CASE REPORTS

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Fetal sacrococcygeal immature teratoma – report of two cases and review of the literature

MĂDĂLINA LUCIA MARCU[1,2], NICOLAE BACALBAŞA[3], ELISABETA CANDREA[4], CĂTĂLINA DIANA STĂNICĂ[3,5], TARIG MASSAWI[6], ANDREEA CHIRILOV[6], ADRIAN NEACŞU[3,5], IRINA PACU[3,7]

[1]*Department of Pathology, Carol Davila University of Medicine and Pharmacy, Bucharest, Romania*

[2]*Department of Pathology, Ilfov County Hospital, Bucharest, Romania*

[3]*Department of Obstetrics and Gynecology, Carol Davila University of Medicine and Pharmacy, Bucharest, Romania*

[4]*Department of Dermatology, Iuliu Haţieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania*

[5]*Department of Obstetrics and Gynecology, St. John Emergency Clinical Hospital, Bucharest, Romania*

[6]*Department of Obstetrics and Gynecology, Ilfov County Hospital, Bucharest, Romania*

[7]*Department of Obstetrics and Gynecology, St. Pantelimon Emergency Clinical Hospital, Bucharest, Romania*

Abstract

Sacrococcygeal teratomas (SCTs) are rare congenital tumors. With the improvement of diagnostic imaging methods and follow-up protocols in pregnancies, *in utero* detection of these tumors has increased. Despite these progresses, SCTs may present difficulties in establishing *in utero* diagnosis and subsequent management. We present two cases of SCT in 18 weeks, respectively 22 weeks pregnancy, diagnosed using ultrasound imaging and pathologically confirmed. Also, the article aims to recapitulate clinicopathological aspects and prognosis of these lesions, following the review of the literature.

Keywords: fetal sacrococcygeal teratoma, MRI, immature tissue, fetal ultrasound.

Introduction

Sacrococcygeal teratomas (SCTs) represent the most common group of fetal tumors. Prevalence is low (1:35 000–40 000), with predilection in affecting female sex (4:1), as reported in many studies on this topic [1–6].

The etiology of these lesions is unclear. Most SCTs are sporadic, although a family variant is also described, suggesting an autosomal dominant inheritance [7].

Teratomas can occur at any level on the median line of the body, between the pineal gland and the coccyx, due to a defect in embryonic development. The most common location for extragonadal teratomas is sacral region, followed by anterior mediastinum, retroperitoneum, cervical area, stomach, vagina [8]. These tumors are thought to arise from pluripotent germ cells that become isolated in aberrant locations during the migratory process [1, 3].

Pathologically, teratomas can be divided into benign (containing well differentiated, mature tissues), immature (with mature and immature tissues in variable amounts) and malignant. Malignant teratomas are classified depending on the type of malignant tissue (yolk sac tumor, embryonal carcinoma, germinoma, choriocarcinoma) [9]. The incidence of malignancy is 10%, most commonly in the form of yolk sac tumor [10].

The constitutive elements of teratomas derive from embryonic germ layers (ectoderm, mesoderm, endoderm) [11]. Immature ectodermal component is dominant, in the form of neuroectodermal rosettes and tubes. Other ectodermal elements are neuroglia, epidermal and dermal structures, teeth. Among the mesodermal structures, we mention immature cartilage, adipose tissue, bone, striated muscle tissue. Endodermal structures [respiratory-type epithelium, hepatic parenchyma, embryonic kidney tissue, immature gastrointestinal (GI) tissue] are less common [1, 10, 11].

Gonzalez–Crussi classification was established to predict malignant potential for extragonadal teratomas, based on histopathological (HP) criteria. Grade 0 contains only mature tissues. Grades 1–3 have immature components containing rare (grade 1), moderate (grade 2) or frequent foci, with or without malignant elements (grade 3) [11, 12]. Separation between benign and malignant teratomas is important for prognosis, as malignant tumors are usually fatal. However, benign teratomas may also be fatal if they affect vital structures [13].

According to the *American Academy of Pediatrics Surgery Section Survey* (AAPSS), the classification of SCTs is based on anatomical localization of the lesion. In type I, the mass is external, with minimal or absent internal component. Type II is predominantly external, with internal intrapelvic extension. In type III, the lesion has both external and internal components, with extension into the abdominal cavity. Type IV is entirely internal. *AAPSS* classification is important for its prognostic value. Most SCTs are type I or II, less than 10% of cases being type IV. Type IV has the highest malignancy risk [2, 7].

