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Ovarian teratomas: One year experience in a rural tertiary health care centre

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Abstract
Ovarian teratomas are said to originate from primordial germ cells and typically contains mature (or less frequently immature) tissue derivatives of three germ cell layers (ectoderm, mesoderm and endoderm). This report includes a series of six mature ovarian teratomas, which were diagnosed in a rural tertiary health care centre over a year and highlights three (out of six) unique cases with intestinal dysplasia, gliomatosis peritonei and struma ovarii respectively. Evaluation and possible mechanism of such rare teratomas are discussed with a brief review of literature.

Keywords: Ovarian teratoma, gliomatosis peritonei, struma ovarii, intestinal dysplasia

Introduction
Teratomas of ovary are known since antiquity and are said to originate from primordial germ cells (according to the most widely accepted Parthenogenic theory).[1] Mostly ovarian teratomas are unilateral and asymptomatic until they reach a considerable size. The most common symptom is abdominal pain.[1]
Typically a teratoma contains mature (or less frequently immature) tissue derivatives of three germ cell layers (ectoderm, mesoderm and endoderm). There are three main histopathological categories of teratomas: 1) mature teratomas, 2) immature teratomas and 3) monodermal and highly specialized teratomas. The most common type is mature cystic teratoma [3, 9].
A variety of ovarian teratomas with unique histopathological findings ranging from uncommon normal tissue to rare malignant transformation have been reported in the literature. Here we report a series of six patients with mature ovarian teratomas, which were diagnosed in a rural tertiary health care centre over a year, three out of which are very rare and unique.

Case report
Case-1
A 15-year-old female patient presented with one week history of lower abdomen pain and vomiting on & off in gynaecology out patient department. Patient was then evaluated with ultrasonography (USG) of abdomen & pelvis which showed a right ovarian cyst. All the other systems were essentially normal. She underwent right oophorectomy for right ovarian dermoid cyst. Intraoperatively, the right ovary was found to be enlarged and twisted more than two and half times. Grossly, the received specimen was identified as a partially cut opened ovarian dermoid cyst which measured 7 x 7 x 5 cm. On cut surface the cyst was uninoculated with variable wall thickness and cyst cavity was filled with hair follicles, pultaceous material and cartilage (Fig1.1). The inner surface of the cyst wall had a grey white nodule (4 x 4 cm) protruding into the cyst cavity. Microscopically, the cystic component showed fibro collagenous cyst wall lined partly by stratified squamous epithelium (Fig1.2). Sections from the cyst contents showed skin with adnexal structure, pilosebaceous unit, adipocytes, many thick walled blood vessels, nerve bundles, scattered melanin pigments, melanophages. Sections from the solid component showed small intestinal structures with well-formed mucosa, surrounding muscular wall (Fig1.3), adjacent gastric mucosa, respiratory lining epithelium, mature cartilage and salivary gland tissue.

Focal area in the intestinal mucosa showed villous arrangement and complex gland pattern and the lining epithelia showed mild to moderate stratification. No evidence of invasion / definite malignant change was made out. Histological diagnosis was mature cystic teratoma with well-formed small intestinal structures and focal mild dysplastic intestinal mucosa.

Fig 1.1: Gross image showing a uniloculated cyst with cavity containing hair, grey white solid areas

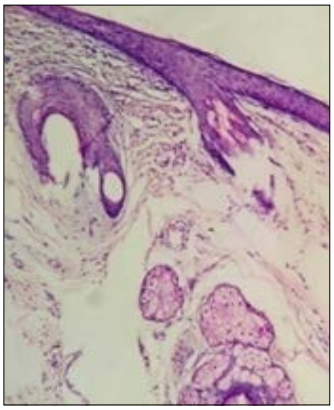

Fig 1.2: LP image showing cyst wall lined by stratified squamous epithelium and subepithelium showing skin appendages

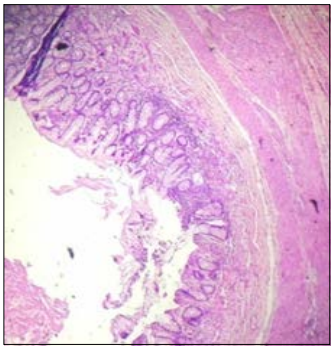

Fig 1.3: LP image showing intestinal mucosa with muscular wall.

