Small Cell Ovarian Carcinomas – Characterisation of Two Rare Tumor Entities

Kleinzellige Ovarialkarzinome – Charakterisierung von 2 seltenen Tumorentitäten

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Key words
- ovarian cancer
- ovarian tumor
- ovary

Schlüsselwörter
- Ovarmalignom
- Ovar
- benigne Ovartumoren

Abstract

Objective: Small cell ovarian carcinomas (SCOC) are differentiated into two types: hypercalcaemic (SCOCHT) and pulmonary (SCOCPT). Unfortunately, little is known about pulmonary-type small cell ovarian carcinoma.

Study Design: We carried out a systematic analysis of all available reports in the literature on individual cases of SCOCHT and SCOCPT.

Results: We found that patients with SCOCPT were significantly older than those with SCOCHT. Vimentin and chromogranin detection by immunohistochemistry allow good differentiation between the two types. Interestingly, SCOCPT but not SCOCHT was found to be associated with other benign and malignant ovarian tumours in about 44% of cases. Although the percentage of R0/R1 resections was high (~74%), survival was poor; even in patients with disease limited to the ovaries (stage Ia and Ib) the recurrence rate was 40%. Chemotherapy with etoposide or anthracyclines could be useful.

Conclusion: Taking the limitations of our study such as its retrospective nature into account and based on the results from studies of small cell carcinomas originating from other tumour sites, we conclude that treatment of SCOCPT should be based on the therapies used to treat other small cell carcinomas. Surgery is appropriate, especially in very early stages of disease, but chemotherapy should not be omitted. Newer concepts such as treatment with somatostatin analogues could help to control symptoms and stabilise some slow-growing tumours.

Zusammenfassung

Einleitung: Es gibt 2 Arten von kleinzelligen Ovarialkarzinomen – die vom hyperkalzämischen (SCOCHT) und die vom pulmonalen Typ (SCOCPT). Leider ist wenig über die Karzinome vom pulmonalen Typ bekannt.

Material und Methode: Wir führten ein systematisches Review aller zur Verfügung stehenden Fälle aus der Literatur zu beiden Tumorentitäten durch.

Ergebnisse: Patientinnen mit SCOCPT waren signifikant älter als diejenigen mit SCOCHT. Vimentin- und Chromogranin-Expression in der Immunohistochemie erlaubte eine gute Unterscheidung zwischen beiden Tumorentitäten. Interessanterweise waren Fälle von SCOCPT, aber nicht solche mit SCOCHT häufig (44%) assoziiiert mit anderen benignen und malignen Ovarialtumoren. Trotz hoher Rate an R0/R1-Resektionen (~74%) war das Überleben der Patientinnen selbst in frühen Tumorstadien (FIGO-Stadium Ia oder Ib) sehr schlecht, und es zeigte sich eine Rezidivrate hier von 40%. Soweit beurteilbar, erschienen Chemotherapien mit Etoposide oder Anthrazyklinen beim pulmonalen Typ sinnvoll.

Schlussfolgerungen: Unter Berücksichtigung der Probleme dieses Studienansatzes und im Vergleich zu Studiendaten zu kleinzelligen Tumoren anderer Lokalisationen kann man schließen, dass sich die Behandlung des SCOCPT allgemein an den dort gewonnenen Erkenntnissen orientieren sollte. Operationen sind angebracht, insbesondere in den frühen Stadien, aber Chemotherapie darf niemals unterlassen werden. Möglicherweise sind neue Behandlungsansätze wie die Behandlung mit Somatostatin-Analoga geeignet, die Erkrankung und deren Symptomatik positiv zu beeinflussen.

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Key Message box

Small cell ovarian carcinomas of the pulmonary and hypercalcaemic type are two entities with a poor prognosis and may require different treatment concepts than those used for the more common epithelial tumors. Surgery seems to be effective only in the very early stages.

