Complexities and Challenges in
Gynaecological Ultrasonography

Book 1

Editors
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Lee Sook Ling
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### ABBREVIATIONS

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<tr>
<th>Abbreviation</th>
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<tr>
<td>3D</td>
<td>Three-dimensional</td>
</tr>
<tr>
<td>βhCG</td>
<td>Beta human chorionic gonadotropin</td>
</tr>
<tr>
<td>μg/L</td>
<td>Microgrammes per litre</td>
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<tr>
<td>AFP</td>
<td>Alpha feto-protein</td>
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<tr>
<td>CA 125</td>
<td>Cancer antigen 125</td>
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<tr>
<td>CA 19-9</td>
<td>Cancer antigen 19-9</td>
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<tr>
<td>CEA</td>
<td>Carcinoembryonic antigen</td>
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<tr>
<td>cm</td>
<td>Centimetre</td>
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<tr>
<td>CRL</td>
<td>Crown rump length</td>
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<tr>
<td>CRP</td>
<td>C-reactive protein</td>
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<td>CSP</td>
<td>Caesarean scar pregnancy</td>
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<tr>
<td>CT</td>
<td>Computed tomography</td>
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<tr>
<td>DIVC</td>
<td>Disseminated intra-vascular coagulation</td>
</tr>
<tr>
<td>EUA</td>
<td>Examination under anaesthesia</td>
</tr>
<tr>
<td>FIGO</td>
<td>International Federation of Gynecology and Obstetrics</td>
</tr>
<tr>
<td>g</td>
<td>Gramme(s)</td>
</tr>
<tr>
<td>g/dl</td>
<td>Grammes per decilitre</td>
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<tr>
<td>GnRH</td>
<td>Gonadotropin-releasing hormone</td>
</tr>
<tr>
<td>GTD</td>
<td>Gestational trophoblastic disease</td>
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<tr>
<td>GTN</td>
<td>Gestation trophoblastic neoplasia</td>
</tr>
<tr>
<td>HELLP</td>
<td>Haemolysis, elevated liver enzyme levels and low platelet count</td>
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<tr>
<td>IUCD</td>
<td>Intra-uterine contraceptive devices</td>
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<td>IUGS</td>
<td>Intra-uterine gestational sac</td>
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<td>IV</td>
<td>Intra-venous</td>
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<tr>
<td>LDH</td>
<td>Lactate dehydrogenase</td>
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<tr>
<td>LMP</td>
<td>Last menstrual period</td>
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<td>LSCS</td>
<td>Lower segment Caesarean section</td>
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<tr>
<td>mm</td>
<td>Millimetre</td>
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<tr>
<td>MRI</td>
<td>Magnetic resonance imaging</td>
</tr>
<tr>
<td>NSAIDs</td>
<td>Non-steroidal anti-inflammatory drugs</td>
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<td>OGD</td>
<td>Oesophagogastroduodenoscopy</td>
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<tr>
<td>PAP</td>
<td>Papanicolaou test</td>
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<tr>
<td>THBSO</td>
<td>Total hysterectomy and bilateral salpingo-oophorectomy</td>
</tr>
<tr>
<td>TOP</td>
<td>Termination of pregnancy</td>
</tr>
<tr>
<td>U/L</td>
<td>Units per litre</td>
</tr>
<tr>
<td>U/ml</td>
<td>Units per millilitre</td>
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<tr>
<td>WHO</td>
<td>World Health Organisation</td>
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Ultrasound technology (transvaginal and transabdominal) has advanced dramatically and broadened the spectrum of diagnostic imaging in Obstetrics and Gynaecology, making it an important part of the diagnostic algorithm. For example, Colour Doppler ultrasound has enabled enhanced evaluation of gynaecological tumours, and changed the way Obstetrics and Gynaecology is practiced. However, there is a limit to what modern technology can achieve on its own. We still need skills, knowledge of application and interpretation, and clinical wisdom and judgement to allow accurate diagnoses to be made.

