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Chemotherapy for Osteosarcoma in Pregnancy - Case Study and Review of Literature

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Abstract: In Poland, sarcoma accounts for about 1% of all malignancies annually about 800 new cases are diagnosed. The most commonly diagnosed primary malignancy of the bone is osteosarcoma. These tumors are more likely to be diagnosed in children and adolescents in males, and rarely in pregnant women. The paper describes the treatment of a 29-year old woman who was diagnosed with osteosarcoma in the second trimester was described. Pregnant women have been qualified for multi-drug chemotherapy according to AP3, which is the primary treatment for this type of sarcoma. From 23 to 34 weeks pregnant she received 4 cycles of cytostatics while monitoring the welfare of the fetus. Pregnancy was terminated by caesarean section at 34 weeks gestation giving birth to a healthy daughter. Surgical removal of the tumor from the chest wall resulted in complete radicalization (R0) of the treatment and continued chemotherapy followed by five further cycles following the same regimen. Because of Hashimoto's disease, two years before pregnancy, he was also monitored for thyroid hormone levels and endocrine monitoring without the need for hormonal substitution. Eighteen months after the treatment of sarcoma, the patient feels well not to have relapses and the baby develops properly. Administering multidrug-resistant chemotherapy in full, due doses of 23 to 32 weeks will not cause any damage to the fetus. And after 18 months from the end of treatment, there is no cure for motherly failure and the baby develops properly.
Keywords: pregnant chemotherapy, sarcoma in pregnant women, osteosarcoma and pregnancy.

INTRODUCTION

Malignant tumours are diagnosed in 1/1000 pregnancies and are very rare. Currently, a steady increase in incidence in this group of women can be observed, to which late mothership and overall increase in malignancy among young adults is conducive. The predominant tumour occurring in about 51% of pregnant women is breast cancer, followed by haematologic malignancies, which account for around 26% of cases [1]. Sarcomas in adult populations account for about 1% of all malignancies, more often, in 7-10% of cases, it is diagnosed in children and adolescents [2]. Annually in Poland, about 800 people suffer from sarcoma, which accounts for 2 out of 100,000 cases. However, the incidence of sarcoma among pregnant women is rare [3].

Sarcomas are mesenchymal tumours derived from supportive tissue: connective tissue, cartilage tissue, muscle tissue, fat tissue, vessel tissue, bone tissue, the cartilage, etc. Primary malignant bone cancer is a heterogeneous group of malignancies of mesenchymal origin, including osteosarcoma, Ewing sarcoma and chondrosarcoma. The differentiating characteristics of these three types of sarcoma are presented in Table 1.

In clinical terms, bone sarcoma is divided into spindle cell sarcoma and small cell sarcoma. Among spindle cell bone cancers, osteosarcoma is the most common. The second most commonly occurring in adults from this group of spindle-cellular bone sarcomas is chondrosarcoma, and others, such as fibrosarcoma or fibrohistiocytoma, are much less frequent. Small cell sarcomas (e.g. Ewing sarcoma or mesenchymal chondrosarcoma) occupy third place in the incidence of primary malignant bone cancers in adults. A small proportion of spindle cell sarcomas occurs on the basis of predisposing diseases such as Paget's disease, congenital retinoblastoma or multiple exostoses. They can also be induced by, for example, prior irradiation. Small cell sarcomas of the bone do not develop secondary to other states and are not present in familial or hereditary cancers [4].

The aetiology of sarcoma in most cases remains unknown. The basis of the procedure is histopathological diagnosis, clinical stage assessment and decision of multidisciplinary team of experts on the

establishment of medical treatment. Such procedure results in higher rates of curing and higher levels of care for these patients.

