Annals of Hematology & Oncology

Open Access

Austin Publishing Group

Case Report

Primary Diffuse Large B-Cell Lymphoma of Ovary: Report of Cases and Literature Review

Zhang XF[1], Diao XL[2], Zhao YT[3], Wang GR[4], Wang SZ[1]* and Zhu L[1]*

[1]Department of Obstetrics and Gynecology, Beijing Chaoyang Hospital, Capital Medical University, Beijing, China

[2]Department of Pathology, Beijing Chaoyang Hospital, Capital Medical University, Beijing, China

[3]Department of Clinical Chemical Examination, Beijing Chaoyang Hospital, Capital Medical University, Beijing, China

[4]Department of Hematology, Beijing Chaoyang Hospital, Capital Medical University, Beijing, China

***Corresponding author:** Wang SZ, Department of Obstetrics and Gynecology, Beijing Chaoyang Hospital, Capital Medical University, Beijing, China

Zhu L, Department of Obstetrics and Gynecology, Beijing Chaoyang Hospital, Capital Medical University, Beijing, China

Received: May 30, 2022; **Accepted:** June 28, 2022; **Published:** July 05, 2022

Abstract

Objective: Our study aimed to review the characters of primary diffuse large B-cell lymphoma (DLBCL) of ovary and provide recommendations of management for this rare disease.

Methods: We presented 4 cases of primary ovarian DLBCL (PODLBCL) from Beijing Chaoyang Hospital between 2003 and 2021. Furthermore, we searched PubMed and Web of Science database for literature published between 1998 and 2021.A total of 16 articles included 24 cases with histopathologically confirmed PODLBCL and detailed evaluation and follow-up were reviewed.

Results: The median age of patients with PODLBCL was 43y (5-73y). The main clinical symptoms were pelvic mass, abdominal pain, followed by irregular vaginal bleeding and urinary incontinence. 25% patients had bilateral ovarian tumors, and 61.1% of unilateral tumors were in the left ovary. Cancer antigen 125 (CA125) and serum lactate dehydrogenase (LDH) were usually elevated to varying degrees. Most cases were diagnosed by surgery and presented in early stage. Treatments included surgery, chemotherapy and monoclonal antibody therapy. There was no evidence of recurrence within a median follow-up time of 20 months (range 5-72 months) in 79.1% (19/21) of patients.

Conclusions: PODLBCL had no significantly specific character to distinguish from ovarian epithelial malignant tumors. The prognosis of patients with PODLBCL was usually good. We proposed that chemotherapy combined with monoclonal antibody therapy may be the first-line treatment for PODLBCL, and surgical resection of the tumor may be avoided. The key problem is how to make an early preoperative diagnosis. Therefore, more case reports and institutional studies are needed to confirm these conclusions.

Keywords: Diffuse Large B-Cell Lymphoma; Primary Ovarian Lymphoma; Management

Abbreviations

DLBCL: Primary Diffuse Large B-Cell Lymphoma; PODLBCL: Primary Ovarian DLBCL; POL: Primary Ovarian Lymphoma; CA125: Cancer Antigen 125; LDH: Lactate Dehydrogenase; NHL: Non-Hodgkin Lymphoma; PLFGT: Primary Lymphoma of the Female Genital Tract; CEA: Carcinoembryonic Antigen; LCA: Leukocyte Common Antigen; R-CHOP: Cyclophosphamide, Vincristine, Doxorubicin, Prednisone, and Rituximab; CNS: Central Nerve System; GCB: Germinal Center B-Cell-Like Lymphoma; IPI: The International Prognostic Index; ECOG: Eastern Cooperative Oncology Group; OS: Overall Survival; NCCN: National Comprehensive Cancer Network; PD-L1: Programmed Cell Death Ligand-1.

Introduce

Although reports of lymphoma involving the reproductive tract have become more common recently, the initial presentation of lymphoma as an ovarian mass is rare and is called as primary ovarian lymphoma (POL), accounting for 0.5% of all non-hodgkin lymphoma(NHL)cases and 1.5% of all ovarian tumors [1]. Nasioudis et al. conducted the largest cohort study on primary lymphoma of the female genital tract (PLFGT) and showed that POL accounts for 37% of all PLFGT cases [2]. Diffuse large B-cell lymphoma is the most common type of POL [3] and the prognosis of primary ovarian DLBCL has been debated by researchers. According to literatures, there is no standard therapeutic management for PODLBCL because of its rarity [4]. Here, we reported 4 cases of PODLBCL in our institution andreviewed the cases in literatures, aimingat analyzing the clinical characteristics, prognostic factors, and treatment outcome of patients with PODLBCL.