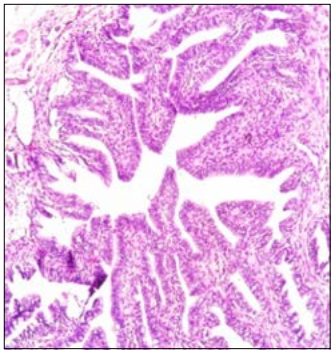

Fig 1.4: LP image showing intestinal mucosa exhibiting villo-glandular pattern and nuclear stratification

Case-2

A 10-year-old female patient presented with history of pain abdomen and not attained menarche. She was then evaluated with MRI which showed dermoid cyst in the left ovary with mild ascites suggestive of pseudo-meigs syndrome. Patient underwent left salpingo-oopherectomy. Intraoperatively left ovarian cyst measured 12 x 10 x 15 cms with peritoneal fluid. Multiple nodules were found over the peritoneum and uterus from which biopsy was taken. Grossly, the left ovarian mass measured 12 x 8 x 5 cm. No capsular breach was made out. The cut surface appeared solid with cystic areas (Fig2.1). Solid component comprised of multiple grey white, grey yellow nodules, irregular bony fragments, and mucoid areas also seen; along with hair follicles. A separate tissue biopsy from the omentum and pouch of douglas showed multiple small firm grey white nodules. Microscopically the left ovary was composed of all three germ cell layers; (predominantly skin with appendages), fibro collagenous tissue, adipocytes, cartilage, respiratory epithelium, intestinal gland, salivary gland tissue, mature osteoid, proliferation of fibrous tissue, large areas of mature glial tissue along with cellular neuroglial tissue forming various layers of cerebellum and choroid plexus. There was no active mitosis/ neural tubules or rosettes. Section studied from the pouch of douglas showed tissue composed entirely of mature glial tissue with increased vascularity. Sections studied from omentum showed fibrofatty tissue with prominent vascular proliferation, forming confluent vessels and multiple nodules of mature glial tissue. Focally epithelioid granuloma was noted. With all these findings, the impression was given as mature solid teratoma of left ovary with cellular neuroglial tissue and mature glial implants in pouch of Douglas and omental tissue (Gliomatosis). Further Immunohistochemistry was suggested to evaluate the cellular areas to look for any immature component.

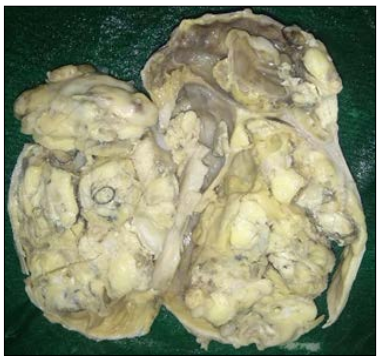

Fig 2.1: Gross image showing predominantly solid lesion with multiple cystic spaces.

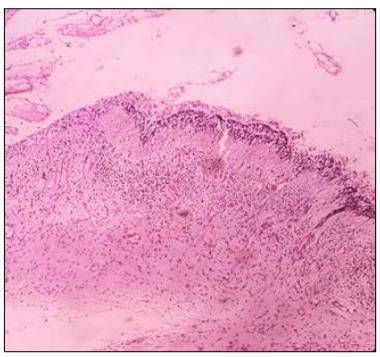

Fig 2.2: LP image of the mature glial tissue

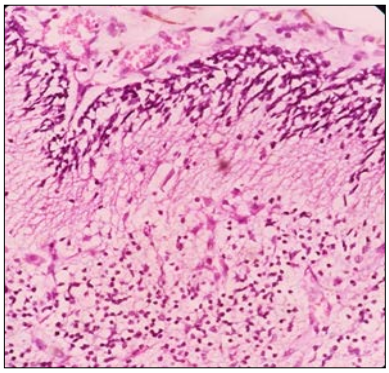

Fig 2.3: HP image of the mature glial tissue forming various layers of cerebellum.

