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Primary ovarian clear cell carcinoma of the abdominal wall – a systematic review of the literature to establish optimal surgical management

Pierwotny jasnokomórkowy rak jajnika powłok brzusznych – przegląd systemowy literatury w celu ustalenia optymalnego zakresu leczenia chirurgicznego

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Abstract

Primary ovarian clear cell carcinoma of the abdominal wall (AW-OCCC) is an extremely rare occurrence. Therefore, data on the prognosis and treatment regime remain limited.

Objectives: *The aim of the study was to provide an evidence-based review of the available case reports to establish optimal surgical management.*

Material and methods: *A literature search according to PRISMA guidelines was performed using PubMed database (from 01.01.1990 to 31.12.2013) with the terms: "clear cell carcinoma" and "abdominal wall". A total of 17 case reports on 18 patients with full text available were identified.*

Results: *All AW-OCCC's appeared after previous laparotomy for gynecological reasons, with cesarean section as the predominant intervention (15/18, 83%). Median age was 46 years (range 37-56) and median time elapsed between the initial laparotomy and the cancer was 19 years (range 9-30). Data on the course of the disease were available for 17 cases. The overall median follow-up was 11 months (range 1-60). No cases of metastatic spread to the ovaries or the intraperitoneal cavity were observed. Eight patients experienced recurrence (8/17, 47.1%). Metastatic lymph nodes appeared in 6 of the 8 relapsed women and local recurrence in the remaining 2 subjects. There were 4 fatal cases (4/17, 23.5%), including 3 with lymphatic cancer spread. The women with treatment failure (recurrence or death) more frequently developed lymph node metastases than the curable cases (p=0.002).*

Conclusions: *Radical resection of the tumor with concomitant pelvic lymph nodes dissection seems to be the most suitable surgical approach. The need for comprehensive intraperitoneal surgical staging for ovarian cancer is questionable.*

Key words: **ovarian cancer** / **clear cell carcinoma** / **tumor** / **abdominal wall** / / **malignant transformation** /

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Streszczenie

Pierwotny jasnokomórkowy rak jajnika powłok brzusznych (JRJ-PB) występuje niezwykle rzadko i dlatego brak jest wiarygodnych danych dotyczących rokowania oraz skutecznych metod jego leczenia.

Celem pracy było ustalenia optymalnego zakresu leczenia chirurgicznego (JRJ-PB) na podstawie systemowego przeglądu literatury medycznej.

Metoda: *Używając słów kluczowych: „clear cell carcinoma", „abdominal wall" przeszukano bazę PubMed (okres objęty analizą: 01.01.1990-31.12.2013). Zidentyfikowano (zgodnie z wytycznymi PRISMA 2009) 17 prac zawierających dane o 18 chorych z potwierdzonym histopatologicznie JRJ-PB.*

Wyniki: *Na JRJ-PB zachorowały wyłącznie kobiety, u których wcześniej wykonano laparotomię z powodów położniczo-ginekologicznych. Dominującym zabiegiem było cięcie cesarskie (15/18, 83%). Mediana wieku zachorowania wynosiła 46 lat (zakres 37-56). Mediana czasu pomiędzy pierwotną laparotomią a rozpoznaniem raka powłok wynosiła 19 lat (zakres 9-30). Pełna informacja o przebiegu choroby dostępna była dla 17 przypadków. Mediana czasu obserwacji w tej grupie wyniosła 11 miesięcy (zakres 1-60). U żadnej z chorych nie stwierdzono rozsiewu raka wewnątrz jamy brzusznej. U 8 wystąpił nawrót choroby (8/17, 47.1%). W sześciu przypadkach była to wznowa węzłowa, a w 2 nawrót miejscowy. W grupie 17 kobiet z JRJ-PB odnotowano 4 zgony (23,5%). Trzy śmiertelne przypadki miały rozsiew choroby do układu limfatycznego. Przerzuty do węzłów chłonnych występowały znamiennie częściej w grupie chorych z niepowodzeniem leczenia (wznowa lub śmierć) niż u pacjentek z całkowitą remisją w okresie obserwacji (p=0.002).*