Aim

We report two rare clinical cases of SCT diagnosed and investigated in the Department of Obstetrics and Gynecology, Ilfov County Hospital, Bucharest, Romania, emphasizing the importance of prenatal diagnosis and postnatal management.

Case presentations

Case No. 1

A 27-year-old female having an uneventful pregnancy until 18th week of gestation, presented at the Department of Obstetrics in our Clinic for pelvi-abdominal pain and vaginal hemorrhagic fluid loss. Clinical examination revealed an enlarged uterus. Premature ruptured membrane test was positive. Ultrasound (US) revealed a viable male fetus with biometrics corresponding to 18 weeks of gestational age. In the sacrococcygeal region, US examination showed a lobular mass, with nonhomogeneous structure (hyperechogenic areas alternating with hypoechogenic areas), measuring 32/28 mm, suggestive of SCT. Doppler examination revealed evident intratumoral vascularization. Amniotic fluid in low amount and a low-lying placenta with placental hematomas and with significant take-off areas were also described. Following an emergency caesarean section for hemostasis [14, 15], a product of conception without cardiac activity and its placenta were extracted. Necropsy examination revealed a male fetus with the anal orifice anteriorly moved due to a subcutaneous nodular tumor. On macroscopic cross-section, the sacrococcygeal tumoral formation measuring 33/30 mm showed mixed (solid and cystic) structure (Figure 1, A and B). Microscopic examination revealed elements derived from all three germ layers: mature and immature nervous tissue (consisting of rosettes, neuroepithelial tubes), retinal tissue, squamous epithelium, cartilaginous foci, glandular structures, serous acinar structures (Figure 2, A and B). Macroscopic and microscopic aspects supported the diagnosis of sacrococcygeal tridermic immature teratoma, grade 3 (Gonzalez–Crussi classification), type II (*AAPSS* classification).

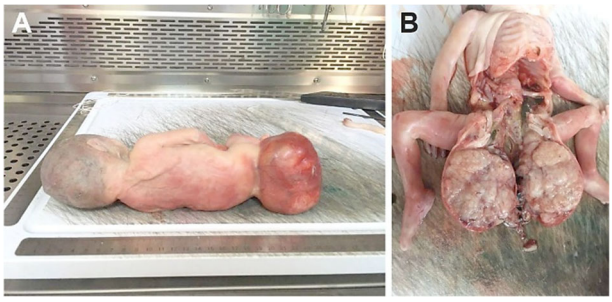

Figure 1 – ***Macroscopic appearance of the fetal sacrococcygeal tumor (A). On cross-section (B), the tumor showed mixed (solid and cystic) structure.***

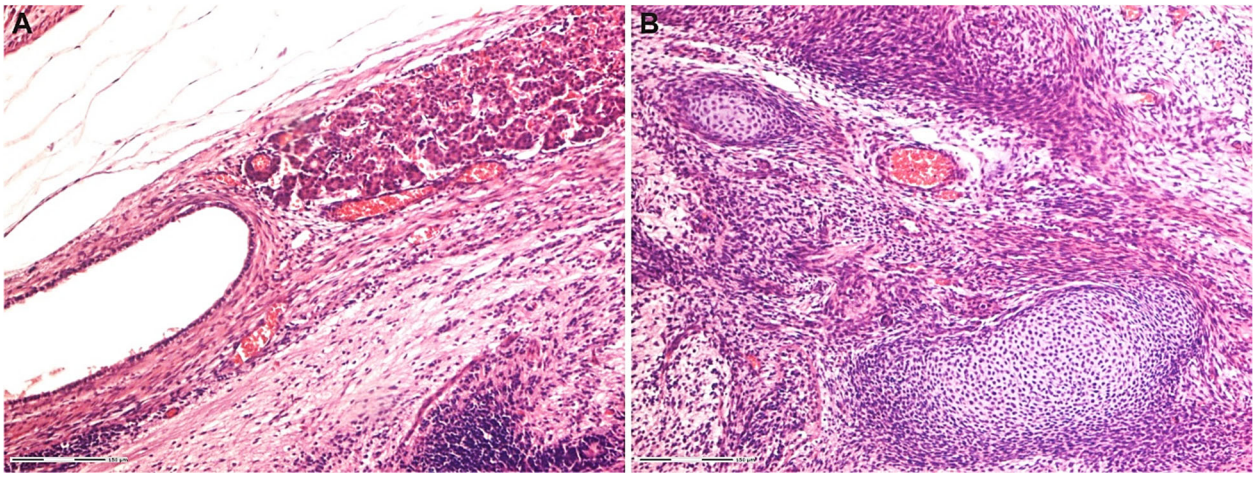

Figure 2 – ***The lesion includes glandular structures and rosettes of nervous tissue (A), as well as cartilaginous foci (B). Hematoxylin–Eosin (HE) staining: (A and B) ×100.***