Case 1

A 57-year-old post-menopausal womanvisited our hospital with complaints of urination frequency for a month and persistent high fever (>38.5°C) for 2 weeks. Past history is nothing remarkable. Physical examination revealed a large solid pelvic mass and bilateral lower extremity edema. Routine blood examination revealed severe macrocytic anemia and thrombocytopenia. An elevated C-reactive protein level at 91 mg/L was also noted. Serum tumor markers were positive forCA125 (217 U/mL). Laboratory examination revealed highly elevated LDH (543 U/L). Other laboratory examinations were all within normal limits. Ultrasonography showed a heterogeneous solid mass measuring 14×11×10 cm in the pelvis and the right urinary tract compressed by the large mass. No lymphadenopathy was noted. Bone

Citation: Zhang XF, Diao XL, Zhao YT, Wang GR, Wang SZ and Zhu L. Primary Diffuse Large B-Cell Lymphoma of Ovary: Report of Cases and Literature Review. Ann Hematol Oncol. 2022; 9(3): 1397.

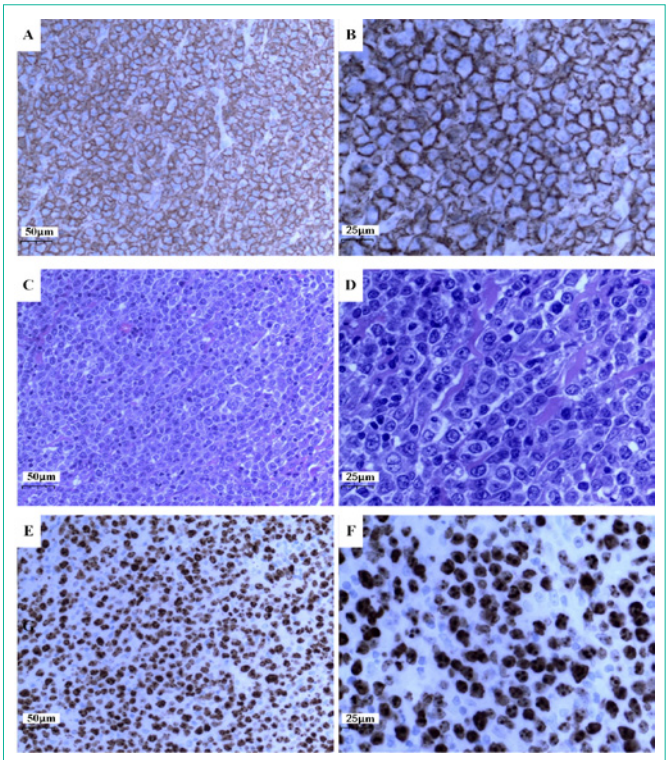

Figure 1: Immunohistochemical staining of diffuse large B-cell lymphoma of ovary. (A, B) The tumor is positive for CD 20 staining. Scale bar 50 μm and 25 μm. (C, D) the tumor is stained by hematoxylin-eosin. Scale bar 50 μm and 25 μm. (E, F) the tumor is positive for Ki67 staining. Scale bar 50 μm and 25 μm.

marrow biopsy and aspiration were normal. After transfusion with washed red blood cells and platelets, an exploratory laparotomy was performed. Approximately 500 ml dark red serous ascitic fluid and a 15cm multinodular solid mass were identified in the peritoneum. The normal anatomical structure of the Douglaspouch had disappeared. Histologic examination of anintraoperative frozen section from the mass showed a malignant neoplasm. As a result, a debulking surgery of the tumor was completed with a right salpingo-oophorectomy, partial omentectomy and appendectomy. Pathological examination revealed DLBCL of the right ovary (Figure 1). According to the Ann Arbor system, the patient had stage BE disease. The patient received 6 courses of R-CHOP (cyclophosphamide, vincristine, doxorubicin, prednisone, and rituximab). She was also administered intrathecal methotrexate (15 mg on day 2) to prevent central nerve system (CNS) relapse. Follow-up to 60 months after surgery showed no evidence of recurrence.

