Emergency Bulletin
Hong Kong College of Emergency Medicine

Abdominal mass in a child

Dr. Chan Kin Ling, Karen
FHKCEM, FHKAM (Emergency Medicine)

A previously well 5-year-old girl was brought by her mother and aunt to the emergency department in the evening for lower abdominal distension for one day, which was noticed by her mother. She was playful and not in distress. She did not complain of abdominal pain, urinary problem or gastro-intestinal upset.

Vital signs were stable and she was afebrile. On general examination, she was average in body weight and height. There was no pallor or jaundice. On abdominal examination, a 6cm mobile non-tender mass was palpated in the lower abdominal region. Bedside ultrasound showed a 7 cm x 7 cm roundish cystic mass sitting above the urinary bladder. There was suspected loculation inside the cystic mass. There was no significant free fluid in the peritoneal cavity or pouch of Douglas

What is the approach to abdominal mass in achild?

When a child presents to the emergency department for intra-abdominal mass, the clinical picture usually would be more subtle.[1] Age of the child is a key point that may help to adjust the list of differential diagnosis. (Table 1).[2,3]

	Common	Less common
Infants	Flank mass Renal origin (55%) - Hydronephrosis - Polycystic kidney disease - Wilms tumour Non-renal origin (10%) - Adrenal haemorrhage - Neuroblastoma	Gastrointestinal origin (15%) - Duplication cyst - Meconium ileus - Mesenteric-omental cyst Hepatobiliary (5%) - Hemangioendotheloma - Hepatoblastoma - Hepatic cyst - Choledochal cyst Genital origin (for girl) (15%) - Ovarian cyst - Teratoma
Children	Flank mass Renal origin (55%) - Wilms tumour Non-renal (23%) - Neuroblastoma -	Gastro-intestinal origin (12%) - Appendiceal abscess, congential abnormality Hepatobiliary (6%) - Hepatoblastoma, choledochal cyst Pelvic (4%) – Ovarian cyst, hydrometrocolpos Ovarian cyst (for girl)

Table 1: Differential diagnoses of abdominal mass in infants and children

What is the role of bedside ultrasound examination in our patient?

Bedside ultrasound would be the most convenient and non-invasive initial assessment tool in the emergency setting. It can be used to assess the size, look for any cystic or solid components and locate the abdominal mass, which may help in differentiating the origin. It can be used to assess complications such as rupture of the cystic mass when we look for any intra-peritoneal free fluid in dependent areas.

In our patient, apart from bedside ultrasound, computed tomography (CT) imaging is employed, which allowed us to more precisely narrow down the differentials.

However, for infants and children, CT imaging often requires the use of sedative agents which is one of the short-comings we often face. Time to arrange CT imaging is another concern especially when the child's condition is unstable. Other concern include the radiation hazard and risk of contrast reaction.

Progress of patient

Her mother and aunt were very concerned about the physical and ultrasound findings of the abdominal mass despite the fact that the condition of patient was stable and well. Plan of management and options were thoroughly discussed. They opted for proceeding to emergent investigations including urgent CT abdomen and pelvis with contrast, blood and urine investigations, and in-patient care.

Urine microscopy, complete blood count, renal function test and liver function test were all unremarkable. CA125, alpha-fetoprotein, beta-HCG and C-reactive protein were within normal range. LDH was slightly raised to 590 U/L (normal reference range 164-286 U/L).

CT abdomen and pelvis with contrast showed a hypodense cystic lesion measuring up to 8.4cm x 7.0cm x 9.2cm (TS x AP x LS) at the lower abdominal cavity (Figure 1). The lesion was indenting onto the dome of urinary bladder and mildly displacing adjacent small and large bowel loops. Mild hypodense pelvic ascites was observed.

There was no rim-enhanced intra-abdominal abscess or pneumoperitoneum. Liver, biliary tree, spleen, adrenal glands pancreas and kidneys were unremarkable. Radiological differential diagnoses would include ovarian cyst, peritoneal inclusion cyst and less likely duplication cyst.

