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# Evaluation of some biochemical parameters in fluid cysts and serum in different types of ovarian cysts

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## Abstract

Despite their high prevalence in women of different age, the aetiopathogenesis of ovarian cysts (O.C.) unknown. This study is aimed to evaluate the total protein bound hexose (TPHex), total protein (TP), total carbohydrate (TCHO), lactate dehydrogenase (LDH) and iron ($Fe^{+2}$) in fluid of function, benign, and malignant ovarian cyst. Also demonstrate the change in serum PHex and LDH (of patients with ovarian cyst) and their roles in diagnosis of patients with malignant ovarian cyst. A cross sectional study included sixty- seven women with ovarian cyst (ten of them with functional cyst, thirty two with benign neoplastic cyst and twenty five of them with malignant ovarian cyst). Twenty-six healthy women as a control group also participated in the current study. The age of subjects ranged from (twelve to sixty-seven) years. Different biochemical parameters were carried out in ovarian cyst fluid (O.C.F.) and in serum include (TPHex), total protein (TP), total carbohydrate (TCHO), lactate dehydrogenase (LDH) and iron ($Fe^{+2}$). In the present study, a comparative study of biochemical parameters revealed that a significant increase in fluid (TPHex), total protein (TP), total carbohydrate (TCHO), lactate dehydrogenase (LDH) and iron ($Fe^{+2}$) levels in malignant and benign ovarian cyst when compared with functional ovarian cyst, also there is a significant increase in malignant (O.C.F.) compared with benign (O.C.F.). In the serum, our study shows a highly significant elevation in PHex and LDL enzyme in patients with malignant and benign ovarian cysts compared with serum PHex and LDL of normal healthy control, while there is insignificant difference in serum PHex level in patients with malignant ovarian cyst compared with that of patients with benign ovarian cyst. There is no correlation between level of PHex in serum and fluid, while There is a direct correlation between LDH level in serum and fluid cyst. In conclusion**,** both fluid and serum LDH level can considered as a tumour marker for malignant ovarian cyst also there is a direct correlation between serum and fluid. Fluid TCHO level have a useful role in diagnosis of benign and malignant ovarian cyst. Iron is useful in differentiating endometrioid cyst from other types of cysts, but it is not useful in differentiating benign from malignant ovarian cyst.

**Keywords:** Ovarian cysts; PHex and LDL; Fluid TCHO

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**Introduction**

Ovarian cyst is commonly revealed in women of reproductive age commonly as well as in those undergoing check-ups for infertility. *(Practice Committee of the American Society, 2012)*.Ovarian cyst is a collection of fluid that comes from an ovary, and growths like blister Roett MA et.al. ,2009 ). Ovarian cysts usually small and subside by themselves. However, sometimes they grow large and cause problems (Roett MA et.al. ,2009; Wu AM.2019 ). The differential diagnosis of an ovarian cyst discovered in women of reproductive age is broad, including physiologic or functional cysts, , inflammatory etiologies such as a tubomovarian abscess, endometrioma, or benign and malignant ovarian neoplasms, ectopic pregnancy. *(Practice Committee of the American Society, 2012)*. Ovarian cancer is difficult to diagnose early. It is one of the classical hidden malignancies that is why a need for biochemical or immunological methods for detecting (Lheureux S *et al*, 2019; , Mukherjee S *et. al*.2021 ). Biologic markers (commonly termed "biomarkers") that are used to aid in the diagnosis of OC are an active area of investigation, and have been identified in serum, urine, ovarian cyst fluid, ascites, and other body fluids (Li, 2021).Serum is the most common source in the search for new biomarkers, but proteomic profiles of urine and ascites have also been evaluated (Kristjansdottir B, 2012]. Because the blood proteome contains contributions from all organ systems in the body, an alternative approach is the proteomic analysis of a proximal fluid, such as ductal or cystic fluids in breast- or pancreatic cancer, and in such case cyst fluids from the ovary (Hanash SM,*et.al*.,2008). The ovarian cyst fluid probably represents the local microenvironment, containing proteins, carbohydrate, enzymes, minerals secreted directly by ovarian tumor cells, surrounding stroma and other cells involved in the tumorigenesis. Early pathological changes within this organ may therefore be reflected in proteomic patterns found in ovarian cyst fluid before secretion into the blood stream. If so, biomarkers in the cyst fluid may be used as direct targets for new diagnostic imaging techniques in early stage ovarian cancer. Few discoveries of markers for diagnostics and prognosis have been reported in studies of ovarian cyst fluid (Sundfeldt K *et.al.* 2001; Ott HW. *et.al.* 2003), but ovarian cysts, especially those that are malignant, have higher concentrations of proteins and enzymes than diluted serum and urine (Savant SS,2018).