Wnioski: *W świetle wyników przeprowadzanej analizy radykalne wycięcie guza powłok z jednoczasową limfadenektomią miedniczną wydaje się być najbardziej odpowiednim zakresem leczenia chirurgicznego JRJ-PB. Typowy dla raka jajnika staging chirurgiczny obejmujący między innymi usuniecie macicy i przydatków nie jest konieczny.*

Słowa kluczowe: **leczenie** / **rak jajnika** / **rak jasnokomórkowy** / **guz powłok** / **chirurgia** /

Introduction

Ovarian cancer (OC) is the most lethal gynecological malignancy worldwide [1]. Despite a dramatic improvement in the survival rate, following the introduction of platinum-taxane chemotherapy [2], the 5-year overall survival rate remains below 45% [3]. OC is subdivided into four major histological types: serous, mucinous, endometrioid, and clear cell [1]. Ovarian clear cell carcinoma (OCCC) constitutes less than 15% of all OC cases. Even though it is recognized in the early stages of the disease in 60% of the affected patients, OC is associated with a worse prognosis [4] due to enhanced resistance to chemotherapeutic agents [5, 6]. Ovarian clear cell carcinoma, initially recognized after biopsy of the fast-growing abdominal wall tumors mostly arising in the presence of external endometriosis, is an unusual form of this malignancy [7]. External endometriosis is mainly associated with cesarean sections and hysterectomy scars, less often appendectomy or episiotomy, and other surgeries [7, 8]. The rate of abdominal wall endometrioma after cesarean delivery oscillates around 0.03-0.04% [7, 8].

It is estimated that no more than 0.9% of extragonadal endometriosis cases undergo malignant transformation, including 67.6% of clear cell carcinomas [9]. For now, there are no therapeutic regimes for abdominal wall ovarian clear cell carcinomas (AW-OCCCs) due to their rarity. Thus, the decision whether to conduct surgical staging for ovarian cancer remains an unsolved problem.

Objectives

The aim of the study was to extract clinical and pathological data and applied treatment modalities from all available pubMed case reports on AW-OCCCs, in order to establish optimal surgical management and to assess the prognosis.

Material and methods

A literature search was performed using PubMed database (utilizing the following filters: case reports; full text available; publication dates from: 01.01.1990-31.12.2013) with the following search terms: "clear cell carcinoma" and "abdominal wall".

Data synthesis

We identified 35 papers but 22 were excluded after the evaluation of the title and the abstract. Thirteen articles that were deemed potentially relevant were located for full manuscript review, and the reference lists from the retrieved articles were scanned to identify other potentially relevant reports.

All of the selected papers were then assessed for eligibility according to the contents of data on clinical and pathological features and treatment modalities of abdominal wall ovarian clear cell carcinoma. A total of 17 articles were identified [7-23]. A retrospective analysis included 18 women diagnosed for primary abdominal wall ovarian clear cell carcinoma (Figure 1).

We then used a structured abstract form to record the author and the year of the case report, patient age, menopausal status, type of previous surgery, confirmed pre-existing endometriosis, leading symptoms, time from initial surgery to the onset of cancer, any abnormalities diagnosed in preoperative imaging, type of surgical treatment, tumor volume, state of tumor margins, presence of intraperitoneal cancer spread, presence of lymphatic cancer spread, type of adjuvant treatment, time of follow up, recurrence, site of recurrence, and the outcome.

The patients were divided into two separate groups for comparative analyses: no failure or failure (recurrence or death) in terms of observation. Clinical and pathological features were compared.

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Statistical analysis

The Mann-Whitney U and Fisher tests were used in order to determine statistically significant differences between the variables. The p-value of <0.05 was considered as significant. All analyses were performed using Statistica 10 software (Stat Soft Inc. USA).

Results

Patient characteristics

The analysis of 18 patients was carried out. Median age at diagnosis was 46 years (range: 37-56). Six of the 18 (33.3%) AW-OCCCs were menopausal and 12 (66.7%) were menstruating at the time of the diagnosis.

Each of the AW-OCCC cases had undergone surgical intervention in the past, with cesarean section as the predominant surgery - 15 out of 18 cases (83%). The remaining 3 patients had a laparotomy because of open tubal sterilization (n=1), myomectomy (n=1), and ovarian endometrioma (n=1).

Median time from the previous surgery to histopathological confirmation of AW-OCCC was 19 years (range 9-30). Ten out of 18 (55.6%) subjects had been treated for endometriosis in the past: 6 women had abdominal wall endometriosis and 4 cases had histopathologically confirmed endometriotic lesions located in the peritoneal cavity.