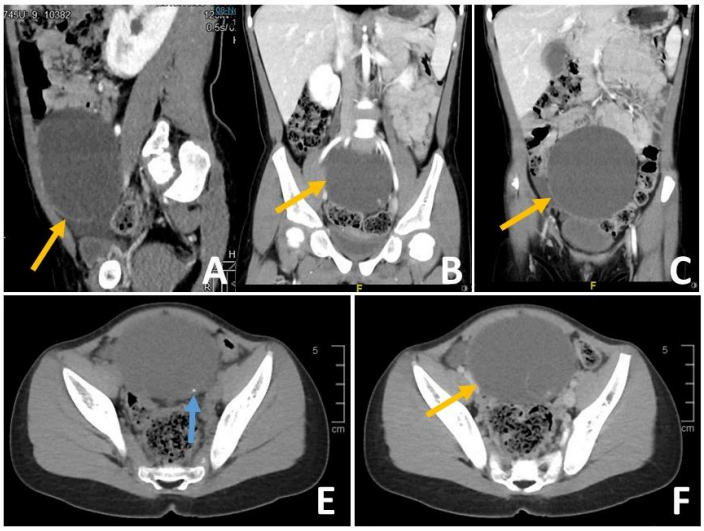

Figure 1 CT scan of the patient showing the abdominal mass (Orange arrow) with eccentric calcification (Blue arrow): A: Sagittal view (Contrast), B: Coronal view (Contrast), C: Coronal view (Contrast), D: Transverse view (Plain), E: Transverse view (Contrast)

What is the likely diagnosis?

Among ovarian lesions in girls, mature cystic teratoma or dermoid cyst is the most common neoplasm.[4,5,6] Other differentials include physiological cyst or malignant neoplasm.

What are the radiological and sonographic features of teratoma?

Plain x-ray

In the plain x-ray, a mature teratoma may show calcific and tooth component within the pelvis. (Figure 2)

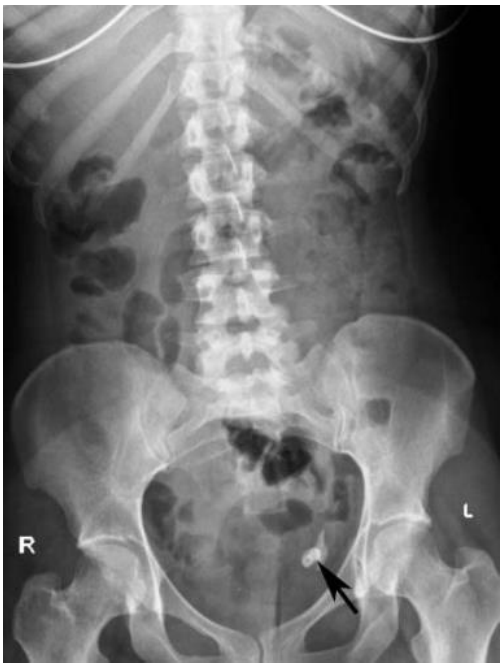

Figure 2: tooth component in the plain x-ray (Not our patient). (Case courtesy of Assoc Prof Frank Gaillard, Radiopaedia.org, rID: 35883)

Ultrasound

The characteristics of mature teratoma in ultrasound include:

- Presence of hyperechoic nodule within the mass with posterior acoustic shadowing owning to sebaceous material and hair within the cyst cavity[7]
- Echogenic calcification or dental components
- Dermoid mesh: multiple thin, echogenic bands caused by hair in the cyst cavity
- Dermoid plug (Rokitansky nodule) – an hyperechoic nodular structure, usually with distal acoustic shadow , situated near the cyst wall[8,9]
- Tip of the iceberg sign: the echogenic interface of the cyst causes marked posterior acoustic attenuation which obscures deep structures[10]
- Presence of fluid-fluid levels

Computed tomography

CT has a high sensitivity in the diagnosis of cystic teratomas[11]. Typically, CT images demonstrate fat attenuation (areas with very low Hounsfield values), fat-fluid level, calcification (sometimes dentiform), Rokitansky protuberance, and tufts of hair.[12]

Progress of patient

Paediatric surgeon was consulted. Emergency laparoscopy and excision of ovarian cyst was performed.

At laparoscopy, a large right ovarian dermoid cyst, which contained clear fluid and another smaller 2cm cyst, which contained gelatinous fluid, hair and calcification were identified (Figure 3).