The present study was designed to attempt a comparison of protein bound hexose (TPHex), total protein (TP), total carbohydrate (TCHO), lactate dehydrogenase (LDH) and iron ( $Fe^{+2}$) level in cystic fluid between samples from patients with malignant and those with benign and functional ovarian cysts. also, a comparison of protein bound hexose (TPHex), lactate dehydrogenase (LDH) and $Fe^{+2}$ levels of serum and cystic fluid between samples from patients with malignant and those with benign ovarian cysts and healthy women.

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**Patient and Methods**

A cross-sectional and case control study was carried out on sixty-seven patients with ovarian tumour aged 12 to 67 years were studied during their admission at the Gynaecology and Obstetrics Department of Al-Yarmouk Teaching Hospital and Al-Habybyia Hospital during period of December 1999 to 2000, with clinical features and Ultasound findings suggest of ovarian cysts. All ovarian cysts submitted for pathologic examination. And 26 healthy women volunteer as a control group. Ten 10 of ovarian cysts were functional cyst, 32 were benign neoplastic and 25 malignant ovarian cysts. Ovarian cysts that ruptured during surgery were excluded from this study as well as any fluid that contaminated with blood or any substance.

2.3. Cystic fluid and Blood:

Five to ten ml of ovarian cyst fluid was aspirated directly from cyst during operation Cystic fluids were centrifuged to remove any solids and supernatants . the supernated was divided into aliquots according to the test planed to be done. Some of these aliquots were stored at 2-8°C and used in the same day of collection for the determination LDH enzyme the remainder wre frozen at -20°C until the day of analysis.. The surgically resected specimens of the

ovaries were sent for histopathology.

Blood samples of 5 ml were drawn pre-operative from 26 patients and from 25 normal healthy control women. blood was allowed to clot at room temperature for 30 min and subsequently samples were centrifuged at 5 000 rpm for 10 min. Serum was collected, aliquoted and stored at −20 °C until time of analysed.

All ovarian cyst fluid were analyzed for, protein bound hexose (TPHex), total protein (TP), total carbohydrate (TCHO), lactate dehydrogenase (LDH) and iron ( $Fe^{+2}$) ion. While serum sample of patients were analyzed for TP and LDL.

**Methods:-**

The glycoprotein (protein- bound hexose) in fluid and serum were determined by the orcinol reaction (Rimington C,1940), total carbohydrate determined calorimetrically by sulfuric acid (Hewitt BR,1958), total protein was determined calorimetrically (Doumas BT,*et.al.*1981), serum and fluid LDL was determined calorimetrically in lkaline medium. (Burd JF,and Usategui-Gomez M,1973) , ferric iron was determined calorimetrically (Ceriotti F,*et.al*. 1980).

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**Data and Statistical Analysis**

Statistical analysis was performed utilizing SPSS Statistics Version 23.0. Results are presented as mean ± standard deviation. Association between LDL levels in ovarian cysts and serum was evaluated by Pearson correlation analysis.

**Results**

This study was conducted on 67 women with ovarian cyst enrolled during the period from 12/1999 to 7/2000. The number and type of ovarin cysts shows included in this study demonstrated in Table 1.