Abbreviations

SCOCHT small cell ovarian carcinoma of the hypercalcaemic type
SCOCPT small cell ovarian carcinoma of the pulmonary type

Introduction

Ovarian carcinomas are quite common. Clear treatment guidelines have been established and include radical surgery and combination chemotherapy with paclitaxel, carboplatinum and bevacizumab in the advanced stage of disease. The role of prophylactic surgery in women at risk for familial breast or ovarian cancer has been defined [1].

Small cell ovarian carcinoma (SCOC) is a rare neoplasm divided histologically into the subgroups SCOC of the hypercalcaemic type (SCOCHT; 8041/3) and SCOC of the pulmonary type (SCOCPT; 8041/3) [2]. They comprise about 1% of all ovarian neoplasms and are distinguished by their growth patterns and immunoprofiles. SCOCHT generally stains for epithelial membrane antigens whereas SCOCPT is typically positive for neuron-specific enolase and, in some cases, chromogranin [2]. However, little is known about SCOCPT and there are no specific treatment guidelines for this tumour type although the prognosis is known to be poorer than the prognosis for common epithelial ovarian carcinomas. Primary ovarian small cell carcinomas of the pulmonary type histologically resemble their counterparts in other organs. They are composed of small cells with little cytoplasm and oval to spindle-shaped nuclei [3]. Recently, we characterised all published cases of SCOCHT [4]. This allowed some conclusions to be made on how treatment of this entity could be improved. However, a systematic review and analysis of all reported cases of SCOCPT has not previously been done. The aim of this study was to assess the cases of SCOCPT in the literature and compare the characteristics of this entity with those of SCOCHT.

Materials and Methods

Search strategy

To identify articles on small cell ovarian carcinoma, we searched Medline and PubMed using the search terms “small cell carcinoma”, “ovary”, “ovarian” and cross-checked the references from retrieved articles. We used the search engine google.de for further investigations.

The search covered articles published between February 1975 and July 2012. All articles were evaluated for individualised patient data on clinical presentation, preoperative diagnostics, surgical and adjuvant therapies as well as follow-up data. In addition to papers in English, papers in French, Italian, Polish, Japanese and Korean were evaluated.

Table 1 Patient characteristics and immunohistochemical expression patterns of SCOCPT and SCOCHT.