Case 2

A 30-year-old unmarried women presented to our clinic with a history of painless abdominal swelling of 2 months. She had nausea and an intermittent low fever for one month. Upon examination, a large pelvic mass with restricted mobility was detected. Laboratory studies showed lowed lever of hemoglobin 91.00g/L, elevated levels of CA125 andLDH, 175U/mL and 2864U/L, respectively. Other laboratory tests, including CA 199 and carcinoembryonic antigen (CEA), were within normal limits. Ultrasonography revealed bilateral solid adnexal mass, 14.9×8.8cm on left and 14.9×10.1cm on right. Bone marrow puncture showed no abnormality. There was no significant lymphadenopathy or distant metastasis.

The patient underwent laparotomy with presumed diagnosis of ovarian malignancy. Ascites in volume of 1500 ml and bilateral mass were removed. Intraoperative frozen section evaluation revealed a poorly differentiated tumor of ovary. The surgery included hysterectomy and bilateral salpingo oophorectomy. A diagnosis of stage IVE (Ann Arbor staging) diffuse large B-cell lymphoma was made. The patient was treated with 8 cycles of R-CHOP chemotherapy. Follow-up to the 29th month after the chemotherapy showed no evidence of recurrence.

Case 3

A 51-year-old grand multiparous woman presented with complaints of progressing abdominal pain for 8month. She had no significant medical or family history. She had used no medications. Physical examination revealed no significant mass in the abdomen. Laboratory studies showed elevated levels of CA125 and LDH, 555.90U/mL and 1140U/L, respectively. Ultrasonography revealed a few of ascetic fluid in the cul-de-sac and mild enlarged ovaries. Other laboratory tests, such as CA 199 and CEA were normal. Laparoscopic examination revealed a yellowish ascites of 500 ml, the greater omentum in a pie shaped, bilateral adnexa mass about 6cm in diameter, multiple implants ranging from 1cm to 5cm on the surface of peritoneum and the Douglas fossa sealed by tumor tissue. Biopsy was performed on the surface of the omentum and rapid freezing was performed to report malignancy. Intraoperative frozen section evaluation revealed a poorly differentiated epithelial tumor of ovary. The surgery included hysterectomy and bilateral salpingo oophorectomy along with omentectomy, pelvic and inguinal lymph node sampling, appendectomy, peritoneal cytology, part of the ileum and peritoneal biopsy. The diagnosis of diffuse large B-cell lymphoma was made and stage was assessed as IV BE according to the Ann Arbor system. Chemotherapy was not started due to her poor general condition and she died 2 months later.

Case 4

A 41-year-old grand multiparous woman presented to our clinic with symptoms of lower abdominal pain and frequent micturition for 1month.She had no significant medical or family history and she had used no medications. Upon examination, a 15×13cm abdominopelvic mass with restricted mobility was detected. Lab test data missed. Ultrasonography showed a 14×12×9cm, complex right adnexal mass with solid and cystic components. The surgery included hysterectomy and bilateral salpingo oophorectomy along with omentectomy, pelvic and inguinal lymph node sampling, appendectomy, peritoneal cytology, and peritoneal biopsy. A diagnosis of stage IV BE (Ann Arbor staging) diffuse large B-cell lymphoma was made. Bone marrow biopsy showed no evidence of malignant cells. A chemotherapy protocol comprising 8 cycles of R-CHOP regimen was administered to the patient. Follow-up to 228 months after chemotherapy showed no evidence of recurrence.

Literature Review

An extensive literature search was conducted to collect information on primary diffuse large B-cell lymphoma of the ovary. PubMed and Web of Science databases were searched for literature published between 1998 and 2021. Other papers are identified by

Table 1: Overview of the reported cases of primary ovarian DLBCL.