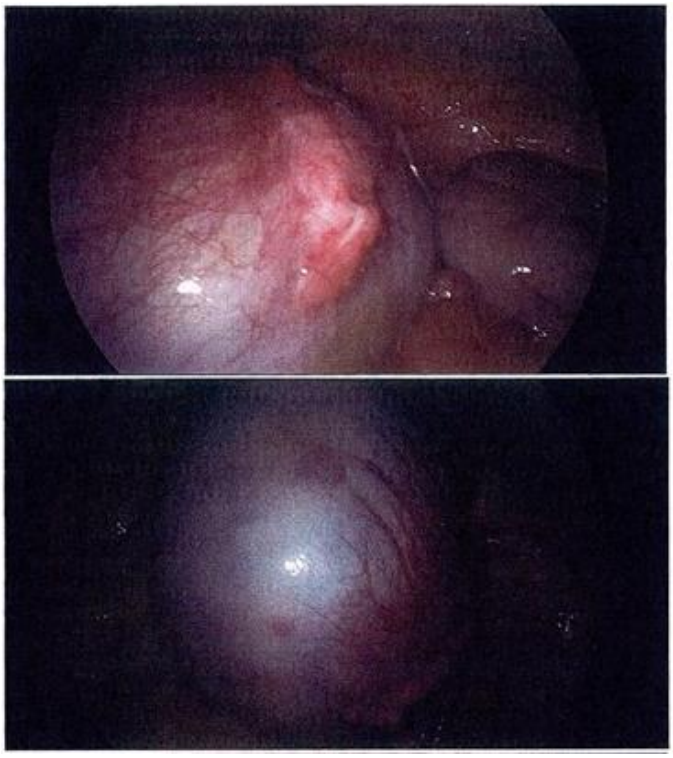
Figure 3: laparoscopic view of the ovarian mass

Right ovarian cystectomy was performed laparoscopically. Patient was uneventful post-operatively and discharged on Day 3. Pathology of the ovarian cyst confirmed mature ovarian teratoma.

What is an ovarian teratoma?

Mature cystic teratomas account for 10-20% of all ovarian neoplasms.[13,14] They are the most common ovarian germ cell tumor. Most are benign and they are bilateral in 10-15% of cases.[15,16]

They are divided into four categories:
- Mature (cystic or solid) – 95% of all ovarian teratomas)
- Immature (malignant)
- Malignant due to a component of another somatic malignant neoplasm
- Monodermal or highly specialized.

Most teratomas are cystic and composed of mature differentiated elements. They are also known as dermoid cysts.

In rare instances, a teratoma is solid, composed entirely of benign-appearing heterogeneous collections of tissue and organized structures derived from all three cell layers. Most mature solid teratomas are unilateral and benign.

The size of a dermoid cyst is highly variable. They can be found incidentally when they measure just around 1 cm and are situated inside the ovary, but they can also have huge dimensions of up to 30-40 cm. They are slow-growing.

What is the complication of teratoma?

Complications of ovarian teratomas include the following:
- Torsion (commonest, occurring in 3-11% of cases)
- Rupture
- Infection
- Auto-immune hemolytic anemia
- Malignant degeneration
- Paraneoplastic anti-NMDA receptor associated limbic encephalitis

What is the management for ovarian mature teratoma?

Most mature teratomas are benign and slow growing (around 1.8mm per year). Some authors recommend non-surgical management if the size is not over 6 cm.[17]
Surgery is indicated especially for larger lesions.

The advantages of surgical treatment include:
- Obtain a definitive tissue diagnosis
- Preserve ovarian tissue
- Avoid potential complications
- Avoid malignant transformation.

The majority of mature cystic teratoma have good prognosis and low rate of recurrence.[18]

What is the risk of malignant transformation for mature teratoma?

Mature cystic teratoma of the ovary is always benign, but in approximately 0.2-2% of cases, it may undergo malignant transformation into one of its elements, the majority of which are squamous cell carcinomas.[13]

Other possible malignant neoplasms include (but are not limited to) basal cell carcinoma, melanoma, adenocarcinoma, sarcoma, and thyroid carcinoma. When malignant transformation has occurred within a teratoma, treatment must be tailored to the transformed histology.

The prognosis for patients with malignant degeneration is generally poor but it depends on the stage and degenerated cell type.[13,19]

What are the risk factors for malignant transformation?