**Table 1.**
The number and type of ovarian cysts

| Main type of ovarian cysts | subtype | | number | total |
|---|---|---|---|---|
| Functional cyst | Follicular | | 6 | 10 |
| | Theca lutein | | 4 | |
| Benign neoplastic | Epithelium tumor | serous | 12 | 32 |
| | | Mucinous | 10 | |
| | | Endometroid | 5 | |
| | Germ cell tumor | Dermoid | 3 | |
| | | Teratoma | 2 | |
| Malignant cyst | serous | | 13 | 25 |
| | Mucinous | | 12 | |

**Table2.**
Biostatisticial calculation for protein bound hexose in fluid of non-neoplastic functional, benign neoplastict and malignant ovarian cyst.

| Main type of ovarian cysts | subtype | | number | mean±SD (mg/dl) | Probability P |
|---|---|---|---|---|---|
| Functional cyst | | | 10 | 42.77±16.59 | |
| Benign neoplastic | Epithelium tumor | Serous + Mucinous | 22 | 94.24±53.09 | <0.05 |
| | | Endometroid | 5 | 940.6±157.0 | <0.00005 |
| | Germ cell tumor | | 5 | 580.8±381.32 | <0.0005 |
| Malignant cyst | | | 25 | 575.71±277.82 | <0.0005 |

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**Table 3.**
Fluid protein bound hexoses (PHex) (mg/dl) level in non-neoplastic functional cysts (follicular, theca lutein), benign neoplastic cyst (epithelium tumor, germ cell tumor) and malignant ovarian cyst (serious, mucinous)

| type of ovarian cysts | | | Fluid pHex (mg/dl) | |
|---|---|---|---|---|
| | | | Mean± SD | Range |
| Functional cyst | Follicular | | 44.81±21.01 | 25-76.7 |
| | subtype | | 39.72±8.04 | 30-49.67 |
| Benign neoplastic | Epithelium tumor | serous | 66.04±53.22 | 20.06-173.36 |
| | | Mucinous | 128.06±27.70 | 81.52-156.7 |
| | | Endometroid | 940.68±157.70 | 716.3-1150.2 |
| | Germ cell tumor | Dermoid | 855.95±47.62 | 803.61-896.73 |
| | | Teratoma | 168.07±96.72 | 100-236.15 |
| Malignant cyst | serous | | 346.39±180.18 | 29.91-641.3 |
| | Mucinous | | 824.14±59.32 | 736.69-903.26 |

**Table 4.**
Biostatisticial calculation for serum protein bound hexose in sera of healthy control women, women with non-neoplastic functional, benign malignant ovarian cysts.

| Groups | number | mean±SD (mg/dl) | P=**value** |
|---|---|---|---|
| Healthy control | 25 | 122.5±13.21 | |
| Benign ovarian cyst | 20 | 133.85±18.79 | *<0.00005 |
| Malignant ovarian cyst | 5 | 142.33±9.11 | *<0.0005<br>**<0.05 |

*t-test comparison between patients with benign and malignant ovarian cyst with normal healthy control women p <0.00005.
**t-test comparison between patients with benign and malignant ovarian cyst p <0.05.

Table 5 : Correlation between serum and ovarian cyst fluid level glycoprotein.

| | Fluid ovarian cyst pHex (mg/dl) |
|---|---|

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| | | |
|---|---|---|
| | **r** | **P-value** |
| Serum pHex (mg/dl) | 0.0521 | p>0.05 |

Table 6:- :- Biostatisticial calculation for total carbohydrate in fluid of non-neoplastic functional, benign neoplastic and malignant ovarian cyst.

| Main types of ovarian cysts | number | Mean±SD (g/dl) | Probability P |
|---|---|---|---|
| Functional cyst | 10 | 0.007±0.002 | |
| Benign neoplastic | 32 | 0.016±0.015 | *<0.005 |
| Malignant cyst | 25 | 0.031±0.013 | *<0.005<br>**>0.25 |

*t-test comparison between functional O.C.F. with benign and malignant ovarian cyst fluid **t-test comparison between benign O.C.F and malignant O.C.F. p >0.05 non-significant.