Case No. 2

A 26-year-old woman with a 22/30 weeks of gestational age, without significant pathological history or pregnancy-related pathology, presented in our Clinic with pelvi-abdominal pain and metrorrhagia. Clinical and paraclinical examination confirmed a 22-week pregnancy with premature membrane rupture and prematurely installed labor [16]. US examination revealed low-placed placenta and a viable female fetus with a sacrococcygeal mass of non-homogenous US density. At necropsy examination, the anal orifice was anteriorly moved by the presence of a subcutaneous, sacrococcygeal mass. The tumor showed a nodular, well-defined aspect; it was predominantly solid with cystic foci, gray, with hemorrhagic areas, and measured 85/55 mm (Figure 3, A and B).

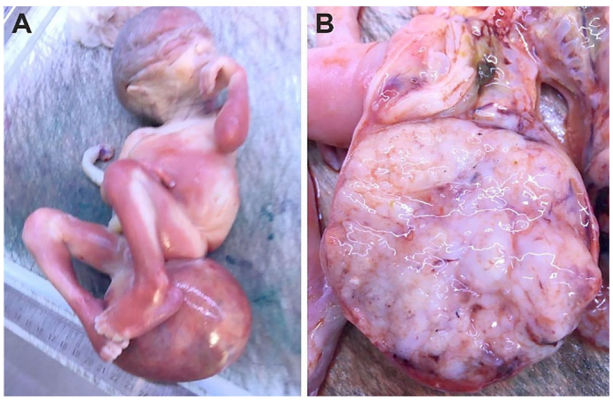

Figure 3 – ***General macroscopic image of Case No. 2 (A) with a sacrococcygeal tumor of nodular, well defined, predominantly solid aspect on cross-section (B).***

Microscopic examination showed the tumor formation consisted of mature and immature nervous tissue (rosettes, neuroepithelial tubes), primitive retinal tissue, squamous epithelium, urothelial islands, cartilaginous foci, bone lamellae, glandular structures, serous acinar structures (Figure 4, A–C). The final diagnosis was sacrococcygeal tridermic immature teratoma, grade 3 (Gonzalez–Crussi classification), type I (*AAPSS* classification).