Case-3

A 30-year-old female presented with history of lower abdomen pain and white discharge per vaginum for past 20 days. Patient was then evaluated with PAP test and USG which showed left ovarian dermoid. Patient underwent left salphingo-oophorectomy with colpotomy. Intraoperatively left ovary measured 6 x 5cm with minimal free fuild in the pouch of douglas. Grossly, the left ovarian cyst measured 5 x 3.5 x 2 cm. External surface of ovarian cyst was grey white. Cut section showed multiloculated cysts filled with fat and colloid-like material. Microscopically, the ovarian cyst wall was lined by flattened epithelium and predominantly composed of nodules of thyroid follicles of varying sizes filled with colloid. Few thyroid follicles were hyperplastic and few showed cystic change. One of the sections studied showed compressed ovarian stroma. Hence the histological diagnosis was benign mature monodermal cystic teratoma (struma ovarii), grade-0.

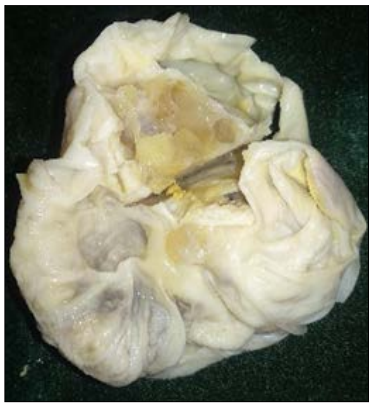

Fig 3.1: Gross image showing a solid cystic lesion with multiple grey yellow fatty areas and brown colloid like material.

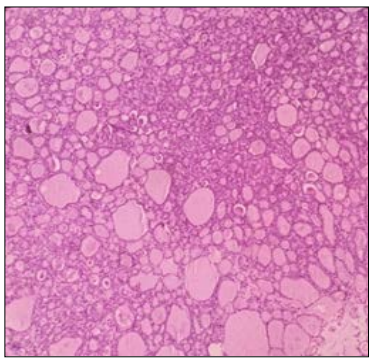

Fig 3.2: LP image showing thyroid follicles of various sizes, filled with colloid.

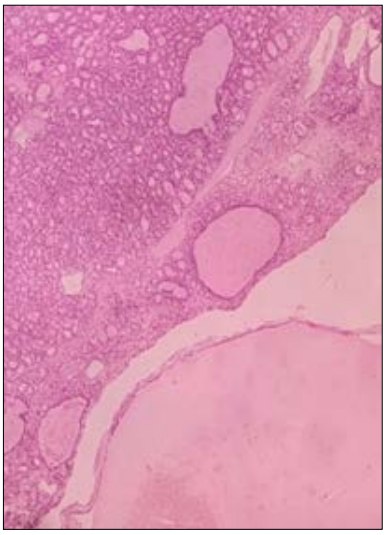

Fig 3.3: LP image showing cystically dilated thyroid follicle filled with eosinophilic secretions.

Cases 4, 5 and 6

Three other cases aged 34, 58 and 30 years respectively, shared similar clinical presentation (lower abdomen pain), examination findings (abdominal mass diagnosed as ovarian teratoma in USG) and underwent salpingo-oophorectomy. Grossly the ovarian masses appeared cystic, the cut section of which showed multiloculated cysts filled with fat, hair and tooth. The relatively smaller solidcomponent appeared haemorrhagic. Micro scopically the sections studied showed cysts lined by keratinised squamous epithelium with abundant keratin flakes, mature adipocytes, sebaceous glands, bundles of smooth muscle cells with blood vessel proliferation and areas of haemorrhage. Few foci showed pseudostratified ciliated columnar epithelium with underlying seromucinous and mucinous glands. There was no evidence of immature elements/ atypia. So the histological diagnosis was mature cystic teratoma in all these cases.