The leading symptom associated with tumor growth was periodically appearing pain, which accompanied 66.6% of the patients. Patient characteristics are presented in Table I.

Preoperative assessment

In 8 cases (8/18, 44.4%) preoperative tumor biopsy confirming OCCC histology was performed. Sixteen patients (88.9%) had imaging evaluation (CT/MRI/PET) prior to the surgery. The remaining two case reports did not include any information about preoperative radiologic assessment.

Preoperative imaging revealed an abdominal wall mass in all of the 16 evaluated cases. Additional abnormalities suggesting cancer spread were found in two patients and both were enlarged external iliac lymph nodes. No other pathologies related to the ovaries and the peritoneum were observed in the remaining 14 patients. Data on preoperative assessment and primary tumor characteristics are included in Table II.

Treatment

Wide local excision of the tumor was performed as the first-line treatment in all subjects. Median tumor volume was 164.5 cm^3, range: 27-4149 cubic centimeters. Ten out of 18 patients (55.6%) had concomitant laparotomy that included TAH and/or BSO and/or omentectomy. Five of them underwent concomitant pelvic lymph node dissection.

No intraperitoneal cancer was detected in all cases surgically treated for AW-OCCC.

Metastatic pelvic lymph nodes were confirmed during the initial surgery in 4 patients and included the 2 with preoperatively suspicious nodes on CT/MRI scans. An additional treatment was performed in 15 out of 18 patients (83.3%) and included: radiotherapy (3 cases), chemotherapy (7 cases), or radiochemotherapy (5 cases). Detailed treatment modalities are presented in Table III.

Follow up

One case report did not include any information about follow-up, thus the course of the disease was further analyzed in a group of 17 patients. The overall median follow-up for the 17 cases was 11 months (range: 1-60). Regardless of the selected methods of treatment, local and distant recurrences have been observed.

Eight patients (8/17, 47.1%) experienced a recurrence (5 – lymph nodes, 2 – local recurrence, and 1 – no data on the recurrence site). Four out of the 5 lymph node recurrences died. One of these was described as alive with no evidence of disease 2 months after the secondary cytoreductive surgery.

In two cases with local recurrence, a wide local re-excision and an adjuvant treatment were performed and these were finally described as living with recurrence.

One case whose site of recurrence was not stated in the case report underwent successful secondary cytoreduction and had no evidence of the disease.

In the end, 11 patients had no evidence of the disease (11/17, 52.9%) (including 1 case with dissected nodal recurrence and 1 subject with resected recurrence of an unknown site: both described above).

There were 4 fatal cases in the analyzed cohort (4/17, 23.5%). One of them was surgically treated only with wide local excision of the tumor. This patient had no evidence of additional abnormalities on preoperative CT scans and concomitant laparotomy with staging for ovarian cancer was not conducted. The patient died after 10 months and the site of the recurrence turned out to be the lympho-vascular space. The remaining 3 fatal cases had histopathologically confirmed metastatic spread to the lymph nodes, which was detected after the initial surgery (2 cases) or revealed later as a recurrent disease (1 case). The detailed course of the disease is presented in Table IV.

Next, the cohort of 17 cases was divided into two groups: patients with treatment failure (n=8, 4 deaths and 4 alive recurrences) and the remaining subjects (n=9). Women with treatment failure (recurrence or death) more frequently developed lymph node metastases than curable forms of AW-OCCCs (p=0.002) (Table V).

Cancer spread

Cancer spread to the lymph nodes was observed in 6 out of the 17 cases (35.3%): 4 during the initial surgery and 2 as a recurrent disease during the time of the observation. No cancer spread to the ovaries, uterus, tubes, and the peritoneum was found in any of the 18 analyzed patients.

Discussion

Unlike serous carcinomas, morphological and molecular studies have clearly linked clear cell carcinoma to an endometriosis precursor lesion, which, in a stepwise fashion, develops atypia before progressing to invasive carcinoma [24-28]. Ten out of 18 women (55.6%) in the analyzed cohort had been treated for endometriosis before developing AW-OCCC.

The presence of abdominal wall clear cell carcinoma theoretically should be also explained by primary malignant transformation of the abdominal wall tissue, including scars or by metastatic spread of the clear cell cancer tissue originating in the ovary [9, 12].