First author	Age (y)	Symptoms	Tumor size (cm)	CA125 (U/L)	LDH(U/L)	Surgery	Chemotherapy	Ann Arbor stage	Survival time (m)	Vital state
Dao AH 1998 [21]	20	Pelvic mass	L13	NA	1569	USO	CHOP	I	30	Live
R Vang 2001 [22]	41	Frequent micturition	L18	NA	NA	BSO	ChT	I	66	Live
	43	Abdominal pain	L8	NA	NA	BSO+TAH	ChT	I	72	Live
	59	Pelvic mass	R7.5	NA	NA	BSO	ChT	I	42	Live
Ambulkar I 2003 [23]	40	Ascites	L3.5+R5.5	131	580	CRS	CHOP	IV	24	Live
	24	Abdominal pain,ascites	R5.5	NA	406	BSO	CHOP	III	6	Live
Yamada Takashi 2003 [24]	47	Abdominal pain,ascites	10	2,448	1,323	Ns	CHOP	IV	72	Live
Weingertner AS 2004 [6]	36	B symptoms	L11	847	Normal	CRS	ACVBP	IV	12	Live
Chang Kil Jung 2004 [25]	29	Abdominal pain	R14	NA	2,450	USO	CHOP	I	12	Live
IslimyeTaskin M 2013 [3]	38	Ascites,vagina hemorrhage	L8.4	Normal	NA	USO	R-CHOP	I	24	Live
Senol T 2014 [26]	65	Ascites,B symptoms	L17.5	541	821	CRS	Nc	I	0.46	Die
	61	Abdominal pain,ascites	R16	312	417	CRS	R-CHOP	I	20	Live
	53	Abdominal pain,ascites,B symptoms	L8+R5.5	648	454	CRS	R-CHOP	IV	6	Live
	52	Abdominal pain	R13	41		USO	RCHOP	I	12	Live
	57	Abdominal pain	L13	220	2012		Nc	I	1	Die
Bhartiya R 2016 [27]	52	Abdominal pain,B symptoms	L10	NA	NA	USO	ChT	I	12	Live
Pavlovic A 2016 [28]	50	Abdominal pain,B symptoms	L12	Normal	Normal	CRS	R-CHOP	I	24	Live
Grigoriadis C 2017 [17]	38	Abdominal pain	L9	37.8	NA	USO	CHOP	II	60	Live
Guvvala SL 2017 [29]	37	Abdominal pain	R7+L9	766	654	CRS	CHOP	IV	18	Live
Khattar P 2018 [30]	15	Abdominal pain	L11+R14	934.8	1245	Ns	ChT	IV	NA	NA
	5	B symptoms	R5	NA	255	Ns	R-CHOP	NA	NA	NA
Iizuka N 2020 [31]	73	B symptoms	L6	NA	517	CRS	R-CHOP	NA	NA	NA
Jerry Chin-Wei Chien 2020 [32]	45	Abdominal pain,ascites,B symptoms	L5+R11.5	1366	NA	CRS	ChT	IV	12	Live
Zivkovic K 2021 [33]	65	Abdominal pain	L5.5	Normal	NA	BSO	R-CHOP	NA	5	Live

L: left ovary, R: right ovary, TAH: total abdominal hysterectomy, BSO: bilateral salpingooophorectomy, USO: unilateral salpingooophorectomy, CRS: cytoreductive surgery, NA: not available, Ns: no surgery, Nc: no chemotherapy, CHOP: cyclophosphamide, vincristine, doxorubicin, prednisone, R: rituximab, ACVBP: doxorubicin, cyclophosphamide,vindesin,bleomycin, prednisone, ChT: chemotherapy, but the detail is not available.

"related articles" in PubMed. Use the following keywords: "diffuse large B cells", "lymphoma", "ovary", "primary", "non-Hodgkin". Literature search and selection are limited to English publications. Only histopathologically confirmed cases of primary diffuse large B-cell lymphoma of ovary with complete clinical information were included in this study.

Results

A total of 16 articles included 24 cases with histopathologically confirmed primary ovarian DLBCL and detailed evaluation and follow-up were collected (Table 1). There was no significantly specific character of ovarian DLBCL patient. Surprisingly, the age of patients ranged from 5 to 73 years old, with a median age of 43y, and 83.3% of patients were younger than 60y. The main clinical symptoms of patients were pelvic mass, abdominal pain, followed by irregular vaginal bleeding and urinary incontinence. There were 33.3% patients with symptom B and 33.3% patients with ascites. 25% patients had bilateral ovarian tumors, and 61.1% of unilateral tumors were in the left ovary. In most patients, CA125 and serum LDH were elevated to varying degrees, with CA125 up to 2448U/mL and LDH up to 1569 U/L.