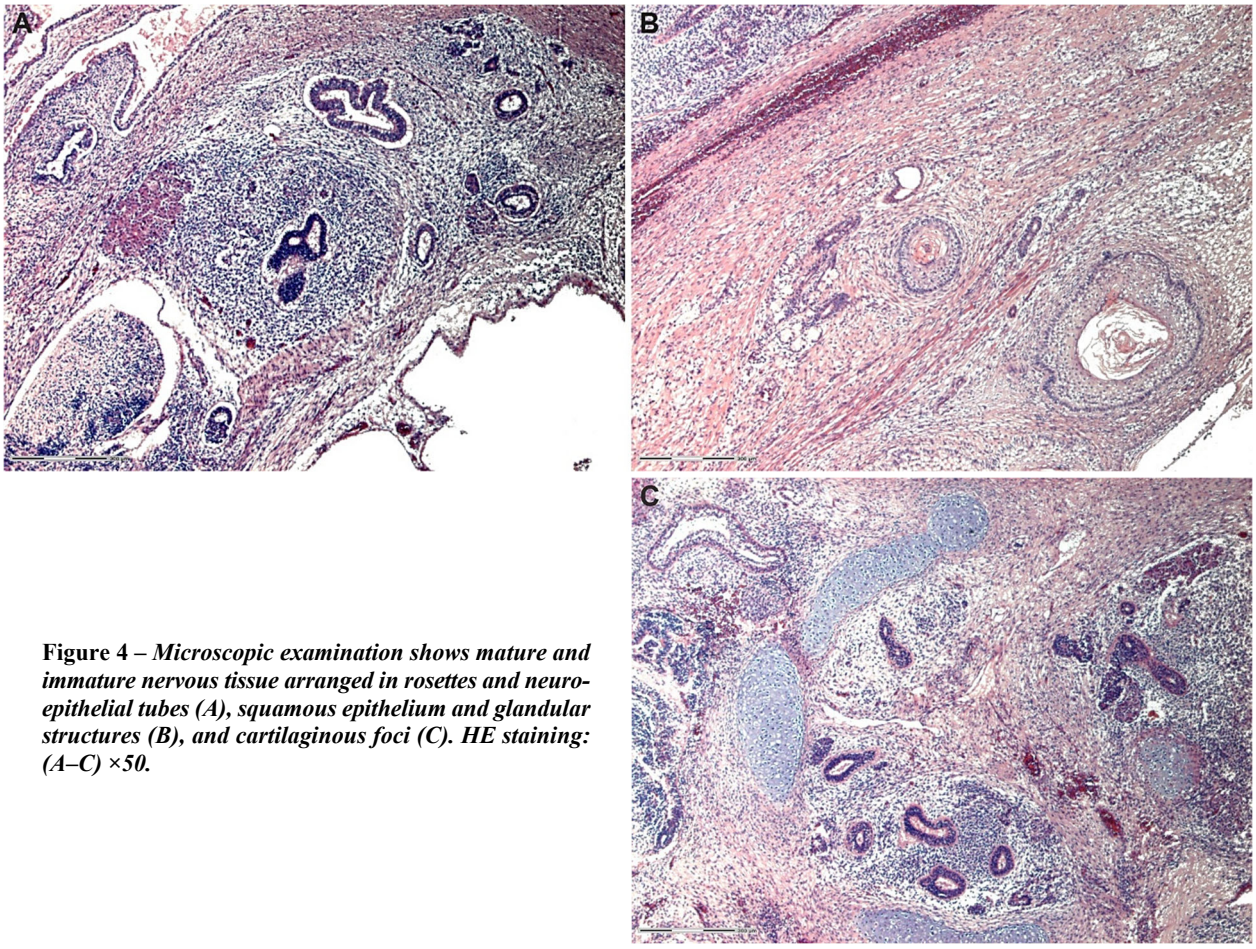

Figure 4 – ***Microscopic examination shows mature and immature nervous tissue arranged in rosettes and neuroepithelial tubes (A), squamous epithelium and glandular structures (B), and cartilaginous foci (C). HE staining: (A–C) ×50.***

Discussions

Teratomas may be discovered incidentally during a routine US or may be suspected in case of increased uterine size for gestational age (GA) [1, 5, 17]. Most lesions are diagnosed in the second trimester, the earliest case being described at 13.5 weeks of GA [18]. Consistent with statistical data, our cases were also identified in the second trimester of pregnancy.

Various studies have analyzed imaging aspects in SCT, describing increased fundal height (as the first US sign), increased uterine dimensions by the presence of polyhydramnios or tumoral mass. Tumoral appearance on US may be solid (most frequently), cystic or mixed. In 15% of cases, it can be purely cystic [1, 6, 13, 19, 20]. In both cases described in our article, the solid component was predominant.

Regular evaluations ensure monitoring of tumor growth and occurrence of complications. Hambraeus *et al.* consider that a tumoral size greater than 4 cm at a GA of 20 weeks requires a weekly US monitoring [21].

In a study by Bond *et al.*, tumor vasculature was evaluated using a Doppler US. Tumor blood vessels were similar to those of the lower extremities in terms of size [19]. Multiple studies have shown that magnetic resonance imaging (MRI) yields additional information compared to US. Using MRI allows an accurate assessment of the presence/absence of the internal component and the intrapelvic/intra-abdominal/intraspinal extension, compression of adjacent organs, tumoral structure (distinguishing between a microcystic structure, solid structure, hemorrhagic changes). MRI has improved preoperative planning for surgical resection [3, 22]. However, as seen in our cases, US investigation remains a useful method to discover such tumors.

SCTs, particularly malignant ones, have been associated with elevated alpha-fetoprotein (AFP) levels in maternal serum [19, 23–27]. Some studies [25, 28] described increased AFP levels in amniotic fluid, unlike Brock *et al.* [23], who found normal values. Electrophoresis of amniotic fluid showed a positive result for acetylcholinesterase (AChE) [25]. In our cases, AFP and AChE were not determined.

In a study by Isaacs, various types of mature tissues were revealed upon microscopic examination: tissues belonging to the central nervous system, respiratory tract, GI tract, skin, cartilage. Less common were pancreas, bone, salivary gland, retina, kidney, urothelium. Immature elements were primitive neuroglial tissue (rosettes, neural "tube-like" structures) [29]. As mentioned before, both our cases showed elements derived from all three germ layers, predominantly immature nervous structures.

Following the correlation between US and HP aspects,

it was shown that echogenic areas were the equivalent of solid fields. Cystic areas described at US imaging represented either epithelial cysts, or hemorrhagic, necrotic foci [30].