Table 7:- the predictive values of total carbohydrate level in malignant ovarian cyst fluid using 0.009g/dl and 0.3g/dl as a cut-off values.

| | Cut-off value= 0.009 g/dl | Cut-off value= 0.03 g/dl |
|---|---|---|
| Sensitivity | 84% | 56% |
| Specificity | 70% | 81% |
| Positive predictability | 87.5% | 66.6% |
| Negative predictability | 63.6% | 62.5% |
| Efficiency test | 80% | 68.4% |

Table 8:- Fluid total carbohydrate (TCHO) (g/dl) level in non-neoplastic functional cysts (follicular, theca lutein), benign neoplastic cyst (epithelium tumor, germ cell tumor) and malignant ovarian cyst (serious, mucinous)

| types of ovarian cysts | Fluid TCHO (g/dl) |
|---|---|

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| | | | Mean± SD | Range |
|---|---|---|---|---|
| Functional cyst | Follicular | | 0.007±0.003 | 0.003-0.009 |
| | subtype | | 0.008±0.001 | 0.007-0.009 |
| Benign neoplastic | Epithelium tumor | serous | 0.005±0.003 | 0.001-0.0095 |
| | | Mucinous | 0.034±0.031 | 0.0087-0.00411 |
| | | Endometroid | 0.008±0.004 | 0.0089-0.0101 |
| | Germ cell tumor | Dermoid | 0.023±0.006 | 0.018-0.03 |
| | | Teratoma | 0.007±0.005 | 0.0074-0.0075 |
| Malignant cyst | serous | | 0.024±0.011 | 0.0064-0.0037 |
| | Mucinous | | 0.039±0.012 | 0.0084-0.0049 |

Table 9:- :- Biostatisticial calculation for LDL enzyme in fluid of non-neoplastic functional, benign neoplastic and malignant ovarian cyst

| Main types of ovarian cysts | number | mean±SD (IU/L) | Probability P |
|---|---|---|---|
| Functional cyst | 10 | 43.89±6.26 | |
| Benign neoplastic | 32 | 145.41±90.71 | *<0.0005 |
| Malignant cyst | 25 | 379.32±100.74 | *<0.0005<br>**<0.0005 |

*t-test comparison between functional O.C.F. with benign and malignant ovarian cyst fluid.
**t-test comparison between benign O.C.F and malignant O.C.F.

Table 10:- the predictive values of LDL enzyme level in malignant ovarian cyst fluid using 50.15 IU/L and 236.12 as cut-off value.

| | Cut-off value= 50.15 IU/L | Cut-off value= 236.12 IU/L |
|---|---|---|
| Sensitivity | 96% | 80% |
| Specificity | 90% | 90.6% |
| Positive predictability | 96% | 86.9% |
| Negative predictability | 90% | 85.3% |
| Efficiency test | 94% | 87.7% |

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Table 11:- Fluid LDL (IU/L) level in non-neoplastic functional cysts (follicular, theca lutein), benign neoplastic cyst (epithelium tumor, germ cell tumor) and malignant ovarian cyst (serious, mucinous)

| types of ovarian cysts | | | Fluid LDL( IU/L) | |
|---|---|---|---|---|
| | | | Mean± SD | Range |
| Functional cyst | Follicular | | 45.39±6.67 | 34.93-53.12 |
| | subtype | | 41.65±5.71 | 34.9-47.5 |
| Benign neoplastic | Epithelium tumor | serous | 147.72±111.66 | 74.69- 450.1 |
| | | Mucinous | 144.03±41.7 | 96.78-232 |
| | | Endometroid | 199.5±107.77 | 199- 374.6 |
| | Germ cell tumor | Dermoid | 43.7±3.15 | 40.1- 46 |
| | | Teratoma | 80.11±7.66 | 74.69- 85.54 |
| Malignant cyst | serous | | 388.78±79.4 | 220- 455.42 |
| | Mucinous | | 368.81±122.58 | 42.2-467.1 |