The cases in this book illustrate the challenges and complexities faced by the doctors working in the Department of Obstetrics and Gynaecology at the Singapore General Hospital. The authors have compiled 22 cases, highlighting the key aspects of their approach, and the complexities and difficulties faced. The case illustrations are presented in short, readable chapters with clearly articulated learning points on the application of ultrasound technology and clinical judgement in arriving at accurate diagnoses.

I share in the enthusiasm that the authors have shown in writing this book, and hope that readers will find it a useful reference when problems or challenges arise in their daily work in Obstetrics and Gynaecology. I look forward to the publication of future volumes featuring more challenging cases. It will certainly be an invaluable resource of knowledge and information not found in ordinary Obstetrics and Gynaecology textbooks.

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PREFACE

Ultrasonography is an indispensable diagnostic tool in current obstetric and gynaecological clinical practice, so much so that it has been hailed as the gynaecologist’s stethoscope. There is no shortage of excellent textbooks and treatises on the subject. This book came about because of the numerous complex and challenging gynaecological cases managed in the Department of Obstetrics and Gynaecology, Singapore General Hospital (SGH).

Since 2006, the Department has held a monthly multi-disciplinary meeting, initiated by Professor Ho Tew Hong, involving clinicians and sonographers to present and discuss these cases. What started as a banal continuing educational tool soon led to the realisation that this meeting was a useful and powerful platform to review, audit and above all learn from these cases.

Trainees in particular enjoyed these sessions, and we decided that we should publish our series in a book which would benefit medical practitioners, nurses and sonographers who use ultrasonography on a daily basis. Our intention is not to attempt to replicate a textbook on ultrasound in obstetrics and gynaecology, but rather to create a readable and accessible book focusing on clinical pearls or vignettes gleaned from these meetings.

We have selected 22 cases for inclusion in this book, beginning with uterine abnormalities, followed by ovarian pathologies and some ‘infamous mimics’ of adnexal and pelvic masses, finishing with cases on molar pregnancies and uncommon and unusual presentations of ectopic pregnancies. Most of these cases, if not already published, have been accepted for publication in view of their clinical relevance and educational value.

The format we have chosen is deliberately simple and consistent: each case is presented like a case report summarising the clinical presentation and findings, followed by a concise description of the scan images, concluding with the key learning point. Considerable effort has been put into collecting and producing high-quality images for these cases.
The reader can make use of this book in several ways. One would be to read it from cover to cover, correlating the clinical scenario to the scan findings for each case. A more novel method would be to study the scan images first and attempt to arrive at a diagnosis. Through this the reader will realise, like we have, that the use of ultrasound imaging in gynaecology goes well beyond simple picture recognition. An experienced gynaecologist will and should always correlate the scan findings and the clinical scenario, thereby facilitating logical targeted investigations and interventions to optimise patient care.

Whichever way the book is used, we suggest that it always be kept readily at hand — it will serve as a valuable aide-memoire, a reference for uncommon differentials and a reminder of the value of other imaging modalities and multi-disciplinary input when one encounters seemingly common symptoms that do not obey the usual rules.

This is the first volume in what we hope to be a continuing and evolving series. We hope that clinicians, sonographers and all involved in the use of ultrasonography in women’s healthcare will find this book useful in their practice.

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Introduction
Ovarian cancer is the most frequent cause of death from gynaecological malignancies because of our inability to detect early-stage disease. While ultrasonography is useful for detecting ovarian cancer in asymptomatic women, its usefulness for detecting early-stage epithelial ovarian cancer in women at increased risk is uncertain.

This chapter reports a case of early ovarian carcinoma with non-specific ultrasonographic features.

Presentation
A 40-year-old married and nulliparous woman presented to the outpatient clinic with a 1-month history of clear vaginal discharge associated with some vague lower abdominal discomfort. She reported no past medical history and normal menstrual cycles.