Table I. Patient characteristics of the abdominal wall ovarian clear cell carcinoma.

Ref.	Age years	Hormonal status	Previous surgery	Confirmed pre-existing endometriosis	Leading symptom	Years from previous surgery to treatment
[7]	46	Pre-menopausal	Cesarean delivery	No	Pain	14
[8]	38	Pregnancy	Cesarean delivery	No	Pain	9
[9]	54	Menopause	Cesarean delivery	No	ND	26
[10]	56	Menopause	Cesarean delivery	No	ND	24
[11]	38	Pre-menopausal	Cesarean delivery, TAH and BSO	Abdominal wall endometriosis	ND	11
[12]	55	Menopause	Open tubal sterilization	No	Pain	30
[13]	46	Pre-menopausal	Cesarean delivery	Abdominal wall endometriosis	Asymptomatic growing mass	26
[14]	38	Pre-menopausal	Cesarean delivery	Abdominal wall endometriosis	Pain	13
[15]	42	Pre-menopausal	Cesarean delivery, TAH	No	Pain	5
[16]	49	Pre-menopausal	Myomectomy	No	Pain	20
[17]	37	Pre-menopausal	Laparotomy for ovarian endometrioma	Abdominal wall endometriosis	Pain	10
[18]	53	Menopause	Cesarean delivery	No	Pain	21
[19]	43	Pre-menopausal	Cesarean delivery	Abdominal wall endometriosis	Pain	20
[20]	41	Pre-menopausal	Cesarean delivery,TAH	Abdominal wall endometriosis	Pain	18
[21]	49	Menopause	Cesarean delivery	No	Pain	26
[22]	47	Pre-menopausal	Cesarean delivery	No	Pain	ND
[23]	42	Pre-menopausal	Cesarean delivery, RSO	No	ND	ND
[23]	51	Menopause	Cesarean delivery, TAH	No	ND	16

ND – no data; mo – months, y – years; TAH – total abdominal hysterectomy; BSO – bilateral salpingoophorectomy;

Table II. Preoperative assessment/surgical plan and primary tumor characteristics in 18 cases with AW-OCCC.

Ref.	Imaging/ abnormalities diagnosed	Preoperative Tumor biopsy	Decision on concomitant laparotomy	WLE	Tumor volume (cm^3)
[7]	ND	No	Yes	Yes	216
[8]	CT,USG/ abdominal wall mass, no intra-abdominal abnormalities	No	Yes	Yes	64
[9]	MRI/ abdominal wall mass, no intra-abdominal abnormalities	No	No	Yes	125
[10]	MRI/ abdominal wall mass, no intra-abdominal abnormalities	Yes	No	Yes	250
[11]	USG,MRI/ abdominal wall mass, no intra-abdominal abnormalities	No	No	Yes	80
[12]	ND	No	No	Yes	64
[13]	MRI, USG/ abdominal wall mass, no intra-abdominal abnormalities	Yes	Yes	Yes	612
[14]	MRI/ abdominal wall mass, no intra-abdominal abnormalities	Yes	Yes	Yes	935
[15]	CT/ abdominal wall mass, no intra-abdominal abnormalities TV-USG/bilateral benign ovarian cysts	Yes	No	Yes	181
[16]	CT/abdominal wall mass, no intra-abdominal abnormalities	No	N	Yes	614
[17]	MRI/ abdominal wall mass, no intra-abdominal abnormalities	Yes	Yes	Yes	1988
[18]	MRI/ abdominal wall mass, enlarged external iliac lymph nodes	No	Yes	Yes	87
[19]	MRI/ abdominal wall mass, enlarged external iliac lymph nodes CT/external lymph nodes adenopathy	No	Yes	Yes	288
[20]	CT/abdominal wall mass, no intra-abdominal abnormalities	No	No	Yes	147

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Table III. Treatment for AW-OCCC.