Variable	SCOCPT	SCOCHT
Age (years)		
▸ Mean	47.8	22.8
▸ SD	17.1	9.8
Distribution of stage at diagnosis (% [n +/n_{total}])		
▸ 1	42.9 (9/21)	46.8 (52/111)
▸ 2	4.8 (1/21)	11.7 (13/111)
▸ 3	47.6 (10/21)	37.8 (42/111)
▸ 4	4.8 (1/21)	3.6 (4/111)
Clinical symptoms at the time of presentation (% [n +/n_{total}])		
▸ overall	94.3 (33/35)	97.6 (80/82)
Specific		
▸ nausea and vomiting	60.0 (21/35)	25.6 (21/82)
▸ palpable mass	48.6 (17/35)	10.9 (9/82)
▸ increase in waist circumference	34.3 (12/35)	24.4 (20/82)
▸ lower abdominal pain	22.9 (8/35)	26.8 (22/82)
▸ stomach ache	20.0 (7/35)	45.1 (37/82)
▸ fatigue	20.0 (7/35)	8.5 (7/82)
▸ urinary pain	17.1 (6/35)	7.3 (6/82)
▸ amenorrhoea, spotting	11.4 (4/35)	8.5 (7/82)
▸ acute abdomen	8.6 (3/35)	3.7 (3/82)
▸ back pain	5.7 (2/35)	7.3 (6/82)
▸ constipation	5.7 (2/35)	18.3 (15/82)
▸ weight loss	5.7 (2/35)	17.0 (14/82)
Serum tumour markers at presentation (% [n +/n_{total}])		
▸ hypercalcaemia	0.0 (0/11)	67.1 (57/85)
▸ parathormone	not reported	27.3 (3/11)
▸ CA 125	82.4 (14/17)	80.0 (28/35)
▸ CA 153	0.0 (0/1)	0.0 (0/2)
▸ CA 19-9	37.5 (3/8)	25.0 (1/4)
▸ CEA	36.4 (4/11)	0.0 (0/7)
▸ NSE	85.7 (6/7)	not reported
▸ SCC	33.3 (1/3)	not reported
▸ AFP	0.0 (0/7)	0.0 (0/19)
Affected side (% [n +/n_{total}])		
▸ left	37.1 (13/35)	35.5 (33/93)
▸ right	31.4 (11/35)	60.2 (56/93)
▸ bilateral	31.4 (11/35)	4.3 (4/93)
Mean tumour size and volume		
▸ size (cm)	13.5 (SD 6.6)	15.2 (SD 4.8)
▸ volume (cm^3)	1449	2165
Association with other tumours (% [n +/n_{total}])		
▸ overall	44.4 (16/36)	1.8%, 2/110
Specific		
▸ endometrioid adenocarcinoma	16.6 (6/36)	–
▸ mucinous carcinoma	8.3 (3/36)	–
▸ benign teratoma	8.3 (3/36)	1.8%, 2/110
▸ Brenner tumours	5.5 (2/36)	–
Expression of tumour characteristics (% [n +/n_{total}])		
▸ synaptopodin	68.4% (13/19)	50.0% (5/10)
▸ neuron-specific enolase (NSE)	86.4% (19/22)	80.0% (16/20)
▸ epithelial membrane antigen (EMA)	55.6% (10/18)	78.8% (26/33)
▸ chromogranin	53.3% (15/28)	9.5% (2/21)
▸ vimentin	4.8% (1/21)	93.9% (46/49)
▸ cytokeratin	68.2% (15/22)	87.7% (50/57)

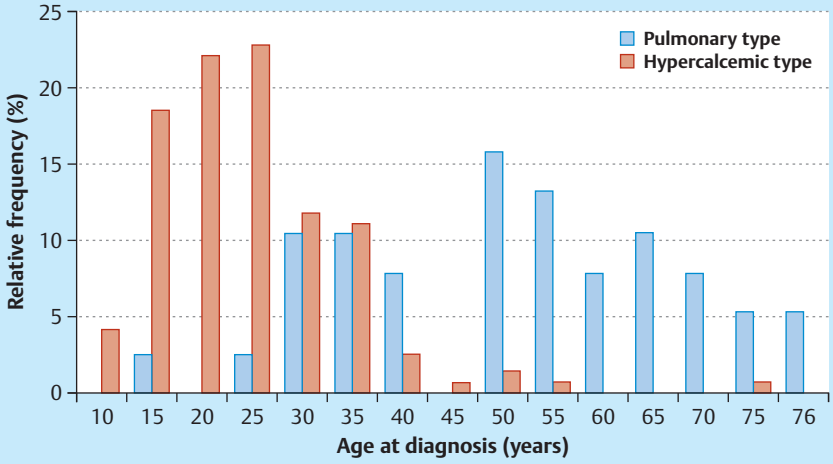

Fig. 1 Age distribution of patients with SCOCPT and SCOCHT ($F_{T\text{-}Test} = 25.7$, $p < 0.001$).

In all, we identified 127 studies which focussed on primary ovarian small cell carcinoma. Papers were excluded if they were about molecular or histological topics (n = 25), did not provide sufficient data on individual patients (n = 4), or were in a language not included in our research (n = 1). Two articles were not accessible by the means available. After excluding these 32 studies, a total of 95 case studies and reports from case series remained with sufficient data on patients (SCOCPT: n = 26; SCOCHT: n = 69) [5–99].

Eighty-six of these papers were published as case reports (from 1 to 3 patients) (SCOCPT: n = 25; SCOCHT: n = 61), and 9 consisted of smaller case series (up to 17 patients) (SCOCPT: n = 1; SCOCHT: n = 8). One of the cases not published in the literature was reported by the Department of Obstetrics and Gynaecology, Hanau Clinics, Germany, in 2009 as a case report by Hrgovic et al. In total, 182 individual cases were available for analysis (SCOCPT: n = 38; SCOCHT: n = 144).