Initial Diagnosis
Examination of the breasts, abdomen and pelvis did not reveal any palpable masses. A 2cm endocervical polyp was found upon an examination of the pelvis. It was removed and found to be benign on histological examination.

Investigation and Findings
A pelvic ultrasound showed a 2.5cm lobulated isoechoic mass in the anterior aspect of the right ovary adjacent to a 5 x 2 x 2cm dilated tube (Fig. 1, next page). The left ovary was not seen and a 3 x 2 x 3cm cyst containing two 1.3cm and 1.9cm mid-grey echogenic areas were noted in the left ovarian region (Fig. 2, page 33).
The vaginal discharge was symptomatically treated but did not improve 2 months later. A pelvic ultrasound was repeated and showed a 7 x 5 x 5cm solid mass with irregular contours in the right adnexa (Fig. 3, page 34) adjacent to a 6 x 2cm tubular cystic structure posteriorly, likely to be a hydrosalpinx (Fig. 4, page 34). This time the left ovary was seen and found to contain some fluid and solid areas (Fig. 5, page 34). The ultrasonographic impression was that it could be an endometriotic lesion. The CA 125 level was markedly raised at 2065U/ml.

**Treatment**
The patient underwent staging laparotomy (THBSO, omentectomy and right pelvic lymph node sampling). Intra-operatively, the right ovary was enlarged with a mixed solid cystic mass of 6cm, adherent to the right pelvic side wall (Fig. 6, page 35). There was a 3cm peritoneal tumour deposit with an enlarged right obturator node. Right hydrosalpinx was noted. The left ovary, uterus, omentum and the intestines were grossly normal.

**Progress**
The patient recovered well post-operatively. Histological assessment confirmed poorly differentiated adenocarcinoma of both ovaries.

**Outcome**
Following the surgery, the patient received 6 cycles of chemotherapy. She remained well and disease-free 2 years after the treatment.
Fig. 2: Pelvic ultrasound showing (top image) a 3 x 2 x 3cm cyst and (middle image) two mid-grey echoes in the left adnexal region measuring 1.3cm and (bottom image) 1.9cm
Fig. 3: Pelvic ultrasound showing the 7 x 5 x 5cm solid mass with irregular contours in the right adnexa 2 months later

Fig. 4: Pelvic ultrasound showing a 6 x 2cm tubular cystic structure adjacent to the right ovary, likely to be a hydrosalpinx

Fig. 5: Pelvic ultrasound showing some fluid and solid areas in the left ovary, likely to be endometriotic in origin
Discussion
The prognosis for most cases of epithelial ovarian cancer is poor due to delayed diagnosis. However, the prognosis can be favourable if the disease is detected early. Among some of the methods that have been evaluated to predict the risk of malignancy in suspicious ovarian masses are transvaginal ultrasonography and Colour Doppler assessment of blood flow.

Ultrasonomorphologic scoring systems have been developed to aid in the screening for ovarian cancer, with each ultrasonographic parameter of an ovarian tumour being assigned a numerical value. However, the positive predictive value of these scoring systems remains low because of the overlap in appearance of many benign ovarian lesions with malignant disease. In addition, some ovarian malignancies appear as simple cysts on ultrasound without exhibiting a complex morphology, as demonstrated in our case at initial presentation. The recommended cut-off size of uterine adnexal tumours beyond which surgery is likely to detect early cancer is also not well established.

Colour blood-flow imaging can be very helpful in detecting uterine adnexal malignancy because of the presence of neovascularisation in malignant
tumours. However, the accuracy of the technique is limited due to the significant number of false-positive results. When the presence of septum or papillary projections or solid components in uterine adnexal lesions is detected in greyscale ultrasonography, the presence of Doppler flow within these lesions increases the sensitivity and specificity of ultrasound evaluation of ovarian tumours. Unfortunately, there is no consensus as to which Doppler parameters and cutoff values are the most predictive of malignancy. Moreover, vascularity within the papillary projection of a malignant tumour may go undetected when it is very small. Studies have shown considerable overlap of pulsatility index rates between benign and malignant uterine adnexal masses, suggesting that pulsed Doppler ultrasonography is not an independent indicator for malignancy.