Risk factors for malignant neoplasm in a mature cystic teratoma include[19,20]
- Age over 45 years (mean age, 50 years versus 33 years for benign teratomas)
- Tumor diameter greater than 10 cm,
- Tumor with rapid growth
- Specific findings on imaging (eg, cauliflower appearance with irregular borders in CT or low-resistance intra-tumor flow on Doppler ultrasound)

Reference

1. Ferrero, Luisa, et al. “Cystic Intra-Abdominal Masses in Children.” Pediatric Reports, vol. 9, no. 3, Oct. 2017.
2. Standardized Toolbox of Education for Pediatric Surgery Abdominal Masses of Childhood. American Pediatric Surgical Association Committee of Education, 2012-13.
3. Ranganath, Shashi H., et al. “Focal Cystic Abdominal Masses in Pediatric Patients.” American Journal of Roentgenology, vol. 199, no. 1, July 2012, pp. W1–16. DOI.org (Crossref), doi:10.2214/AJR.11.6642.
4. de Silva, K. S. H., et al. “Ovarian Lesions in Children and Adolescents - An 11-Year Review.” Journal of Pediatric Endocrinology and Metabolism, vol. 17, no. 7, Jan. 2004.
5. Łuczak, Justyna, and Maciej Bagłaj. “Ovarian Teratoma in Children: A Plea for Collaborative Clinical Study.” Journal of Ovarian Research, vol. 11, no. 1, Dec. 2018, p. 75.
6. Alotaibi, Mohammed O. S., and Oscar M. Navarro. “Imaging of Ovarian Teratomas in Children: A 9-Year Review.” Canadian Association of Radiologists Journal, vol. 61, no. 1, Feb. 2010, pp. 23–28.
7. Jermy, K., et al. “The Characterization of Common Ovarian Cysts in Premenopausal Women: Premenopausal Ovarian Cysts.” Ultrasound in Obstetrics and Gynecology, vol. 17, no. 2, Feb. 2001, pp. 140–44.
8. Outwater, Eric K., et al. “Ovarian Teratomas: Tumor Types and Imaging Characteristics.” RadioGraphics, vol. 21, no. 2, Mar. 2001, pp. 475–90.
9. Valentin L, Callen PW. Ultrasound evaluation of the adnexa (ovary and falopian tube. In: Callen PW (ed) Ultrasonography in obstetrics and gynecology. Saunders-Elsevier, 5th edition 2008:968-985.
10. Calin Mos. Ovarian dermoid cyst: ultrasonographic findings. Medical ultrasonography. 2009, Vol 11, no. 4, 61-66
11. Buy, J. N., et al. “Cystic Teratoma of the Ovary: CT Detection.” Radiology, vol. 171, no. 3, June 1989, pp. 697–701.
12. Patel, M. D., et al. “Cystic Teratomas of the Ovary: Diagnostic Value of Sonography.” American Journal of Roentgenology, vol. 171, no. 4, Oct. 1998, pp. 1061–65.
13. Comerci JT Jr, Licciardi F, Bergh PA, Gregori C, Breen JL. Mature cystic teratoma: a clinicopathologic evaluation of 517 cases and review of the literature. Obstet Gynecol. 1994 Jul. 84(1):22-8
14. Stany, Michael P., and Chad A. Hamilton. “Benign Disorders of the Ovary.” Obstetrics and Gynecology Clinics of North America, vol. 35, no. 2, June 2008, pp. 271–84.
15. Alanbay I, Coksuer H, Erean M, Karasahin E, KeskinU, Basar I. Multiple recurrent mature cystic teratoma of the same ovary: case report and literature review. Med J Kotatepe. 2011;12:8-12
16. Fibus TF. Intraperitoneal rupture of a benign cystic ovarian teratoma: findings at CT and MR imaging. AJR Am J Roentgenol. 2000;174 (1): 261-2. AJR Am J Roentgenol
17. Caspi B, Appelman Z, Rabinerson D, Zalel Y, Tulandi T, Shoham Z. The growth pattern of ovarian dermoid cysts: a prospective study in premenopausal and postmenopausal women. Fertil Steril 1997; 68:501–505.
18. Claire L. Templeman, S. Paige Hertweck, James P. Scheetz et al. The management of mature cystic teratomas in children and adolescents: a retrospective analysis. Human reproduction. 2000; Vol.15, Issue 12.
19. Dos Santos L, Mok E, Iasonos A, Park K, Soslow RA, Aghajanian C, Alektiar K, Barakat RR, Abu-Rustum NR. Squamous cell carcinoma arising in mature cystic teratoma of the ovary: a case series and review of the literature. Gynecol Oncol. 2007;105(2):321. Epub 2007 Jan 22
20. Hackethal, Andreas, et al. “Squamous-Cell Carcinoma in Mature Cystic Teratoma of the Ovary: Systematic Review and Analysis of Published Data.” The Lancet Oncology, vol. 9, no. 12, Dec. 2008, pp. 1173–80.