Ref.	Free Margins after WLE	Laparotomy staging surgery		ICS (surgery or imaging)/ other pathology	ECS (surgery or imaging)	CHTH	RTX
		Concurrent	Delayed				
[7]	Yes	TAH+BSO	No	No/ Adenomyosis	No	No	No
[8]	Yes	TAH+BSO, omentectomy	No	No	No	Cisplatin 3 cycles	Radiotherapy Dosage unknown
[9]	Yes	No	No	No	No	No	50,4 Gy
[10]	Yes	No	No	No	No	Cisplatin based chemotherapy	No
[11]	Yes	No	No	No	No	Paclitaxel+ carboplatin 6 cycles	45 Gy
[12]	No	No	No	No	No	No	10 fractions of radiotherapy dosage unknown
[13]	Yes	BSO	No	No	No	Neoadiuvant triptorelin therapy Post-operatively: Carboplatin+ paclitaxel 3months	No
[14]	Yes	TAH+BSO, omentectomy	No	No/ Adenomyosis	Yes	Neoadjuvant Carboplatin + paclitaxel 3 cycles	No
[15]	Yes	No	No	No	No	No	No
[16]	No	No	No	No	No	Chemotherapy dosage unknown + 3 additional cycles- drugs unknown	Radiotherapy Dosage unknown
[17]	No	TAH+BSO, iliac lymph nodes dissection, omentectomy	No	No	No	Docetaxel + carboplatin 6 cycles	No
[18]	No	TAH+BSO, omentectomy, PLND, bilateral inguinal lymhadenectomy	Radical resection of the parietal tumor 6 months later	Dermoid ovarian cyst, adenomyosis, CIN III	Yes	Paclitaxel +carboplatin 4 cycles	No
[19]	Yes	Bilateral external iliac lymphadnectomy	TAH+BSO 45 day later	No	Yes	Paclitaxel + carboplatin 6 cycles	45 Gy
[20]	Yes	No	No	No	No	Neoadiuvant: gestrinone treatment (1month) and Paclitaxel +carboplatin 3 cycles	No
[21]	Yes	TAH+BSO	No	No	No	Paclitaxel + carboplatin 6 cycles	No
[22]	Yes	Iliac lymph nodes dissection, left ovarian cyst excision	No	Endometrial ovarian cyst	Yes	Cisplatin based chemotherapy 6 cycles	Radiotherapy Dosage unknown
[23]	Yes	TAH+BSO, iliac lymph nodes dissection, partial omentectomy	No	No	No	No	No
[23]	Yes	No	BSO, omental biopsy (2months later)	No	No	No	50, 4 Gy

ND – no data; TAH – total abdominal hysterectomy; TLH – total laparoscopic hysterectomy; BSO – bilateral salpingo-ooporectomy; RSO – right salpingo-ooporectomy; PLND – pelvic lymph nodes dissection; ChTH – chemotherapy; RTH – radiotherapy; ICS – Intraperitoneal cancer spread; ECS – Extraperitoneal cancer spread; LND – lymph nodes.