Three-dimensional power Doppler ultrasound is increasingly used to evaluate features of tumour vascularity and while its positive predictive value awaits validation, it represents a novel approach for early and accurate detection of ovarian cancer in patients with suspicious findings on standard ultrasound scans.

Serum CA 125 levels have been used in conjunction with ultrasonography to minimise false-positive results although its role as a standalone screening tool remains limited. The combination of serum CA 125 levels and pelvic ultrasound scan seems to improve the sensitivity and specificity of predicting adnexal malignancies in post-menopausal women with an adnexal mass. This is in contrast to the results seen in pre-menopausal women. A positive predictive value of up to 40% can be achieved by combining CA 125 with transvaginal ultrasound results. However, these diagnostic tools appear to have greater sensitivity in detecting ovarian cancer at an advanced stage, as screening tests results remain normal in 3 out of 4 tumours with early-stage disease prior to the diagnosis.

**Conclusion**

If early ovarian malignancy cannot be conclusively excluded, close surveillance of suspicious ovarian lesions with ultrasound together with CA 125 levels may more accurately identify those who will benefit from surgical intervention.
**Learning Point**

Diagnostic ultrasound examination as an independent modality has limited value for the detection of early-stage epithelial ovarian cancer in asymptomatic women.

**Bibliography**


RUDIMENTARY HORN PREGNANCY IN THE EARLY SECOND TRIMESTER
Ho Tew Hong, MBBS, MRCOG, FAMS

Introduction
A unicornuate uterus is a Müllerian anomaly that is caused by the failed development of one of the Müllerian ducts. Most unicornuate uteri have a rudimentary horn, which is non-communicating to the main uterine cavity and connected to the uterus only by fibrous bands. The rudimentary horn may consist of a functional endometrial cavity, or it may be a small solid lump of uterine muscle with no functional endometrium. Pregnancy can occur in the non-communicating rudimentary horn because of transperitoneal migration of sperm through the contralateral tube. Incidence of rudimentary horn pregnancy is reported by Nahum, as well as Urtal and Artal, to be 1 in 100,000 pregnancies or 1 in 5,000–15,000 ectopic pregnancies.

This chapter reports a case of pre-rupture diagnosis and management of rudimentary horn pregnancy in the early second trimester.

Presentation
A 26-year-old woman at 15 weeks of her first pregnancy was referred for 2 weeks history of left iliac fossa pain.

Initial Diagnosis
Clinical examination confirmed a 15-week-sized mobile uterus.

Investigation and Findings
Pelvic ultrasound confirmed a large extra uterine gestational sac with a live foetus, measuring 10.3 x 8.4cm, in the left adnexal region (Fig. 1, next page). This extrauterine pregnancy was located either in the interstitial part of the left Fallopian tube or in a rudimentary horn of a unicornuate uterus, as the configuration of the endometrial echo within the uterus appeared to be
Fig. 1: Pelvic ultrasound confirming a large extra uterine gestational sac with a live foetus, measuring 10.3 x 8.4cm, in the left adnexal region.
tubular and the upper end extended only towards the right cornual region (Fig. 2). There was no connection from this gestational sac with the endometrial cavity and no connection with the cervix could be demonstrated.

**Treatment**

The patient underwent open excision of the left rudimentary horn, interstitial/cornual pregnancy and left salpingectomy. Intra-operatively, there was a large left rudimentary horn seen with the pregnancy *in situ* with dehiscence walled off by the omentum and 50mls haemoperitoneum.