Treatments for patients with sarcoma require certain regimens that improve the outcome of treatment. Osteosynthesis should not be performed in patients in the case of pathologic fracture, due to the probability of intramedullary dissection. The microscopic examination of the tumour should be performed by open-surgery biopsy with a very precise determination of the location of the material to be collected for microscopic evaluation. The cut cannot interfere with subsequent surgery and should located be furthest from the neurovascular bundles, and during later radical surgery the scar from the biopsy must be removed. The tumour section should be removed "sharply" from the perimeter of the tumour - the place with the largest proliferation and the smallest necrosis. In tumours, without crossing the cortex of long bones, a "bone window" should be cut in the thinnest location, so as not to weaken the bones and not to promote pathological fracture. Severe bleeding from the tumour may occur during the sampling. Careful hemostasis should be performed within the soft tissues and bones using, for example, wax. During the removal of the tumour, the cut should be long enough to reach the deep change and should be parallel to the long axis of the limb. During preparation, boundaries of the muscle compartment should not be crossed [3,5]. Adherence to these principles and the team's qualification for treatment causes that the patients are treated with the greatest care and have the greatest chance for being cured.

Table-1: Comparison of microscopic construction, treatment method and prognosis in three types of bone sarcoma [6]

Mięsak Kościopochodny ***Osteosarkoma (Osa)***	**Mięsak Chrzęstnopochodny** ***Chondrosarcoma (Chsa)***	**Mięsak Ewinga** ***Ewing Sarcoma (Es)***
Most common incidences of primary malignant bone cancers: 0.3-2/1 million people/year 60-100 cases in Poland/year male prevalence (M:F=1.4:1) age: II-IV (80%) and VI-VII decade of life (20%).	Second malignant bone cancer, as regards the incidence in adults, third in children. Frequency: 0.5/1 million people/year 50-60 new cases in Poland/year Male dominance (M:F = 1.5-2:1) Age: central variant: 40-50 years; clear-cell: 25-50 years; mesenchymal: 10-40 years; Surface: 30-40 years; dedifferentiated: 30-60 years.	Third, as to the incidence in adults, second most common malignant bone cancer in children Frequency: 0.1/1 million people/year 40-60 new cases in Poland/year Comparable in both sexes Average age of disease occurrence - 15 (occurrence in patients below 5 years of age also recorded).
HIST-PAT : osteo-, chondro-fibro-blast - 80%. Teleangiectatic Small cell Parosteal and periosteal, high-grade surface Low-grade central	**HIST-PAT:** acc. to WHO 2008 ChSa NOS (Not Otherwise Specified) Juxtacortical Myxoid Mesenchymal Clear cell Dedifferentiated	**HIST-PAT**: ES cells: Small, round, low-grade ES and PNET belong to the Ewing sarcoma family of tumours (ESFT). Differentiation: lymphomas, other sarcomas, neuroblastoma metastasis and melanoma. Immuno-histochemical and molecular tests: FISH for the presence of translocation of *EWSR1* gene, e.g. t(22;11)
CLINICAL: 90% long bone metaphysis, 50% knee joint; Axial location in older patients; pathological fracture 15%; with distant metastasis at diagnosis: adults (20%), children (35%) **X-RAY**: osteoblastic/osteolytic growth, periosteal reactions, "spicules", Codman triangle **MRI** basic test evaluating the extent of the tumour **CT** (also chest), **bone scintigraphy** **PET** in selected cases	**CLINICAL**: Primary form (50-80%): pelvis, femur, proximal humerus, ribs; Secondary form (20-60%): pelvis, hips and shoulders; in Maffucci Syndrome/Olliers Disease: possible in each bone. **X-RAY**: osteoblastic growth, periosteal reactions **CT/X-RAY** (also chest), **bone scintigraphy** in selected cases	**CLINICAL**: most often the central part of long bones or axial skeleton is diseased; in adults more often extraosseous. **X-RAY**: periosteal reactions, so-called "onion skin." **MRI** basic test evaluating the extent of the tumour **CT** (also chest), **bone scintigraphy** **PET** and **BONE MARROW BIOPSY** in selected cases
TREATMENT: **Radical: 3xCHT+SUR+3-6xCHT** **Palliative: CHT +/- palliative RTH.**	**TREATMENT: SURGERY is the primary treatment** **Complementary treatment depends on the subtype and**	**TREATMENT:** **Radical: 3-6xCHT + RTH/SUR+ CHT (1 year)** **Palliative: CHT +/- palliative RTH**