Immunohistochemistry showed positive CD20 and leukocyte common antigen (LCA), negative CD3 and CD45RO in diffuse large B-cell lymphoma. The Ann Arbor stage at presentation was I in 57.1%, II and III in 4.8%, and IV in 33.3% of patients. Treatment included surgery in 83.3% (21/24) of cases and cytoreductive surgery account for 42.8 (9/21). In 4.2% (1/24) surgery was the only mode of treatment, with 12.5% (3/24) having chemotherapy only, and the rest having multimodal treatment. Rituximab was used in 33.3% (8/24) of the cases. There was no evidence of recurrence within a median follow-up time of 20 months (range 5-72 months) in 79.1% (19/21) of patients.

Table 2: Immumohistochemical staining of the cases.

Case	Immumohistochemical staining
1	CD20(+), CD21(+), CD3(-), CD10(-), LCA(+), Bcl-6(+), Bcl-2(+), Mom-1(+), CK(-), CyclinD1(-)
2	CD20(+), CD21(-), CD3(-), CD10(+), CD5(-), CD30(-), CD38(+), CD57clinp1(-), Bcl-6(+), Bcl-2(+), Pax-5(+), Ki-67 90%, Mum-1(+), C-myc(+), MO-2(+), CK(-), EMA(-), HMB-45(-), MelanA(-), S-100(-), Syn(-), CgA(-)
3	CD20(+), CD3(+), CD10(-), CD7(+), CD30(-), CD34(-), CD56(-), CD117(-), LCA(+), Bcl-6(+), Bcl-2(+), Mum-1(-), C-myc(+), CyclinD1(-), Ki-67 90%, CK(-), Vimentin(+), S100(-), SALL4(-), EMA(-)
4	CD20(+), CD3(-), CD5(-), CD8(-), CD79(+), LCA(+)

Discussion

Although it is difficult to distinguish whether an ovarian lymphoma is primary or secondary, this information is crucial for subsequent therapy. In 1976, Fox H et al. proposed the following criteria for the diagnosis of POL [5]:

At the time of diagnosis, the lymphoma should be clinically confined to the ovary, and a full investigation should have failed to reveal evidence of lymphoma elsewhere. The lymphoma can still be considered primary if it has spread to immediately adjacent lymph nodes or if it has directly invaded into immediately adjacent structures.

Peripheral blood and bone marrow should not contain any abnormal cells.

If further lymphomatous lesions are observed at sites remote from the ovary, at least several months should have elapsed between the appearance of the ovarian and extraovarian lesions.

According to the above criteria, the 4 patients were diagnosed as POL and the immumohistochemical staining of the cases were listed in (Table 2), which confirmed the diagnosis of DLBCL.

The manifestations of POL include B symptoms (fever, night sweat, or weight loss), abdominal pain, ascites and pelvic mass. However, B symptoms are not as necessary for POL as they are for generalized lymphoma [4]. The tumor is frequently bilateral and homogeneous, without ascites, and with diameter exceeding 5 cm [3]. Moreover, no concurrent lymphadenopathy or hepatosplenomegaly is usually observed at the time of diagnosis, but compression of the urinary tract by the mass is often reported [6]. Nevertheless, the overall clinical and imaging findings are often non-specific and cannot distinguish POL from other more common ovarian malignancies [7]. Most of the POL cases reported in the literature thus far have been diagnosed by postoperative pathological examination, and few cases have been diagnosed by fine needle aspiration cytology [8].

The most common histologic phenotype of POL is DLBCL, which is thought to have a good prognosis by most researchers [4,10]. The expression pattern of CD10, Bcl-6 and Mum-1 by immunohistochemistry can be used to categorize DLBCL into germinal center B-cell-like lymphoma (GCB) DLBCL and non-GCB DLBCL. GCB DLBCL expresses CD10 and/or is positive for Bcl-6 but negative for Mum-1, whereas non-GCB DLBCL is negative for CD10 and positive for Mum-1 [9]. B-cell lymphoma with concurrent MYC rearrangements and either Bcl-2 and/or Bcl-6 expression is called double-hit B-cell lymphoma and has a particularly poor prognosis [9,10]. But it is regrettable that our 4 patients were not examined for the MYC gene status.