Table-12: Biostatisticial calculation for serum LDL enzyme level in sera of healthy control women, women with non-neoplastic functional, benign malignant ovarian cysts.

| Group | number | mean±SD (IU/L) | P=**value** |
|---|---|---|---|
| Healthy control | 25 | 134.88±30.6 | |
| Benign ovarian cyst | 20 | 200±111.24 | **<0.00005 |
| Malignant ovarian cyst | 5 | 335.34±57.26 | **<0.0005<br>*<0.05 |

*t-test comparison between patients with benign and malignant ovarian cyst with normal healthy control women p <0.00005.

**t-test comparison between patients with benign and malignant ovarian cyst p <0.05.

**Table 13 :** Correlation between serum and ovarian cyst fluid level LDL enzyme.

| | Fluid ovarian cyst LDL (IU/L) | |
|---|---|---|
| | **r** | **P-value** |

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| | | |
|---|---|---|
| Serum LDL (IU/L) | r= 0.454 | p<0.05 |

Table14:- Biostatisticial calculation for iron in fluid of non-neoplastic functional , benign neoplastic and malignant ovarian cyst.

| Main types of ovarian cysts | Subtypes | | number | mean±SD (umol/L) | Probability P |
|---|---|---|---|---|---|
| Functional cyst | | | 10 | 60.67±10.52 | |
| Benign neoplastic | Epithelium tumor | Serous + Mucinous | 22 | 66.75±9.79 | >0.05 |
| | | Endometroid | 5 | 1882.35±66.22 | |
| | Germ cell tumor | | 5 | 79.96±10.11 | <0.005 |
| Malignant cyst | | | 25 | 68.75±15.54 | <0.0005 |

Table 15k:- Fluid iron (umol/L) level in non-neoplastic functional cysts (follicular, theca lutein), benign neoplastic cyst (epithelium tumor, germ cell tumor) and malignant ovarian cyst (serious, mucinous)

| types of ovarian cysts group | | | Fluid iron( umol/L) | |
|---|---|---|---|---|
| | | | Mean± SD | Range |
| Functional cyst | Follicular | | 58.03±12.33 | 48.9- 79..8 |
| | subtype | | 64.62±6.63 | 57.8- 70.9 |
| Benign neoplastic | Epithelium tumor | serous | 63.44±10.87 | 50.12- 80.7 |
| | | Mucinous | 70.76±6.75 | 53.8- 78.01 |
| | | Endometroid | 1882.35±47.58 | 1790- 1974.46 |
| | Germ cell tumor | Dermoid | 77.66±2.82 | 75.1- 80.96 |
| | | Teratoma | 83.4±18.8 | 70.1- 96.7 |
| Malignant cyst | serous | | 65.3±11 | 43.56- 76.35 |
| | Mucinous | | 71.9±19.98 | 40.7- 94.2 |

**Ovrain cyst fluid protein bound hexose (PHx)**

The results of this study revealed highly significant elevation of pHex in malignant ovarian cyst fluid (575±277 mg/dl), germ cell tumor (580±381 mg/dl) and endometroid (940± 157 mg/dl) compared with functional ovarian cyst fluid (42.77±16 mg/dl) , p≤0.0005, p≤0.005, p≤0.0005

respectively, also there is a significant elevation in mean pHex level of epithelium cell tumor (serous and mucinous O.C.F.) (94.24±53.02 mg/dl) compared with functional cyst ( p≤0,05) table- 2.

Table -3 represented the mean of pHex level expressed as mg/dl in subtype of O.C. comparing to each other. The highest level was found in endometrioid cyst (940.68± 15.77 mg/dl) while the lowest level was found in functional theca lutein cyst (39.72±8.04 mg/dl).