SUR: conserving surgery (80% of patients with regression or stabilisation) or non-conserving surgery **CHT**: 1st crisis: in adults - ADM/DPP (6-9 cycles) in adults, in children - ADM/DPP/HDMTX, 10 weeks before SUR, after SUR depending on level of tumour necrosis: ADM/DPP/HDMTX or ADM/DPP/HDMTX/VP/IFO; in case of recurrence or progression: in adults: VP/IF, GZM+DOX,CTX,MTX,CBDCA or other; In children, additionally: VCR/TMZ/IRN, VCR/DOX/CTX/DDP **RTH**: does not apply to radical treatment **Metastasisectomy** after primary tumour removal, if radical removal of metastases is possible and in case of regression or stabilisation of disease; always in parallel with CHT.	**degree of histologic malignancy.** G1/2, located centrally in the bone and formed on the base of exostoses - SUR G3/4, clear cell subtype and axially located – SUR with wide margins Dedifferentiated ChSa: CHT-SUR-CHT as in osteosarcoma; high risk of local recurrence - amputation recommended Mesenchymal ChSa: CHT like in Ewing sarcoma	**CHT**: 1st crisis: in adults - ADM/VCR/ADT/VP/IFO (up to 1 year); in children: 6xVCR/IFO/ADM/VP + SUR/RTH + 8x VCR/ACTD/IFO or VCR/ACTD/CTX; In recurrence/progression: topotecan, IFO/VP16, other **RTH** : inoperable tumour; > 10% of live cells after CHT; non-radical surgery. In case of lung metastases – better treatment results after RTH for the whole lung **SUR**: conserving or non-conserving – improves treatment results. Warning! Metal clips should be worn during the surgery, especially in areas of dubious radicality.
PROGNOSIS: 5-year survival: SUR - 10-20%; SUR-CHT - 40%; CHT-SUR-CHT - 60-70% Recurrence: 40-50% of patients; most often in the first three years after the end of treatment; The most common are lung metastasis (70%) or local recurrence after conserving treatment (7% of patients).	**PROGNOSIS**: 5-year survival: G1 – 80%; G2/3 – 50-60%;G4 – 20% Recurrence: first of all local recurrence, rarely distant metastases (mainly to the lungs, bones, soft tissue); frequency of metastasis depends on stage of progression, histological variation and histological malignancy.	**PROGNOSIS**: 5-year survival: SUR <10%; SUR/RTH 20-30%; CHT+RTH/SUR+CHT up to 50%; prognosis in case of metastasis to bone marrow and/or bone – 10-20%. Recurrence: 60-70% of patients; most often in the first three years after treatment.

Osteosarcoma (OSa) is the most common primary bone cancer diagnosed in people aged 10-20, in 75% of patients occurring before the age of 19. It does not develop in children below 5 years of age and morbidity increases during growth spikes in puberty between 10 and 14 years of age. In youth under 19 years old, sarcoma is diagnosed in about 5 per million of patients.

In adults, two peaks of occurrence are observed: in the third decade of life (about 60%) and at the turn of the sixth and seventh decade (about 20%). Osteosarcoma is diagnosed annually in 1-2 adults per million, which accounts for 60-100 per year. Women account for 49% of patients with osteosarcoma and 80% of patients are Caucasians. Malignant lesions are located mainly in the knee joint area, less often in the metaphysis of the distal femur or the proximal tibia, in the humerus, in the fibula. Occurrence in flat bones such as shoulder, ribs or pelvis is extremely rare, especially in pregnant women [7].