Discussion

The World Health Organization has classified ovarian teratomas into immature teratoma, mature (solid or cystic) teratoma, and mesodermal & highly specialized teratoma.

Most ovarian teratomas (99%) are represented by mature cystic teratomas (dermoid cysts), whereas mature solid teratomas are rare.

Mature cystic teratoma

Mature cystic teratoma is the most common benign germ cell tumor of the ovary. They are composed of well-differentiated tissue derivatives of three germ cell layers (ectoderm, mesoderm and endoderm) but the predominant elements are ectodermal in origin.

The microscopic presence of gastrointestinal tract epithelium with or without other components (submucosa, muscularis propria and serosa) in a mature cystic teratoma is rare. This can occur in 7-13% of mature cystic teratomas [8]. Well-formed gastrointestinal tracts within ovarian mature cystic teratomas are seldom found with less than 20 cases reported in the past. Woodfield *et al*. reported a case of mature cystic teratoma with complete development of the gastrointestinal tract and concluded that the most identified epithelia were from small and large bowel [8]. However other unusual cases with identified epithelia from esophagus,

cecum with appendix and ileum with appendix have also been reported. IHC can be done to distinguish the specific type of GI mucosa [3, 11].

Mature cystic teratoma can rarely undergo malignant transformation (approximately 1%) which adversely affects the patient prognosis. Malignant transformation is marked by disruption of cyst wall, disseminated metastatic deposits, high grade tumor, malignant ascites, adhesion with adjacent structures and some tumour types (other than squamous cell carcinoma). Fujiwara *et al*. reported a case of mature cystic teratoma with complete intestinal wall differentiation containing an intestinal-type adenocarcinoma [3]. Fujiwara, Tang and Takao have reported cases of mature cystic teratoma with well-formed colonic epithelium harbouring mucinous cystadenoma [3, 11]. In such instances, immuno profile of CK7/CK20 can aid in distinguishing intestinal-type secondary neoplasms associated with mature cystic teratoma from primary ovarian mucinous tumors. According to Makihara *et al*. the probability of malignant transformation in mature cystic teratoma increases with age above 60 years with a large teratoma of size >10cm.[7] In our case the solid component of the mature cystic teratoma showed totally organized small intestine-like elements composed of mucosa, muscularis mucosa, muscularis propria and serosa with a focal area of intestinal dysplasia but there was no evidence of definite malignant transformation.

Mature soild teratoma

Solid teratomas are relatively more common in infants and children (accounting for 15% of ovarian tumor). Though the peak age incidence is at second decade, few cases have been reported in the postmenopausal women.

Typically a mature solid teratoma is a large, lobulated, encapsulated mass with a variegated external surface due to degenerative changes and hemorrhage [1, 3]. On histopathology the tumors are mostly solid, but characteristically have multiple small cysts (occasionally there can be 1 or more large cysts) that contain hair, sebaceous material, or serous or mucinous fluid. In addition, cartilage or bone, foci of haemorrhage and necrosis may be discernible. Possibility of apparent embryonal carcinoma, choriocarcinoma, or dysgerminoma may be grossly seen if present [2].