**Ovrain cyst fluid protein bound hexose (PHx):-** this study revealed highly significant elevation of serum pHex in patients with malignant O.CO. (142±9 mg/dl) and patients with bengin O.C. (133±mg/dl) compared with normal healthy control (122±13 mg/dl) p< 0.0005, <0.01 respectively, while there is no significant difference in serum pHex level in patients with malignant O.C. compared to patients with benign O.C. p> 0.05 table-4. Pearson's correlation test was used to investigate the probable correlation between serum pHex level and its level in O.C.F. as shown in table-5, there was no significant correlation between pHex level in O.C.F. and serum pHex of patients ( r=0.0521, p>0.05)

**ovarian cyst fluid total carbohydrate** :- O.C.F. TCHO level mean for malignant O.C. was ((0.031±0.013 g/dl) and for benign O.C.F. (o.o16±0.013 g/dl) while for functional O.C.F. (0.007±0.002 g/dl) . The difference between malignant and benign O.C.F. was very highly significant when compared to the functional O.C.F. (P<0.005, P<0.05 respectively while there was no significant difference in fluid TCHO level in malignant O.C.F. when compared with O.C.F. (P>0.1) table 6.

Table 7showed the criteria of diagnostic validity (sensitivity, specificity, positive predictability, negative predictability and efficiency test) of fluid TCHO in malignant O.C. compared to that of being O.C.F. using 0.007 g/dl and0.03 g/dl as cut-off values( 84%, 70%, 87.5%,63.6% and 80%) (56%, 81%, 66.6%68.5% and 68.4% ) respectively.

The increase in specificity from 70% to 81% and decrease in sensitivity from 84% to 56% using cut-off value 0.03 g/dl is to eliminate the moderate increase of fluid TCHO in benign O.C.F. so that we can differentiate the benign O.C. from malignant O.C. by using the fliud TCHO level.

Table 8 shows the mean of fluid TCHO level in subtype of ovarian cyst comparing to each other. The highest level is found inmalignant mucinous cyst (0.039±0.012 g/dl) while lowest level is found in functional follicular cyst ( 0.007±0.003 g/dl).

**Ovarian cyst fluid lactate dehydrogenase:** There was highly significant elevation in the mean of fluid LDH in malignant O.C. (379.32±100.74 IU/L) and benign O.C.F. (145.41±90.7

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IU/L) compared with functional O.C.F. (43.89±1.26 IU/L) p<0.005. also there is a significant increase in fluid LDH level in malignant O.C. compared to bengin O.C.F. P<0.005 table 9.

Tables 10 showed the criteria of diagnostic validity (sensitivity, specificity, positive predictability, negative predictability and efficiency test) of fluid LDH in malignant O.C. compared to that of being O.C.F. using 50.15 IU/L as cut-off value are 96%, 90%, 96%,and 90% respectively. Using 236.12 IU/L as a second cut-off value is to eliminate the moderate increase of fluid LDH in benign O.C.F. so that we can differentiate of the functional O.C. and benign O.C. from malignant O.C. by using the fluid DLH level.

Table 11 showed the mean of fluid LDH in subtype of O.C. malignant serouse cyst contain the high level of LDH (388.28±79.4 IU/L) while functional theca lutein cyst contain the lower level (41.65±5.71 IU/L.

**Serum lactate dehydrogenase enzyme:-**

The result presented in this study revealed highly significant elevation in mean of serum LDH level in patients with malignant O.C. (335.34±57.56 IU/L) and patients with benign O.C. (200±11.24 IU/L) when compared to normal healthy control (134.88±30.6 IU/L) ( p<0.0005. p<0.005 respectively). Also there was significant different in the level of serum LDH in patients with malignant O.C. and patients with benign O.C. table-12.

Our study showed a significant positive correlation (r= 0.454; p<0.05) between serum and O.C.F. LDH level in these cases fig 13.