CA125 is a glycoprotein expressed by epithelial ovarian cancer and is widely used to monitor ovarian cancer. Zi Dan J et al. found that CA125 levels were elevated in 43% of patients with low-grade NHL and in 46% of patients with aggressive non-Hodgkin lymphoma (NHL) and proposed that CA125 was an important prognostic factor in NHL, as it was correlated with more advanced disease and poor surviva [11]. These findings were confirmed by Sun J et al [9]. This is also consistent with our study that case 3 with the highest level of CA125 had the worst prognosis. With the remission of the disease, the CA125 level of case 1 decreased to normal, which can be used as an important indicator of tumor follow-up.

The International Prognostic Index (IPI) is a valuable prognostic indicator for patients with NHL who are treated with CHOP or CHOP-like regimens. The IPI assesses five risk point parameters, including age, number of extranodal sites, Eastern Cooperative Oncology Group (ECOG) performance status, serum LDH level and stage by the Ann Arbor system [12]. The high-risk subgroup (4 or 5 risk factors) is associated with a 26% 5-year overall survival (OS). With the advent of rituximab, using data from the National Comprehensive Cancer Network (NCCN) database collected during the rituximab era, a modified index known as the NCCN-IPI was contructed [13]. The NCCN-IPI employs a refined categorization of age and normalized LDH levels to better capture the associated increased risk of mortality. The NCCN-IPI is better than the IPI in discriminating low- and high-risk subgroups (5-year OS: 96% vs 33% and 90% vs 54%, respectively). In addition to the NCCN-IPI, researchers have been exploring other prognostic markers, such as uric acid levels [14], infiltrating $CD8^+$ T-cells, programmed cell death ligand-1(PD-L1) expression, absolute blood monocyte count, and serum iron, albumin, and beta2-microglobulin levels [15].

The R-CHOP/CHOP regimen is known as the standard treatment for NHL. Rituximab, a monoclonal antibody against CD20, is an immunotherapeutic agent that plays an important role in the treatment of CD20-positive B-cell lymphoma, including extranodal lymphoma [16]. Grigoriadis et al. have reported that rituximab may be a better choice for patients desiring to preserve their fertility [17]. As early as 2007, Signorelli M et al. proposed that a conservative management based on exclusive chemotherapy at early stages of PLFGT may be attempted in patients desiring to become pregnant [18]. Until now, several institutional reviews have revealed that surgical treatment is not associated with improved outcomes and that radical surgery could be avoided [2,19]. Data from a study by Kansara R et al. supported the use of high-dose methotrexate, which can penetrate all CNS barriers, for CNS prophylaxis [20].

In conclusion, ovarian DLBCL had no significantly specific character to distinguish from ovarian epithelial malignant tumors. The prognosis of patients with PODLBCL was usually good. In our

limited experience, we proposed that chemotherapy combined with a monoclonal antibody therapy may be the first-line treatment for PODLBCL, and surgical resection of the tumor may be avoided. The key problem is how to make an early preoperative diagnosis. Therefore, more case reports and institutional studies are needed to confirm these conclusions.

Conflicts of Interest

All of the authors have no relationship with companies, and have no financial interest.

References

1. Dimopoulos MA, Daliani D, Pugh W, Gershenson D, Cabanillas F, Sarris AH. Primary ovarian non-Hodgkin's lymphoma: outcome after treatment with combination chemotherapy. Gynecologic oncology. 1997; 64(3): 446-450. doi:10.1006/GYNO.1996.4583.

2. Nasioudis D, Kampaktsis PN, Frey M, Witkin SS, Holcomb K. Primary lymphoma of the female genital tract: An analysis of 697 cases. Gynecologic oncology. 2017; 145(2): 305-309. doi:10.1016/j.ygyno.2017.02.043.

3. Taskın MI, Gokgozoglu L, Kandemır B. Primary Ovarian Large B-Cell Lymphoma. Case Reports in Obstetrics and Gynecology. 2013; 2013: 1-3. doi:10.1155/2013/493836.

4. Zhao X, Hong X, Cao J, Leaw S, Guo Y, Li Z, et al. Clinical features and treatment outcomes of 14 cases of primary ovarian non-Hodgkin's lymphoma: a single-center experience. Medical Oncology. 2011; 28(4): 1559-1564. doi:10.1007/s12032-010-9578-0.

5. Fox H, Langley FA, Govan AD, Hill AS, Bennett MH. Malignant lymphoma presenting as an ovarian tumour: a clinicopathological analysis of 34 cases. Br J Obstet Gynaecol 1988; 95(4): 386-90. doi: 10.1111/j.1471-0528.1988.tb06611.x.