Statistical analysis

SPSS software 17.0 (SPSS Inc, Chicago, IL, USA) for Windows® was used for data management and statistical analysis. Actual disease-free survival and overall survival of patients with reported follow-up was estimated using the Kaplan-Meier life-table method. Differences in survival rates were assessed by log-rank test. The Mann-Whitney U-test was used to check for significant differences in quantitative parameters and the chi-square test was used for qualitative variables. Survival time was measured from the date of the initial laparotomy. We compared the data from this analysis to our earlier analysis of small cell ovarian carcinoma of the hypercalcaemic type [3]. A p value below 0.05 ($p < 0.05$) was regarded as indicating a significant difference.

We informed the local ethics committee of the study prior to analysis. The local ethics committee consented to the study on January 15th, 2010 (application number 07/2010).

Results

Various characteristics are shown and compared in **Table 1**. Mean age of patients with SCOCPT was significantly higher than that of patients with SCOCHT ($F_{T\text{-}Test} = 25.7$, $p < 0.001$). A more detailed age distribution of the two entities is shown in **Fig. 1**.

Most patients with either tumour type had clinical symptoms at the time of presentation. A detailed summary of complaints is given in **Table 1**. Time between onset of symptoms and diagnosis in patients with SCOCPT was 16.1 weeks (SD = 14.8), which was much longer compared to that in SCOCHT (4.9 weeks, SD 4.4; $F_{T\text{-}Test} = 19.1$, $p < 0.001$). At diagnosis, several tumour markers were elevated. CA125 was increased in both tumour entities. Neuron-specific enolase (NSE) and carcinoembryonic antigen (CEA) were more frequently elevated in patients with SCOCPT, whereas hypercalcaemia was not found in patients with SCOCPT but frequently in patients with SCOCHT (**Table 1**).

We also found evidence that SCOCHT occurred more frequently as a right-sided unilateral tumour, which was not the case for SCOCPT ($\chi^2_{Pearson} = 20.0$; df = 2; $p < 0.001$; **Table 1**). Average tumour size and volume of SCOCPT was significantly lower compared to SCOCHT, however, due to the low numbers this is only significant for size ($F_{T\text{-}Test} = 5.4$, $p = 0.022$; **Table 1**). We also found that vimentin and chromogranin were the best parameters to distinguish between tumour types using immunohistochemistry.

Distribution of tumour stages according to the International Federation of Gynecology and Obstetrics (FIGO) classification is also shown in **Table 1**. Prognosis was very poor for both tumour types (**Fig. 2**). Metastases of SCOCPT were found in the omentum (n = 8), lymph nodes (n = 6), the peritoneum (n = 5), intestine (n = 5), the liver (n = 3), lungs (n = 2) and breast (n = 2). All but 2 patients (94.7%; 36/38) underwent primary surgery that included bilateral (n = 24) and unilateral (n = 9) salpingo-ovariectomy, hysterectomy (n = 24), omentectomy (n = 17), lymphadenectomy (n = 14) and bowel surgery (n = 2). R0/R1 resection was achieved in 73.9% of the patients (17/23) and R2 resection in 26.1% (6/23). In three cases, additional surgical interventions were required to complete tumour resection; one case required interval debulking surgery and another case required second-look surgery.

FIGO tumour stage proved to be a significant prognostic factor after classifying some cases based on the descriptions (log-rank$_{SCOCPT} = 18.2$; df = 3; $p = 0.0004$; log-rank $_{SCOCHT} = 12.6$; df = 3; $p = 0.006$). The result of the Kaplan-Meier analysis is shown in **Fig. 3**. Recurrence rates even in patients with disease limited to the ovaries (stage Ia and Ib) were high. Of the 5 patients with SCOCPT staged as FIGO Ia or Ib and followed up, two (40%; 2/5) had recurrence and died of the disease.