**Ovarian cyst fluid iron ion:**

This study showed a highly significant elevation in mean level of fluid iron in benign neoplastic endometrioid cyst (1882.35 ±66.22 umol/L ) also there was a significant difference in mean level of fluig iron in germ cell tumor (79.96±10.11 um/L) compared with functional O.C. (60.67±10.5 um/L) (p<0.05) while there was no significant change in mean fluid iron in malignant O.C. (68.75±15.54 u,ol/L) and benign germ cell tumor (79.96±10.11 umol/L) compared with functional O.C. (p>0.05) table 14. table 15 showed the mean of fluid iron in subtype of O.C. the highest level was found in endometrioid cyst (188824.47±58 umol/L) while the lowest level was found in follicular functional cyst (58.03±12.33 umol/ L).

**Discussion**

Ovarian cyst and tumor are common condition in clinical practice (Albers CE, *et.al.* 2020). Their management depend on the type of the lesion whether it is functional or neoplastic.

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Fine needle aspiration is a simple and rapid method of sampling palpable or radiologically demonstrable masses in various sites of the body (Sheeja S*, et.al*.2021). Combination of cytology as well as biochemical examination of the aspirated fluid is expected to yield better results and more thorough understanding of the nature of ovarian cysts.

**Ovarian cyst fluid protein bound hexose (pHex) :**

During the last two decades, glycoproteins have been recognized as an important group of compounds found in all forms of life. (Gaunitz S,*el.al.,*2017). Recent study revealed that the 25% of benign O.C. had pHex level lies with rang of functional cyst, while 8% of malignant O.C. had pHex level lies with range of functional cyst. This result were in agreement with the findings reported by yonagi (Khomei Y,et.al. 1990). The high level of pHex in endometrioid cyst fluid due to pHex production from blood cells which are found in this type of fluid. In dermoid cyst the high level of pHex is due to sebaceous gland secretion found in this cyst. While in malignant ovarian cyst fluid, Kloppel and Morre postulated that the increase in protein bound carbohydrate arises as a result of depolymerisation of the ground substances of connective tissue adjacent to tumor, with substances release of these compounds into the circulation (Kloppel TM,and Morré DJ,1980) . other suggestion of elevation of the fluid pHex reflects merely the occurrence of tissue destruction (Kristjansdottir B*,et.al*. 2012).

Serum protein bound hexoses:- an increase in glycoprotein during inflammatory or oncogenic processes has been described, molecular varieties of serumglycoprotein have been reported (Cylwik B,et.al.,2005), and its conceivable that different types of tumor are responsible for different molecular variants of glycoprotein being synthesized and/ or released into blood stream(Zhang Z.et.al.2018). Our result obtained in this study revealed highly significant elevation of serum pHex in patients with malignant O.C. and patients with benign O.C. compared with control group. Ourresult was consistent with results reported by (Gaunitz S,*el.al.,*2017) and (Kori M, *et.al2021)*. The possible source of increased serum pHex in malignant disease dueto: first, pHex in production by the tumor. Second, inceased synthesis of pHex by the liver (Bose KS, et.al.. 2013 ). Wilma Delphine Silvia CR and his colleagues have suggested that the elevated release or plasma glycoprotein reflect merely the occurrence of tissue destruction and the tissue proliferation or repair is mor probable explanation as etiological factor for behaviour of glycoprotein in cancer (Wilma Delphine Silvia CR.*et.al*.2001)

**Ovarian cyst fluid total protein:**

Fluid TP had been studied by many authors, Sand and his colleagues (Sand JA.et.al.1996) reported that there was no significant difference in the level of TP in pancreatic pseudocyst fluid and neoplastic cyst fluid, while Demirci H, found a significant elevation of TP level in thyroid cyst fluid when compared with sera of normal human (Demirci H,et.al.2007).