6. Weingertner AS, Hamid D, Roedlich MN, Baldauf JJ. Non-Hodgkin malignant lymphoma revealed by an ovarian tumor case report and review of the literature. Gynecologic oncology. 2004; 95(3): 750-754. doi:10.1016/J.YGYNO.2004.08.020.

7. Crawshaw J, Sohaib SA, Wotherspoon A, Shepherd JH. Primary non-Hodgkin's lymphoma of the ovaries: imaging findings. The British journal of radiology. 2007; 80(956): e155-e158. doi:10.1259/BJR/35049074.

8. Yadav R, Balasundaram P, Mridha AR, Iyer VK, Mathur SR. Primary ovarian non-Hodgkin lymphoma: Diagnosis of two cases on fine needle aspiration cytology. CytoJournal. 2016; 13: 2. doi:10.4103/1742-6413.173588.

9. Sun J, Zhang J, Ling Q, Luo Y, Wu S, Liang Z, et al. Primary diffuse large B-cell lymphoma of the ovary is of a germinal centre B-cell-like phenotype. Virchows Archiv. 2014; 466(1): 93-100. doi:10.1007/s00428-014-1682-7.

10. Prochazka KT, Posch F, Deutsch A, Beham-Schmid C, Stöger H, Abdyli L, et al. Immunohistochemical double hit score enhances NCCN–IPI and is associated with detrimental outcomes in refractory or relapsing patients with diffuse large B cell lymphoma. British Journal of Haematology. 2018; 183(1): 142-146. doi:10.1111/bjh.14912.

11. Zidan J, Hussein O, Basher W, Zohar S. Serum CA125: a tumor marker for monitoring response to treatment and follow-up in patients with non-Hodgkin's lymphoma. The oncologist. 2004; 9(4): 417-421. doi:10.1634/THEONCOLOGIST.9-4-417.

12. Ng SP, Leong CF, Nurismah MI, Shahila T, Jamil MA. Primary Burkitt lymphoma of the ovary. The Medical journal of Malaysia. 2006; 61(3): 363-5.

13. Zhou Z, Sehn LH, Rademaker AW, Gordon LI, Lacasce AS, Crosby-Thompson A, et al. An enhanced International Prognostic Index (NCCN-IPI) for patients with diffuse large B-cell lymphoma treated in the rituximab era. Blood. 2014; 123(6): 837-842. doi:10.1182/blood-2013-09-524108.

14. Prochazka KT, Melchardt T, Posch F, Schlick K, Deutsch A, Beham-Schmid C, et al. NCCN-IPI score-independent prognostic potential of pretreatment uric acid levels for clinical outcome of diffuse large B-cell lymphoma patients. British Journal of Cancer. 2016; 115(10): 1264-1272. doi:10.1038/bjc.2016.325.

15. Gong Y, Chen R, Zhang X, Zou ZM, Chen XH. Role of Immune Microenvironmental Factors for Improving the IPI-related Risk Stratification of Aggressive B Cell Lymphoma. Biomedical and environmental sciences : BES. 2017; 30(7): 492-500. doi:10.3967/bes2017.065.

16. Sakurai N, Tateoka K, Taguchi J, Terada T. Primary precursor B-cell lymphoblastic lymphoma of the ovary: case report and review of the literature. International journal of gynecological pathology : official journal of the International Society of Gynecological Pathologists. 2008; 27(3): 412-417. doi:10.1097/PGP.0b013e31815ea7e3.

17. Grigoriadis C, Tympa A, Chasiakou A, Baka S, Botsis D, Hassiakos D. Bilateral primary ovarian non-Hodgkin's lymphoma and fertility preservation: 5-year follow-up. Il Giornale di chirurgia. 2017; 38(2): 77. doi:10.11138/GCHIR/2017.38.2.077.

18. Signorelli M, Maneo A, Cammarota S, Isimbaldi G, Parra RG, Perego P, et al. Conservative management in primary genital lymphomas: the role of chemotherapy. Gynecologic oncology. 2007; 104(2): 416-421. doi:10.1016/J.YGYNO.2006.08.024.

19. Ahmad AK, Hui P, Litkouhi B, Azodi M, Rutherford T, McCarthy S, et al. Institutional Review of Primary Non-Hodgkin Lymphoma of the Female Genital Tract: A 33-Year Experience. International Journal of Gynecologic Cancer. 2014; 24(7): 1250-1255. doi:10.1097/IGC.0000000000000201.