Histologically a mature solid teratoma may be composed entirely of mature tissues, among which neuralelements are commonly detected. In rare instances, varieties of embryonal tissue (primarily neuroepithelium, embryonal connective tissue, and embryonal glia) may be encountered [2]. Occasionally, mature solid teratoma may be associated with peritoneal implants composed entirely of mature glial tissue (gliomatosis). Metastatic implantation of glial tissue on surfaces of visceral or parietal peritoneum is called as Gliomatosis peritonei (GP) [4, 5]. Occurrence of GP is very rare, which is possibly implanted after surgical resection of ovarian teratoma. But in our case, peritoneal nodules were noticed intraoperatively (very uncommon) which turned out to be mature glial tissue on histopathological examination. Histologically these implants of gliomatosis peritonei resemble benign mature glial tissue with delicate fibrillar processes and scattered supporting cells. Despite extensive gliomatosis peritonei the prognosis is excellent (irrespective of the mode of treatment) [4].

Malignant transformation is exceedingly rare [17]. However, there is a potential risk of recurrence of glial implants in patients with gliomatosis pertonei associated with immature ovarian teratoma [5, 17]. Therefore, a thorough histopathological examination of the solid ovarian teratoma should be done to look for any immature glial tissue and a careful monitoring of residual lesions (using computed tomography) is required. In such cases GFAP immunostaining (expressed by immature glial cells) can be helpful [5, 17].

The mechanism of implantation is unknown [4]. There are two hypotheses to explain the origin of GP. The glial implantation can be genetically related (the gial cells from the primary tumor would have relocated through a defect in the capsule or may be a spontaneous / disseminated spread via angiolymphatic channels) or unrelated (glial implants would have been developed from normal peritoneum or adjacent mesenchymal cells which possibly have derived from pluripotent mullerian stem cells or may be a metaplastic process in response to an unknown neoplastic stimulus) to the associated teratoma [5]. To identify if the glial implants are genetically related or unrelated to the associated ovarian teratoma, genetic profiling can be done. Most of the molecular analytical studies support that ovarian teratoma and gial implants are genetically distinct (both tumors unrelated to each other) [4, 5].

Struma ovarii

Thyroid tissue is a rare finding on histological examination of teratoma, but if the thyroid tissue predominates >50%, it is termed as struma ovarii. Most of the struma ovarii are diagnosed post-operatively [18]. Histological diagnosis of struma ovarii is very rare (3% of ovarian teratoma, 2% of all germ cell tumors and 0.5% of all ovarian tumors) - Talerman A *et al*. and Yamashita Y *et al*. Peak incidence of struma ovarii is during the reproductive age, but it can be seen at any age. Most of the struma ovarii are hormonally inactive (clinically asymptomatic). It may be associated with ascites, with or without pleural effusion (Pseudo-Meigs syndrome) and sometimes associated with thyrotoxicosis. Further malignant transformation of struma ovarii is found to be less than 5% [18, 19]. It can be histologically identified on the basis of cellularity, cellular atypia, mitotic activity and angioinvasion. Even in such cases conservative or radical surgery remains as a definitive treatment. But regular follow-up should be done with thyroglobulin (marker of relapse) as radiation therapy is the palliative treatment for metastatic poorly differentiated malignant struma ovarii [19].

In conclusion, all mature ovarian teratomas should be subjected to extensive histopathological examination to rule out any immature component and malignant transformation. Also a predominant highly specialized component should be further evaluated. In patients with evidence of struma ovarii, supportive clinical (ovarian mass with ascites and thyroid disorders), laboratory investigations (TFT) and serum markers (CA 125) must be evaluated. In mature solid teratomas, the glial component should be carefully evaluated and more sections from the glial component should be submitted to rule out the possibility of a glial tumour. Also in such patients, the intraoperative findings of peritoneal nodules followed by biopsy from the same are useful to provide a diagnosis of gliomatosis peritonei. Whenever a mature ovarian teratoma contain GI tract like epithelial components, extensive sectioning and careful microscopic examination for the presence of any dysplasia / malignant transformation are necessary. Further, the type of mucosa and malignant transformation can be established with help

of IHC (CK7/CK20 and others). Also in these patients, the clinical evaluation of malignant ascites (if any) and serum markers can be helpful.

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