Entities included in the differential diagnosis of SCTs were meningocele, myelomeningocele, rectal abscess, lymphangioma, lipoma, perineal cyst, anal imperforation, rectal prolapse, duplication of the inferior digestive tract, with the risk of establishing an erroneous diagnosis [2, 13, 24, 31]. Evans *et al.* described a case of a fetal sacral lesion, diagnosed as myelomeningocele on US and found to be a cystic SCT following post-necropsy HP examination. It also highlighted the importance of necropsy in establishing an accurate diagnosis [24].

Obstetric complications occurred in 81% of ongoing pregnancies, some of which may be fatal for both mother and fetus. These were polyhydramnios, oligohydramnios, preterm birth, preeclampsia, gestational diabetes, hemolysis, elevated liver enzymes and low platelets (HELLP) syndrome, hyperuricemia, dystocia [1, 6].

A fetus with SCT has an increased risk of perinatal complications and death due to cardiac output failure determined by tumoral arteriovenous shunt [6]. Tumor invasion or compression of adjacent organs have led to increased morbidity. Most frequently encountered were the urological complications (41% of cases) [22].

Associated anomalies have been described in several studies [2, 6, 13]: pulmonary (pulmonary hypoplasia), GI (meconium peritonitis, rectal stenosis/atresia), genitourinary (kidney dysplasia, urinary obstruction with hydronephrosis, ureteropelvic junction obstruction, urethral stenosis/atresia, urogenital sinus), musculoskeletal (hip dislocation). On US examination, SCTs described in our article did not show complications, nor associated lesions, most likely due to the predominance of the external tumoral component.

Some authors tried to find prognostic factors to establish an appropriate management for these lesions. Several studies showed that the GA at which tumor is diagnosed, location, tumor volume/fetal weight ratio, morphology (cystic or solid), size, intratumorally vascularization, tumor growth rate, presence/absence of complications (polyhydramnios, hydrops, intratumorally hemorrhage), associated anomalies are features that could predict the evolution of SCTs [1, 3, 4, 6, 19, 32, 33].

Although the evolution may be unpredictable, it has been observed that large, predominantly solid, highly vascularized lesions are associated with increased mortality and morbidity. From a legal point a view, it is important to explain the prognosis and therapeutic options to the parents and that, despite current advances in pediatric surgery, outcomes are sometimes poor with severe sequelae. Also, when possible, it is recommended to rule out fetal distress during labor and intrapartum asphyxia by documenting umbilical cord gases [34].

Intratumorally abundant vasculature leads to fetal anemia and blood shunting from the placenta to the tumor, with the subsequent development of high-output cardiac failure, polyhydramnios. Cardiac failure induces placentomegaly, fetal hydrops, preeclampsia, maternal mirror syndrome [33].

Benachi *et al.* attempted to establish a prognostic classification based on tumor diameter, growth rate, cystic/solid morphology, presence/absence of intratumorally vasculature and high-output cardiac failure. Group A was characterized by a lesion less than 10 cm diameter, absent vascularization and low growth rate; in group B, diameter was greater than 10 cm, with pronounced vasculature or cardiac failure, high growth rate; group C, with a diameter greater than 10 cm, predominantly cystic, with minimal/absent vasculature and low growth rate. Group B associated higher mortality and morbidity compared to the other two groups [35]. Both our cases belong to group A according to their small size, however there were clear signs of tumor vascularization in Case No. 1, rendering its classification less precise. As with all tumors, HP characteristics are sometimes the most important factor in predicting outcome. Also, therapeutic strategies must be tailored depending on tumor histopathology and markers expression, as response to therapy can vary widely depending on the tumor type, especially in rare HP types where protocols are not available [36, 37].

Conclusions

SCT remains a rare event. Each tumor is unique from clinical, paraclinical, HP and prognostic points of view. Establishing an accurate prenatal diagnosis is essential both for prenatal and postnatal management, and determination of the possibility of subsequent pregnancies. Also, it is necessary to identify prognostic factors to optimize the surveillance of SCTs diagnosed prenatally.

Conflict of interests

The authors declare that they have no conflict of interests.

Author's contribution

Mădălina Lucia Marcu and Adrian Neacşu contributed equally to this work.

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Corresponding author
Cătălina Diana Stănică, Assistant, MD, PhD, Department of Obstetrics and Gynecology, Carol Davila University of Medicine and Pharmacy, 37 Dionisie Lupu Street, Sector 2, 020021 Bucharest, Romania; Phone +40745–018 537, e-mail: catalina.stanica@umfcd.ro

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