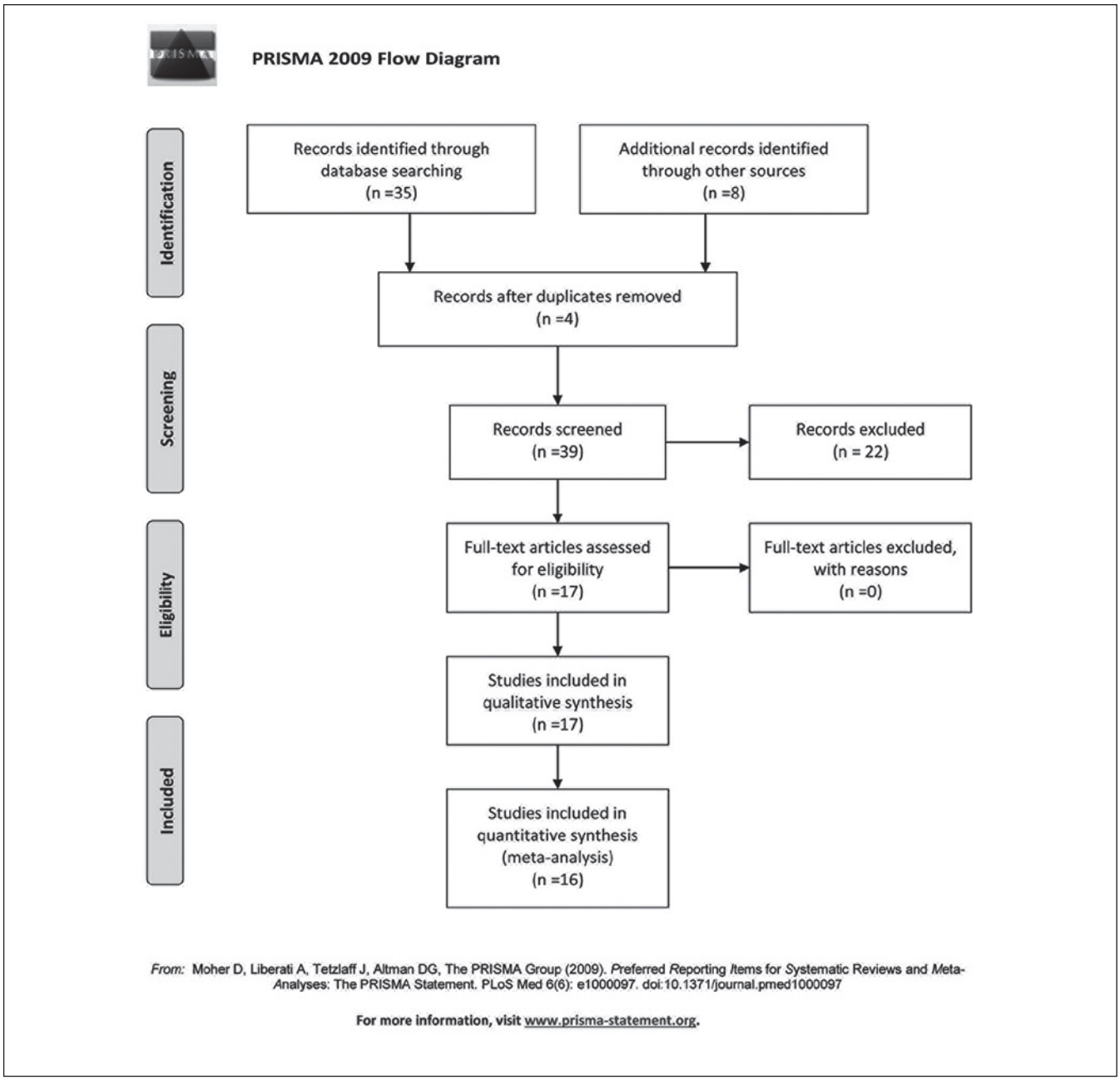

Figure 1. PRISMA 2009 flow diagram for the study.

Our findings revealed that AW-OCCC does not exist without previous surgery. Therefore, the idea of a malignant transformation of a postoperative scar cannot be neglected. Inversely, the concept of a metastatic spread of the primary lesion located in the ovary is questionable, as none of the surgically staged patients had cancer detected in the intraperitoneal cavity, including the ovaries and the ovarian tubes. Those who were not staged had no intraperitoneal abnormalities on CT/MRI scans and none of them revealed intraperitoneal recurrence during the time of the observation.

Owing to its rarity, there is no standard approach for treating clear-cell carcinoma of the abdominal wall. Wide local excision of the abdominal wall tumor was a commonly accepted procedure in all described AW-OCCC cases. Two of the resected tumors had cancer positive margins. Only these cases recurred locally, indicating the need of complete surgical excision not only for removing cancerous tumors but also for prevention of a relapse. Abdominal-wall reconstructions with surgical mashes are frequently needed due to the size of AW-OCCCs [9].

Ovarian histology of the tumor and the related potential aggressiveness suggest the necessity of comprehensive staging for ovarian cancer. On the other hand, the fact that no abnormalities were found in the imaging (CT/MRI scans) and the young age of the affected patients make such decisions questionable. Indeed, the abdominal cavity and the pelvis were explored in only a half (55%) of the analyzed group of patients and these were not performed in a uniform way (TAH and/or BSO and/or omentectomy).