Factors favouring development of the disease are: Rapid bone growth, in adolescence, but also environmental factors such as past bones irradiation and genetic factors. OSa sarcoma is more common in siblings, in the Li-Fraumeni syndrome, in patients with retinoblastoma. It may develop in previously unchanged bones, thus being defined as primary, or in material altered by benign bone lesions, dysplasia or Paget's disease [2]. A characteristic symptom of the disease is the nighttime pain of the affected area. They may be accompanied by swelling, deformation, swelling of the limb and pathological fractures due to the bones being weakened by the ongoing process. Osteosarcoma early infiltrates the surrounding soft tissues with metastasis through the blood vessels to the lungs and bones. Metastases are present in about 20% of patients already at the time of diagnosis.

CASE STUDY

MK, a 29-year-old woman, visited a gynaecologist during the 17th week of her second pregnancy (delivery date 20.06.2015) due to a hand-sized tumour located in the chest wall at height of the 9th-11th rib on the right side. She had been observing the change described by a family doctor as a lipoma for about 9 months. The area around the tumour initially did not cause any problems; the change was poorly perceptible and slightly tender to the touch. Around week 15-16 of the pregnancy, it became visible, well noticeable with the inclusion of spontaneous pain that worsened in the night. The patient is a chemist; she has had one delivery by caesarean section in 2013, resulting in a successful full term delivery. For 2 years, due to Hashimoto's disease, she was under the care of an endocrinologist. However, due to the correct results of TSH, FT3 and FT4, she did not require hormone

treatment. This condition also did not change during pregnancy. Monthly thyroid hormone tests have not changed and she did not undergo hormone treatment. Other chronic diseases have not been diagnosed. There is family history of gastrointestinal and genitourinary cancers among first and second degree relatives over the age of 40.

Immediately after the visit on 8.01.201, an MRI was performed and a tumour with a size of 8x4cm was diagnosed, with blurred boundaries and suspicion of tumour growth. She was referred to a regional hospital where a surgical biopsy of the lesion was performed. Histopathological examination diagnosis: osteosarcoma high-grade.

Because of the diagnosis of sarcoma, she was referred to the Institute of Oncology (COI) where second MRI (on 14.01.2015) was performed, which found: well-defined expansive tumour in the back section of the 10th rib on the right side, which increased in comparison with previous test to: 90x56x42 mm, inflates the paraspinal rib section, occupying the head of the rib and is closely adjacent to the stem and the transverse process Th10. The process with characteristics of bone marrow oedema (from compression) penetrates into the quadriceps muscle and in the rectal musculature of the ridge at a distance of about 20 mm (no tumour pouch in this area). Otherwise encapsulated, well demarcated from the pleura which it models, it adheres to intervertebral cavities Th9, Th10, Th 11, modelling intercostal nerves without penetrating into the intervertebral cavities.

At the Institute, which has the highest rate of referrals for treating sarcoma, tumour specimens from the Th9-10 and 10th rib area on the right side were analysed, description: epithelioid tumour tissue with high cellularity, high-grade cytoplasmic atypia, and mitotic activity 10/10 HPF including atypical mitosis. In addition, unevenly distributed multinucleated giant cells without necrosis were isolated within the lesion. Poor tumour stroma with multifocal osteoid deposition. Rectal infiltration of brachial plexus. Immunohistochemical reactions were performed during primary biopsy: CK PAN (+) in single cells, VIMENTINE (+), SMA (-), CD99 (+/-), S-100(-), KI-67 40%. Also testing was additionally expanded with further immunohistochemical reactions: S-100(-), HMB45 (-), MELAN-A (-), WT-1(+) intensive cytoplasmic reaction in most cells, CD56 (+), INI-1(+), CD31 (-), LCA (-), CD30 (-), CD138 (-), KAPPA(-), LAMBDA(-).