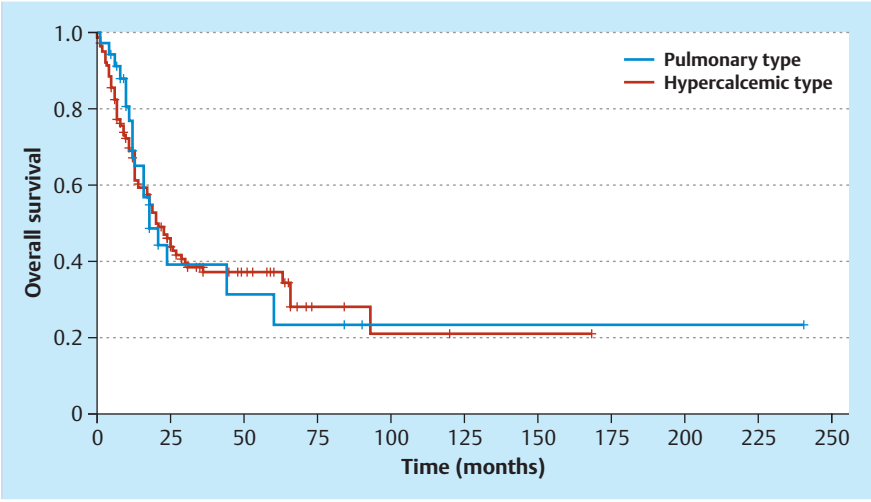

Fig. 2 Comparison of overall survival in patients with SCOCPT and SCOCHT (n. s.).

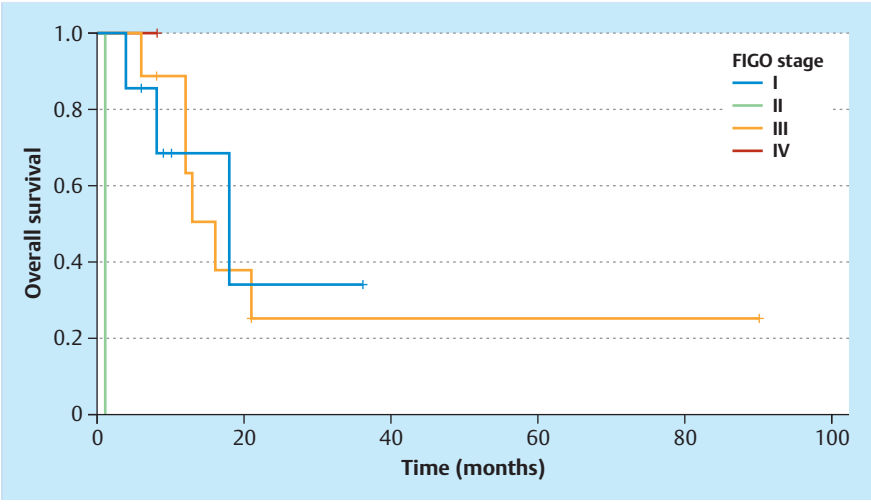

Fig. 3 Survival of patients with SCOCPT depending on tumour stage (FIGO; log-rank = 18.2; df = 3; p = 0.0004).

SCOCPT was frequently found to be associated with other ovarian tumours which contrasts with SCOCHT ($\chi^2_{Pearson} = 45.6$; df = 1; p < 0.001). We investigated whether there were differences between "primary" SCOCPT, consisting solely of SCOCPT, and "secondary" SCOCPT, originating from or associated with other tumours. Information on associated tumours was available in 36 cases. We found no differences with respect to the parameters in **Table 1**, except for NSE, which was expressed in all cases of primary SCOCPT (n = 12) but only in 70% (n = 10) of secondary SCOCPT ($\chi^2 = 4.2$; p = 0.041). There was a trend for primary SCOCPT to be found more frequently in early FIGO stages I and II (70%; n = 10), whereas 63.6% of secondary SCOCPT were found in the advanced FIGO stages III and IV.