Pathological examination confirmed the rudimentary horn of the uterus to measure 9 x 7 x 3cm in dimension and ruptured at one end with attached placental tissue. A dead non-macerated male foetus with normal appearance was noted within the amniotic sac. Microscopic sections showed a percreta placentation resulting in rupture of the uterine wall of the rudimentary horn.

**Progress**

Serial monitoring of serum βhCG levels was performed. Serum βhCG levels fell from an initial level of 398U/L at post-operative day 7 to less than 1.2U/L at 3 months post-surgery. Pelvic ultrasound done 3 months post-surgery revealed that the uterus and both ovaries were normal.
Outcome
The patient was well at follow-up, with plans for yearly review.

Discussion
The usual outcome of rudimentary horn pregnancy is rupture in the second trimester in 70% of cases, resulting in life-threatening heavy bleeding. Only in rare cases has foetal survival been reported. Pathologic placentation leading to placenta accreta further increases the risk of rupture.

In recent years, there have been increasing reports of pre-rupture diagnosis of rudimentary horn pregnancy made as early as the first trimester.

Studies have suggested several ultrasonographic diagnostic aids that may help in the diagnosis of a rudimentary horn pregnancy. The differential diagnoses of rudimentary horn pregnancy on ultrasonography include: tubal ectopic, cornual ectopic and pregnancy in a bicornuate uterus. Distinguishing between these possibilities may be useful because of implications on management.

Tsafrir et al. suggested several criteria for ultrasonographic diagnosis of a rudimentary horn pregnancy: (1) pseudo-pattern of an asymmetrical bicornuate uterus: variation in thickness of the myometrium in 2 horns and a marked distance between them favour the diagnosis of a rudimentary horn pregnancy; (2) absent visual continuity between the cervical canal and the lumen of the pregnant horn: ultrasonography of pregnancy in a bicornuate uterus would usually demonstrate continuity between the endometrium lining the gestational sac and the other uterine horn; (3) presence of myometrial tissue surrounding the gestational sac: a tubal pregnancy will not show a ring of myometrium surrounding the gestational sac. Additionally, hypervascularisation typical to placenta accreta may support the diagnosis of rudimentary horn pregnancy (Fig. 3, next page).

Other radiologic modalities such as CT scan and MRI have also been shown by Ozeren et al. and Lawhon et al. to be useful in confirming the diagnosis of rudimentary horn pregnancy. In the past, a majority of cases were diagnosed after rupture of the rudimentary horn. However, with the advent of investigative methods such as ultrasound scan, CT scan, MRI,
and laparoscopy, the diagnosis is more often being made before rupture. There have even been reports of first trimester pre-rupture diagnosis of rudimentary horn pregnancy.

Surgical excision is the mainstay of treatment of rudimentary horn pregnancy. Significant blood loss can occur intra-operatively when there is extensive fusion between the rudimentary horn and unicornuate uterus. Laparoscopic resection may be possible when the rudimentary horn pregnancy is small or when its attachment to the uterus is in the form of a fibrous band. Conservative management with methotrexate has been described by Edelman et al. but these were followed by surgical excision.

IV urogram should be performed to rule out concomitant urinary tract abnormalities (absent, pelvic or horseshoe kidney) at the side ipsilateral to the rudimentary horn. These are associated with 40–60% of unicornuate uteri.

**Conclusion**

Early pre-rupture diagnosis of a rudimentary horn pregnancy is crucial but remains challenging. Cases of late and false diagnosis leading to uterine
rupture have been reported repeatedly, with some diagnosed only after failed termination of an incorrectly diagnosed intra-uterine pregnancy. In the past, many cases were diagnosed only at laparotomy for acute abdomen in pregnancy.

Pelvic ultrasound remains the main diagnostic tool with other imaging modalities as important adjuncts.

**Learning Point**
Rudimentary horn pregnancy is a gynaecological emergency which mandates immediate surgical treatment to prevent a potentially fatal rupture.

**Bibliography**