The microscopic image was compared with a macroscopic resonance image: in the MRI assessment, a change in the whole region shows numerous levels of fluid as in the secondary aneurysmatic cyst. Microscopic picture together with the immunohistochemical profile and the MRI test corresponds to a high grade malignant osteosarcoma, a teleangiocorm variant. It is not possible to visualise the perimeter of the lesion and the radiological features of its malignancy on the basis of the MRI.

After a multidisciplinary consultation at the COI in Warsaw, a team of experts established a diagnosis: Osteosarcoma of the 10th rib with a high degree of differentiation – G3.

The patient who was 23 weeks pregnant was qualified for treatment, which included 4 cycles of preoperative chemotherapy according to AP3: ADM 30 mg (1-3 d) and Cisplatin 40 mg (1-3 d), doses are adjusted to body weight before pregnancy. Pregnancy solution and then continuing chth to 9 cycles after childbirth. Treatment in the form of 1 chth cycle was started by the patient on 17th February 2015 at the COI, and then continued with 3 cycles according to AP3 in a university gynecological and obstetric hospital where the assessment of the well-being and maturity of the foetus was made until the completion of the pregnancy by caesarean section was conducted. Chemotherapy treatment was continued until 21.04.2015. At that time, the patient received 3 further cycles of chemotherapy according to the assumptions of the expert committee. Chemotherapy was performed in the casing of anti-emetic drugs (Atossa, Torecan), anti-coagulant drugs (Clexan 1x 40mg sc) and Dexamethasone until the caesarean section on 12.05.2015.

Monitoring of foetal status revealed minor deviations from normal in the course of the mother's entire treatment by chemotherapy. Prior to the 3rd chth cycle at 28.3 weeks of gestation, an ultrasound showed normal foetal development corresponding to 27.4 weeks of gestation, which was not consistent with the duration of gestation calculated on the basis of the date of the last menstrual period. It was recommended to perform a cardiotocography (CTG) 4xday, the results of which showed no deviation from normal.

Before the 4th cycle of chemotherapy, the foetal weight of 1400 g was diagnosed at 31 weeks of gestation in an ultrasound test. The only deviations from normal for this gestational age were biometrics correlated to 30 weeks of gestation and lower than the normal value (counted according to the last menstrual period) and decreased abdominal circumference, normal for 28 weeks of gestation. The frequency of CTG tests was increased to 6 per day and foetal heart rate was monitored once a day by means of a portable foetal heart rate detector. During the entire observation, mean foetal heart rate was assessed as normal. On the 3rd day after the 4th chth cycle, an ultrasound showed poorly marked foetal movement, no respiratory movements. Mean age of pregnancy on the basis of the test – 31.2 weeks and normal value (calculated according to the last menstrual period) should correspond to 32.2 Hbd (Hebdomas). Uterine-placental flow was normal.

The next ultrasound examination was performed on day 13 after completion of chemotherapy. A small incidence of biometric level disturbance of 32.2 Hbd was observed in comparison to 33.3 Hbd according to the last menstrual period. Abdominal circumference was alarming, normal for 30.4 weeks of gestation. Estimated foetal of weight 1700 g, correct amniotic fluid index, correct uterine-placental flow.

On 12.05.2015, at 34 weeks of gestation, a planned caesarean section was performed under subarachnoid anaesthesia. Premature living daughter was born weighing 2110 g and 50 cm, scored at 1 minute as 10 points, 3 minutes as 8, 5 minutes as 9, 10 minutes as 9 points on the Apgar scale. After birth, the uterine cavity was examined. The placenta was sent to a histopathological examination in which no pathology or metastases were found. Amniotic fluid culture was performed, the result was normal, without growth in aerobic and anaerobic conditions. On 15.05.2015 the patient was discharged with the child from the gynaecological and obstetric hospital in good condition.