20. Roopesh Kansara, Diego Villa, Alina S Gerrie, Richard Klasa, Tamara Shenkier, et al. Site of central nervous system (CNS) relapse in patients with diffuse large B-cell lymphoma (DLBCL) by the CNS-IPI risk model. Br J Haematol. 2017; 179(3): 508-510. doi: 10.1111/bjh.14229.

21. Dao AH. Malignant lymphoma of the ovary: report of a case successfully managed with surgery and chemotherapy. Gynecologic oncology. 1998; 70(1): 137-140. doi:10.1006/GYNO.1998.5033.

22. R Vang LJM, R A Warnke, J P Higgins, M T Deavers. Ovarian Non-Hodgkin's Lymphoma: A Clinicopathologic Study of Eight Primary Cases. Mod Pathol. 2001; 14(11): 1093-9. doi: 10.1038/modpathol.3880442.

23. Ambulkar I, Nair R. Primary Ovarian Lymphoma: Report of Cases and Review of Literature. Leukemia & Lymphoma. 2003; 44(5): 825-827. doi:10.1080/10428190310000067945.

24. Yamada T, Iwao N, Kasamatsu H, Mori H. A case of malignant lymphoma of the ovary manifesting like an advanced ovarian cancer. Gynecologic oncology. 2003; 90(1): 215-219. doi:10.1016/S0090-8258(03)00229-4.

25. Jung CK, Park JS, Lee EJ, Kim SH, Kwon HC, Kim JS, et al. Autoimmune Hemolytic Anemia in a Patient with Primary Ovarian Non-Hodgkin's Lymphoma. Journal of Korean Medical Science. 2004; 19(2): 294. doi:10.3346/jkms.2004.19.2.294.

26. Senol T, Doger E, Kahramanoglu I, Geduk A, Kole E, Yucesoy I, et al. Five Cases of Non-Hodgkin B-Cell Lymphoma of the Ovary. Case Reports in Obstetrics and Gynecology. 2014; 2014: 1-5. doi:10.1155/2014/392758.

27. Bhartiya R, Kumari N, Mallik M, Singh RV. Primary Non-Hodgkin's Lymphoma of the Ovary - A Case Report. J Clin Diagn Res. 2016; 10(5): ED10-1. doi: 10.7860/JCDR/2016/19346.7766.

28. Pavlovic A, Durdov MG, Lozic D, Librenjak LS, Alfirevic D. Primary ovarian lymphoma and benign Brenner tumor. Taiwanese journal of obstetrics & gynecology. 2016; 55(1): 138-139. doi:10.1016/j.tjog.2015.04.005.

29. Guvvala SL, Sakam S, Niazi M, Alagkiozidis I, Skaradinskiy Y. Case of primary bilateral diffuse large B-cell lymphoma of the ovary with plasmablastic features in an HIV-negative female patient. BMJ Case Reports. 2017; 2017: bcr2016218117. doi:10.1136/bcr-2016-218117.

30. Khattar P, Bedi P, Gonzalez M, Zhong M, Yin C, Huang W, et al. Genomic Analysis Reveals Distinct Subtypes in Two Rare Cases of Primary Ovarian Lymphoma. Pathology, research and practice. 2018; 214(4): 593-598. doi:10.1016/j.prp.2017.12.017.

31. Iizuka N, Ikura Y, Fukuoka Y, Shibata T, Okamoto M, Kamiya A, et al. Malignant Lymphoma of the Ovary: A Diagnostic Pitfall of Intraoperative Consultation. International journal of gynecological pathology: official journal

of the International Society of Gynecological Pathologists. 2020; 39(1): 79-83. doi:10.1097/PGP.0000000000000571.

32. Jerry Chin-Wei Chien C-LC, Wing P. Chan. Case 210: Primary Ovarian Lymphoma. Radiology 2020; Radiology: 306-9.

33. Živković K, Marton I, Luetić AT, Gašparov S, Pavlov KH, Sović L, et al. Torquated large ovarian lymphoma as a cause of acute abdomen: a case report of diffuse large B-cell ovarian lymphoma with a germinal center B-cell-like phenotype. Wiener Medizinische Wochenschrift. 2021; 1-3. doi:10.1007/s10354-021-00823-z.