82.4% (28/34) of patients with SCOCPT received additional postoperative chemotherapy, complemented in 2 cases with radiotherapy. Chemotherapeutic regimens mainly consisted of cisplatinum or carboplatinum (83.9%; 26/31), etoposide (41.9%; 13/31), alkylating agents (cyclophosphamide or iphosphamide [25.8%; 8/31]), paclitaxel (19.4%; 6/31), anthracyclines (doxorubicin 12.9%, 4/31), bleomycin (12.9%, 4/31), vinca alkaloids (6.5%; 2/31) and irinotecan (6.5%; 2/31). Using Kaplan-Meier analysis, we investigated the possible effect of various therapeutic approaches. We found a trend towards improved survival with the use of etoposide (p = 0.123) and anthracyclines (p = 0.154). Radiotherapy and other types of chemotherapy failed to show such effects. Interestingly, the success of surgery as indicated by R0/R1 resection did not prove to be a prognostic factor.

For SCOCHT we showed that administration of etoposide (log-rank = 18.5; df = 1; p < 0.001), cisplatinum or carboplatinum (log-rank = 5.9; df = 1; p = 0.015) or vinca alkaloids (log-rank = 3.9; df = 1; p = 0.047) was associated with improved survival.

Recurrence was reported for 60% of patients with SCOCPT (18/30). Most frequently, local recurrence was reported as liver metastasis (n = 8), followed by brain metastasis (n = 7), bone metastasis (n = 5), lung (n = 3) and lymph node metastasis (n = 3). Information on treatment for recurrence was available for 15 patients. Two patients (13.3%) underwent surgery for recurrence, 10 (66.7%) underwent chemotherapy and 9 received radiotherapy (60.0%).

Discussion

To the best of our knowledge, this is the most comprehensive analysis of SCOCPT to date. SCOCPT is a highly malignant tumour that affects women at a median age of 45 years. It has a poor prognosis even when diagnosed at an early stage. As noted previously by other authors, SCOCPT is frequently associated with oth-

er tumours, which raises the question whether it may have a different pathogenesis [29,93]. Interestingly, we found that radical surgery was not as successful as in the treatment of common epithelial ovarian carcinomas. Moreover, we observed that vimentin and chromogranin allowed a good immunohistochemical distinction between SCOCPT and SCOCHT. Taking the limitations of this study into account (publication and selection bias; the fact that information on prognostic factors was incomplete in many reports or few details on surgical outcomes including residual tumour mass were available), we identified that treatment with etoposide and anthracyclines could be useful. This is very much in line with other reports which showed a beneficial effect of both drugs on small cell cancers originating from areas other than the ovaries [100,101]. Since patients with stage 1 disease have a better survival, surgery appears to be a reasonable option for these patients but not necessarily for patients in more advanced stages [100,101]. In contrast to other epithelial ovarian tumours, additional chemotherapy should not be omitted, even at very early stages. The conclusion is that treatment of SCOCPT should be based on the therapies used to treat other small cell carcinomas. The transfer of findings from other small cell carcinomas originating in other tissues could be useful. For example, it has been noted that somatostatin analogues can control symptoms and stabilise certain slow-growing tumours [102]. Integrating such approaches, perhaps even the use of oncolytic viruses, into the management of SCOCPT could help to improve patients' chances of survival [103].

As shown for SCOCHT, treatment with etoposide, cisplatinum or carboplatinum and vinca alkaloids may offer some benefits [4]. Again, the poor prognosis for this entity calls the concept of primary surgery in advanced stages of disease into question. Only patients with early stage disease appear to benefit from surgery [4]. Since it is very unlikely that there will be studies of these two rare tumour entities, the authors of case reports of these malignant tumours are requested to include all relevant information as this would allow future investigations to include multifactorial analysis.

Conflict of Interest

None.

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