Month after childbirth on June 16, 2015, an "en bloc" resection of the primary tumour with the site of primary tumour biopsy (Th9-10 with ribs 9, 10, 11 on the right) was performed at the neurosurgery ward. Primary diagnosis was confirmed in the microscopic assessment, tumour regression after chemotherapy was not reported and necrosis was not reported. Margins around the tumour were free of tumour necrosis.

After surgery on day 6, chemotherapy was resumed at the COI following the AP3 schedule. Five consecutive cycles were administered, in total the patient received 9 chemotherapy cycles. On 27.08.2015, during the first check-up, a CT scan of the chest and abdominal cavity revealed postoperative lesions and a change in the right lung segment 8 with a diameter of 4 mm and a calcification of 2 mm in the right lung segment 2 requiring further screening. In subsequent MRI, CT scans and palpation imaging tests, no progression of disease was observed. The last check-up 18 months after the end of treatment showed good general condition and the MRI and CT scan showed no spread or local recurrence of disease. The child is developing correctly.

DISCUSSIONS

The paper described a rare case of osteosarcoma of the 10th rib in a pregnant woman who has not undergone complete treatment with multiple regimens of chemotherapy according to the protocol adopted for this disease. Sarcoma teleangiectaticum, which is classified as a worse prognosis compared to other types of OSa, was diagnosed microscopically. The teleangiectatic form accounts for about 3% of bone marrow sarcoma. Under a macroscope it looks like a cyst filled with blood, which can cause a wrong diagnosis of an aneurysmal cyst. In the patient's first MRI, fluid levels in the tumour were described, which may confirm the presence of such a form of sarcoma. From the 23rd week of pregnancy, the patient was treated with chemotherapy, 10 weeks before birth and 9 weeks after childbirth, she received 9 cycles of chemotherapy according to AP3. Pregnancy did not result in a dose reduction or the number of scheduled and conducted chemotherapy cycles. Tolerance of treatment was comparable to other patients. Surgical treatment was performed after childbirth to achieve full radicalness (R0) in the removal of the sarcoma, which was confirmed in the microscopic assessment of the tumour removed. However, microscopic assessment revealed no response of sarcoma tissues to chemical treatment; no traces of cancerous tissue damage or necrosis caused by cytostatic treatment were found.

The chemotherapy programme used for this patient, in the assessment of the European American Osteosarcoma Study Group EURAMOS, is among the most effective. The degree of tumour necrosis >90% as a treatment effect is a recognised positive factor for curing. In this case, the absence of sarcoma necrosis significantly deteriorates prognosis [5,8].

Osteosarcoma is a chemo-sensitive but not chemo-curable tumour, and full and radical treatment consists of chemotherapy combined with surgical removal of the tumour. Chemotherapy causes the tumour to shrink and the tumour cells spread into the blood are destroyed, so it is important to combine these methods.

Despite the radical sarcoma treatment in the pregnant woman, adequate to the diagnosis, tumour destruction was not achieved. Evaluating the weak effect of chemotherapy, we should consider the effects of molecular factors and the occurrence of genetic diseases. Patients with recognised retinoblastoma, with the current mutation in the RB1 gene in reproductive cells, are at increased risk for OS. Osteosarcoma is one of the tumours that can also occur in people with a dominant mutation in p53 suppressor oncogene in reproductive cells (Li-Fraumeni syndrome). This genetic disease has not been found in this case, and family history does not reveal the family's tendency to develop this type of cancer.

The poor sarcoma treatment results cause that prognostic factors are still being sough that may help in the selection of personalised treatment and thereby improve the rate of curing. The factor that is currently being evaluated is β-HCG gonadotropin. Studies of patients with generalised osteosarcoma, with multiple metastases to bones and parenchymal organs revealed increased ectopic secretion of this gonadotropin. The research was conducted primarily among non-pregnant women and also in the few male groups. Preliminary results of β-HCG evaluation show a negative correlation between poor prognosis and more frequent recurrence

of sarcoma in patients with higher levels of β-HCG [9,10].