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Our result were in agreement with the findings reported by Boss EA *et.al.* and were in disagreement with findings reported by Parker *et.al.* (Boss EA,et.al. 2001, Parker MF.et.al. 1999). Our explanation for the presesnce of TP in normal level in malignant O.C.F. maybe due to the balance between increased in protein synthesis and increase in protein break down.

**Ovarian cyst fluid total carbohydrate:-**

A different kind of repeating polydsaccharid is present in the cell surface and in the extracellular matrix of human cells. More complex and diverse carbohydrate unit are displayed by many integral membrane proteins and secreted proteins. the diversity and complexity of the carbohydrate unit of glycoproteins suggest that they are rich in information and functionally important so that carbohydrates guide many biological processes. Our results found in this study shown that there is a significant elevation in mean fluid TCHO in malignant and benign O.C. as compared to functional O.C.F.. the possible sources of an increased in fluid TCHO level in malignant ovarian cyst could be contributed to: firstly, the essential qualities of malignant cell are related to increase in binding of TCHO residues with glycoprotein of the cell surface and membrane, secondly, the high turnover of tumor cells and the consequently increased release supposedly cause high TCHO concentration in the fluid (Bose KS.et.al.2013 ). Our results exposed that can differentiate the benign ovarin cyst from malignant ovarian cyst by using the level of TCHO in O.C.F..

**Ovarian cyst fluid lactate dehydrogenase enzyme:-**

LDH is present in almost all the tissues of the body and variation in activity of LDH was encountered in different malignant neoplasms. The present study showed a highly significant elevation in the mean of fluid LDH in malignant and benign O.C. compared with functional O.C.F. the possible sources of an increased in fluid LDH in malignant cyst because malignant cells have a distinctive type of metabolism in which the glycolytic sequence and tricarboxylic acid cycle are poorly integrated, hence the cells tend to utilize From 5-10 times as much glucose as do normal cells, converting most of it into lactate (Schneider D.et.al. 1997).

**Serum lactate dehydrogenase enzyme:**

Serum LDH level was measured by many authors to determine its usefulness in detection, staging, and follow up after treatment in patients with different types of cancer. The rsults presented in this study revealed highly significant elevation in mean of serum LDH level in patients with malignant O.C. and patients with benign O.C. when compared to normal healthy control. Our results was in consistence with the results reported by Sheiko and Heart, Awais and Fujii *et.al.* (Sheiko MC, and Hart WR .1982; Awais GM 1983; Fujii S.*et.al*.1985) elevation of serum LDH activity in patients with malignant O.C. is due to increase in glycolysis in cytoplasm of malignant cells, accompanied by a high turnover rate .

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**Ovarian cyst fluid iron ion:**

Our study showed highly significant elevation in mean level of fluid iron in benign neoplastic endometrioid cyst and in germ cell tumor compared with functional O.C. while there was no significant change in mean fluid iron in malignant O.C. our results were in agreement with the findings reported by Lizuks (Iizuka M.*et.al*.1998). The high level of iron in endometrioties cyst because this type contain nodule of endometriosis and bleeding from this nodule gradually displaces the ovarian cortex, which becomes part of the cyst capsule (Guo SW,2015), so this fluid is rich with red blood cells and for this reason why this type of cyst contain iron in high amount.

**Conclusion**

**Competing interests**

The authors declare no conflict of interest.

**Ethics Statement**

This study has been approved by the Ethical Review Committee of the Shanghai University of Sport (approval number: 312672411BN112). The publication of any potentially identifiable images or data contained in the article requires personal written informed consent. The research team will provide consultations for all subjects and their families to answer any research questions. Before signing the informed consent form, after the patients and their families fully understand the research process, our team members will organize the patients to sign the informed consent form or withdraw from the research. All subjects or their guardians will sign informed consent. Authors tend to submit research results to peer-reviewed journals or academic conferences for publication.

**Authors' contributions**

All authors shared in the conception and design and interpretation of data, drafting of the manuscript and critical revision of the case study for intellectual content and final approval of the version to be published. All authors read and approved the final manuscript.

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