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Table IV. Disease course and outcome of patients with AW-OCCC.

ref	Recurrence / site of recurrence/ treatment	Follow up (mo)	outcome
[7]	No/ No treatment	30	No evidence of disease
[8]	No/ No treatment	60	No evidence of disease
[9]	No/ No treatment	2	No evidence of disease
[10]	Yes-LVSR/ND	24	Died of disease
[11]	No/No teratment	ND	No evidence of disease
[12]	No/No teratment	18	No evidence of disease
[13]	Yes -LVSR/ Cisplatin+ adriablastin- 3 months later	6	Died of disease
[14]	Yes LVSR/ Pelvic and para-aortic lymphadenectomy	2	No evidence of disease
[15]	ND/ND	ND	ND
[16]	Yes-local/ Cyclophosphamide+ cisplatin 3 cycles+Radical resection of the parietal tumor+Radiotherapy dosage unknown (6 months after diagnosis)	6	Recurrence
[17]	Yes-local/ Cytoreductive surgery 6 months later, Docetaxel+ carboplatin chemotherapy 18 months after diagnosis	18	Recurrence
[18]	Yes-LVSR/ Palliative care	11	Died of disease
[19]	Yes-LVSR/ Enterolysis, bilateral inguinal lymphadenectomy/ Topotecan 4 cycles	22	Died of disease
[20]	No/ No treatment	24	No evidence of disease
[21]	No/ No treatment	8	No evidence of disease
[22]	Yes-ND/ 6 cycles of radiotherapy after 5 months	7	No evidence of disease
[23]	No/ No treatment	1	No evidence of disease
[23]	No/ No treatment	31	No evidence of disease

ND – no data, LVSR – Lympho-vascular space recurrence.

Table V. Comparison of the clinical and pathological features between patients with and without relapse treated for AW-OCCC (n=17*).

Clinicopathological feature	No failure n=9	Failure n=8	p-Fisher/UMW*
Age (median)	46	46,5	p=1,000**
Postmenopausal	4/9	2/8	p= 0.620
Cesarean section	7/9	6 /8	p=1.00
Time from surgery to tumor WLE (Years) median	17,0	20	p=0.955**
Tumor volume (median)	125 cm3	450 cm3	p=0.167*
Lymphatic spread	0 /9	6/8	p=0.002

* one case lacked the data on course of the disease, ** test UMW; Failure = died (n=4) and recurrence (n=4); No-Failure = never recurred or died.

Preoperative imaging (MRI/CT scans) was reliable for the assessment of intraperitoneal cancer spread, while it was not sensitive enough for lymphatic cancer spread. More metastases were found than had been suggested by imaging.

Chemotherapy, radiotherapy, and progestin therapy have been proposed to treat this disease, but the efficacy of those treatments is debatable [9]. More clinical evidence is necessary to compare the efficacy of different types of adjuvant treatment.

Our manuscript examines abdominal wall tumors with ovarian clear cell carcinoma only. This is a unique approach because recent reports have either analyzed abdominal wall tumors with different histology [9, 16], or malignant tumors of different sites arising in the presence of external endometriosis [29].

Recent papers have focused on the relation of this rare malignancy to endometriosis and their findings are unlikely to contribute significantly to routine clinical practice. We aimed at answering the question if comprehensive staging for ovarian cancer is a reasonable approach.

Our study has the traditional weaknesses of a retrospective analysis and the results obviously represent a small cohort, therefore the suggested surgical approach paves the way for future independent studies.

AW-OCCCs were recognized in relatively young (46 years), premenopausal women (67%), with a history of cesarean delivery (83%) two decades previously (19 years). Half of this cohort had confirmed endometriosis. The ovaries and other intraperitoneal

organs were free of cancer, while the pelvic lymph nodes were frequently affected.

Conclusions

Radical wide local excision (WLE) of the abdominal tumor and concurrent lymphadenectomy seem to be a suitable solution for the efficient treatment of this rare malignancy, because metastatic spread to the lymph nodes was frequently observed and was correlated with poor prognosis. In light of the conducted meta-analysis, it seems safe to conclude that the intraperitoneal surgery is unnecessary. The information about the risk of AW-OCCCs should be incorporated into the informed consent for cesarean section.

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Conflict of interest

The authors have all contributed equally to the manuscript and declare that there is no conflict of interests to be disclosed.

Oświadczenie autorów

1. Aleksandra Ohler – zebranie materiału, analiza statystyczna wyników, współautor tekstu pracy, zgromadzenie literatury, opracowanie graficzne.
2. Mirosław Dudziak – weryfikacja i akceptacja manuskryptu.
3. Jacek Jan Sznurkowski – autor koncepcji i założeń pracy, przygotowanie manuskryptu i piśmiennictwa – autor zgłaszający i odpowiedzialny za manuskrypt.

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