Another interesting study is the evaluation of lactoferrin (LF). Lactoferrin is a protein with molecular weight of approximately 80 kDa, belonging to the group of transferins, proteins having an affinity for iron ions. Lactoferrin can be secreted by neutrophils and seems to prevent metastasis. Several animal studies have shown that it significantly inhibits metastasis, which is attributed to its ability to stimulate the production of interferon gamma – an immunological cytokine. In addition, LF stimulates the activity of natural cytotoxic cells, T cells and macrophages. LF has chemopreventive properties: it regulates the activity of phase 1 and 2 enzymes involved in the activation and detoxification of carcinogens and regulates the microflora composition of the gastrointestinal tract. In this way it prevents tumour growth and development in the early stages of cancerogenesis [11,12].

Sarcoma among pregnant women is an extremely rare disease in both the bone and the soft tissue. Table 2 shows the incidence of various types of bone sarcoma and soft tissue among pregnant women. At present there are about 174 descriptions of these disease occurrences. This small group of patients does not entitle us to make conclusions regarding the correctness of treatment or assess the curing ratio, as the treatment in the presented group was started several times after the completion of pregnancy and hence its results are often very bad [13,14].

Table-2: Occurrence of bone and soft tissue sarcoma in 142 pregnant women based on literature review

Form of sarcoma	Number of patients	%	Period of illness	Literature sources
BONES				
Osteosarcoma	25	18	1963-2015	[1,10,18,19,26,27]
Ewing sarcoma	21	15	1963-2015	[1,5,14,20,22,31]
Chondrosarcoma	10	7	1989-2015	[1,8,18,28]
SOFT TISSUE				**[**4,6]
Leiomyosarcoma	17	12	1993-2014	
Liposarcoma	18	13	1969-2015	
Rhabdomyosarcoma	14	10	1969-2014	
GIST - Gastrointestinal stromal tumours	9	6	1996-2014	
Synovial sarcoma	12	8	2004-2014	
Kaposi's sarcoma	8	6	1971-2012	
Endometrial stromal sarcoma	5	4	2002-2014	
Fibrosarcoma	1	1	2003-2016	
Clear ceall sarcoma soft tissue	1	1	2010-2016	
Ewing sarcoma (of kidney)	1	1	2016	

Some authors emphasise the frequent spread of sarcoma in pregnant women at the time of diagnosis. Treatment deferred until the time of completion of the pregnancy or spread of the disease at the time of diagnosis causes that often only palliative or symptomatic treatment is used in this group of patients [7]. Postponing chemotherapy on the basis of ever increasing literature on successes of chemotherapy in pregnant women appears to be inappropriate. Multidrug treatment starting in the second trimester often does not show foetal damage. It is possible to safely adjust the cytostatic drugs to the gestation period, which raises the hope that, as in the case described above, the treatment may be carried out from the time of diagnosis and not from the spread of the disease after the birth of the child.

The paper describes the case of a pregnant woman undergoing systemic chemotherapy according to the diagnosed type of sarcoma, under strict control of foetal wellbeing, followed by continued treatment after pregnancy. The child was born without any somatic lesions only with lower body weight and with good mental development after the first year of life.

With the current state of knowledge and ability to personalise the monotherapy, treatment of many cancers in pregnant women can start even during organogenesis without causing foetal damage. And from the second trimester it can be widened by the required drugs, also without causing negative symptoms in the foetus. It is major factor that so far there have been too few success stories in the treatment of pregnant malignant patients, which is why the old, obsolete ways of dealing with this group of patients are still applied. However, due to the deferment of motherhood and the steady growth of cancer among young adults, it should be noted that pregnant women will represent an increasing number of patients requiring oncological treatment. The presented case is part of a group more and more frequently presented in the literature on curing pregnant women without damaging the child [1, 5-17].

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