compared to controls. There was no statistically significant difference ($P > 0.05$) in the mean value of sodium ion concentration in UF when compared to controls. There was no statistically significant difference ($P > 0.05$) in the mean value of potassium ion concentration in UF when compared to controls. There was no statistically significant difference ($P > 0.05$) in the mean value of chloride ion concentration in UF when compared to controls (103.99 ± 3.53 mmol/L). There was a statistical significant increase ($P < 0.05$) in the mean value of membrane potential in UF patient when compared to controls. **Conclusion:** UF is associated with an increased level of estrogen and membrane potential, but there was no significant alteration in the level of sodium, potassium, and chloride ion in women with UF.

Key words: Calcium, membrane potential, estrogen, uterine fibroid

INTRODUCTION

Uterine fibroids (UFs) originate from the myometrium and it is benign, monoclonal tumors of the female genital tract.^[1] They are diagnosed in many women, and their development depends on various exposing factors.^[2] They are tumors with a great public health problem. The major UF-dependent symptoms include abnormal, excessive uterine bleeding, pain, infertility, and obstetric pathologies.^[3]

Some studies have reported on the risk factors for UF occurrence.^[4] These include advanced age, increased body mass index, positive family history, and genetic predisposition. Fibroid growth depends mostly on steroid hormones.^[5]

The essential role of estrogens in the pathophysiology of UFs is by the fact that UFs rarely occur before menarche and decrease after menopause. It influences cellular physiological and pathological pathways through various mechanisms.^[6] This interacts with estrogen receptor (ESR) α and ESR β , which are members of the nuclear receptor family of intracellular receptors.^[7]

Calcium ions are important upstream signaling molecules that tend to start cell contractions. The calcium channel proteins are molecular switches in signal transduction, and they not only regulate cell contraction. It is involved in cell cycle regulation which is strictly linked with various tumors as well as oncogenic pathways.^[8]

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Membrane potential is known as transmembrane potential or membrane voltage which is the difference in electric potential between the interior and the exterior of a biological cell (Bruce, 2014). As regards the exterior of the cell, the differences in the concentrations of ions on opposite sides of a cellular membrane lead to a voltage called the membrane potential.^[9]

UF is the most common benign tumor of female reproductive organs.^[10] Some reports suggest that UF is associated with estrogen, androgen, and abnormal cell proliferation. However, the exact pathogenesis still remains unclear so far.^[11] Due to the dearth of knowledge on the level of calcium, estrogen, and membrane potential in fibroid patient, the study is aimed at evaluating estrogen, calcium, and membrane potential in UF patient.

MATERIALS AND METHODS

Study Population

A total of 50 subjects were recruited for the study, of which 30 are subjects suffering from UF, while 20 are healthy subjects (controls).

Sample Collection

In all subjects, about 5 ml of various blood were collected by venepuncture technique from an antecubital vein with 5 ml disposable syringe. The whole blood samples were dispensed into a centrifuge test tube with anticoagulants and were immediately labeled for proper identification. The centrifuge test tubes containing the whole blood sample were allowed to stand for about 20 min for the whole blood sample to clot. After that, the centrifuge test tubes were loaded in the centrifuge and were spun at 10,000 rpm for 10 min using wisperfuge model 1384 centrifuge. The supernatant plasma was separated from the sedimented clothed blood by using Pasteur pipette to collect the serum and transferred it into a sterile plasma sample tubes again properly labeled. The plasma samples collected were used for all estimations.

The level of serum oestradiol was determined using ELISA method,^[12] while serum calcium was determined by colorimetric method based on the principle in which calcium ions form a violet complex with O-Cresolphthalein complex one in an alkaline medium. The absorbance of the test is read at 570 nm.^[13]

RESULTS

The levels of serum estrogen was significantly increased in uterine fibroid when compared with control at $P < 0.05$ as shown in Table 1. While the level of calcium in uterine fibroid was not significantly affected when compare with normal healthy subjects (control) at $P > 0,05$ [Table 1].

Table 1: The levels of serum estrogen and calcium in uterine fibroid and normal healthy subjects (control)

Parameters	Uterine fibroid	Control	P-value
Estrogen (pg/ml)	40.00±20.8*	20.80±8.48	0.02
Calcium (mmol/l)	2.43±0.92	2.38±0.3	0.340

*Significantly increased when compared with control at $P < 0.05$

Table 2: The levels of membrane potential in uterine fibroid and control

Parameters	Uterine fibroid	Control	P value
Membrane potential (mV)	10.90+1.00*	9.23+2.11	0.037

*Significantly increased in uterine fibroid when compared with control at $P < 0.05$

Similarly, the level of membrane potential in uterine fibroid was significantly increased when compared with control at $P < 0.05$ as shown in Table 2.

DISCUSSION

UF usually involves the proliferation of the smooth muscle cells in the uterus 5 (Bulun, 2013) which scarcely linked to symptoms. Though However, earlier identification and management could preserve the uterus.^[14]

The present study reveals that estrogen concentration was statistically significantly increased ($P < 0.05$) in UF patient when compared with the control subjects. This is in agreement with the study that reported an increase in UF growth rates as seen in the hyperoestrogenic state.^[15] Estrogen is linked with elevated proliferation of cells.

On the other hand, there was no statistically significant difference ($P > 0.05$) in the mean value of calcium concentration in UF when compared to controls. This result is in disagreement with another research report^[16] which reported an elevated calcium level. Some factors such as diet, medication, and environmental exposure might be associated with these differences in result.

There was a statistical significant increase ($P < 0.05$) in the mean value of membrane potential in UF patient when compared to control. Membrane potential is due to differences in concentration and permeability of important ions across a membrane. Due to the unequal concentrations of ions across a membrane, the membrane has an electrical charge.^[17] These changes indicate action potentials. This may likely give cells the ability to send messages around the body. The significant increase in membrane potential in women with UF connotes an increase in the activity of electric charges.

CONCLUSION

UF is associated with an increased level of estrogen and membrane potential in women with UF.

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