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What you see might not be what you get: Discrepancies between intraoperative findings and preoperative diagnosis of ovarian tumors. Appendicular mucocoele presenting as an adnexal mass - Case report and review of literature

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ABSTRACT

INTRODUCTION: Adnexal masses include those affecting the ovary or fallopian tubes. We report a unique case with discrepancy between the pre-operative diagnosis (adnexal mass) and the post-operative definitive findings (appendicular tumor invading ovary). We also employ a literature review to provide four scenarios of uncertainty that are encountered between appendiceal and adnexal masses.

PRESENTATION OF CASE: A 58 year old female with history of treated left colon cancer, referred to the gynecology clinic with intermittent vaginal bleeding for 5 days. Examination showed lower abdominal midline mobile non-tender mass, bulky uterus and right adnexal fullness. Other history, physical examination and laboratory tests were unremarkable. US and MRI suggested a right ovarian mass and uterine fibroids. Intraoperatively, she had a right ovarian large mobile multi-locular mass. The appendix was adherent to the ovary, with mucus extruding through its tip. Appendectomy was undertaken alongside hysterectomy and bilateral salpingo-oophorectomy. Histopathology showed right ovarian mucinous neoplasm, but the origin was a low-grade appendiceal mucinous neoplasm (pT4aNxMx). The patient was recurrence free across 3 years of follow up.

DISCUSSION: Appendicular mucocoele can present as adnexal mass. Pre-operative diagnosis and differentiation is sometimes difficult.

CONCLUSION: Adnexal masses need careful pre-operative diagnoses. The definitive management is based on the final intra- and post-operative findings. As a variety of scenarios could be encountered, there could be a need to involve general/colorectal surgeons in case of appendicular tumors. Patients should be counselled regarding the possible change in intra-operative plan, and are better operated upon in facilities with appropriate teams and equipment.

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1. Introduction

Adnexal masses include those of the ovary or fallopian tube [1]. Adnexal masses have wide differential diagnosis, e.g., benign/malignant gynecologic, gastrointestinal, urinary, or metastatic. Hence, ovarian origin should not be routinely assumed [2]. Abscesses, cysts, and cancers of the gastrointestinal tract or other abdominal or pelvic organs can mimic adnexal masses on imaging or examination [1]. One main gastrointestinal mass frequently overlooked as adnexal is appendicular tumor [3].

Appendicular mucocoele (AM), an obstructive dilatation of the appendiceal lumen due to the abnormal accumulation or hyperproduction of mucus, is a rare pathology with ≈ 0.2 – 0.3% incidence of all appendicectomies [4]. AM is classified into four histologic subtypes: mucosal hyperplasia, simple/retention cyst, and mucinous cystadenoma or cystadenocarcinoma [5]. Ruptured AM of the latter two subtypes, spontaneously or accidentally (during surgery), may result in pseudomyxoma peritonei, where malignant cells disperse through the peritoneal cavity as multiple mucinous deposits [5].

Although AM may present traditionally as acute appendicitis, preoperative diagnosis remains difficult [4], and > 70% of AMs are discovered incidentally during laparotomy or laparoscopy [3]. AM may have a sonographic appearance of adnexal mass, but subsequent exploration shows no evidence of ovarian tumor [6].

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Table 1

Pre-operative initial diagnosis of adnexal mass: Four possible subsequent scenarios of intra-operative findings.

Evidence*	Intra-op Findings		Origin of Tumor
	Appendix	Ovary	
Case reports (Table 2)	Abnormal	Normal	Appendix
Case reports (Table 3)	Normal	Abnormal	Ovary
Case reports (Table 4)	Abnormal	Abnormal	Appendix
Retrospective studies (Table 5)	Abnormal	Abnormal	Ovary

* Examples selected based on the literature review in order to provide illustrations for each scenario.

We report an uncommon case scenario of a unique discrepancy between the pre-operative provisional diagnosis (adnexal mass) and the intra/post-operative definitive finding (tumor appendiceal in origin). As appendiceal and adnexal masses mimic each other; thus, in addition, we employ a literature review to generate a matrix of four scenarios of uncertainty frequently encountered when the surgeon is confronted with an initial provisional pre-operative diagnosis of an adnexal mass. The differentiation between appendiceal and adnexal masses is important, as each of the four scenarios has its distinct intra-operative considerations and subsequent management plan. We report this case in line with the updated consensus-based surgical case report (SCARE) guidelines [7].

2. Case presentation

A 58 year old Qatari female referred to gynecology clinic at Hamad General Hospital in Doha, Qatar, with intermittent vaginal bleeding for 5 days, fresh red blood, minimal in amount. The patient denied abdominal pain, bowel habit changes or vomiting. This was her first attack since menopause 8 years back.

Her past history was positive for left side colon cancer, for which she underwent extended left hemicolectomy followed by chemotherapy 15 years back and she was still on surveillance follow-up upon presenting to our clinic. The patient was being gynecologically followed up for suspicion of adenomyosis or fibroid; however, she had refused hysteroscopy and other diagnostic work up. Past social, environmental, family and employment history were unremarkable. She did not smoke, never consumed alcohol and was not on long-term medications.

On physical examination, her abdomen was soft with no tenderness or guarding, and a mobile non-tender 15 × 10 cm mass was felt in the lower abdominal midline, in addition to midline laparotomy scar of previous surgery. Digital vaginal examination showed a bulky uterus with right side adnexal fullness. Her cervix was difficult to visualize by speculum (displaced to the left) and endometrial pipelle sampling could not be taken due to tightly closed cervical os. The rest of the physical urological and rectal examinations were unremarkable.

At admission, her vital signs were normal. Tumor markers showed normal CA 19-9, CA 125 and CA 15-3. CEA was 6.4 ng/L (not significantly elevated having her colon cancer history). Her hemogram and metabolic panel were within normal.

Pelvic ultrasound showed a complex septated pelvic cystic mass (21 × 11 cm), pushing the uterus anteriorly, containing internal echoes with multiple solid components. Doppler revealed vascular invasion. MRI showed a right adnexal complex cystic lesion (21.4 × 10.3 × 16.2 cm) with thin enhancing septations, displaying low signal intensity on T1 and high signal intensity on T2, with restricted diffusion at the most cephalic component containing an area of crowded septations. The MRI findings were suggestive of right ovarian epithelial neoplasm, probably of low malignant potential, and did not show significant abdominal lymphadenopathy nor peritoneal deposits, but there were multiple small myometrial lesions (5–8 mm) exhibiting low signals on T2. Ureters were posterior to the mass, with bilateral mild hydronephrosis. Transvaginal US

was declined by the patient, CT abdomen was not done as MRI is superior to detect ovarian cancer in cases of adnexal mass and it was deemed sufficient at this stage. Preoperative colonoscopy was unremarkable apart from a small right colonic polyp which was removed and found to be tubular adenoma. The patient was discussed at the gynecology multidisciplinary team (MDT) meeting and the decision was to proceed to surgery.

2.1. Surgical technique and findings

The patient was admitted for diagnostic laparotomy with total abdominal hysterectomy, bilateral salpingo-oophorectomy, possible omentectomy and lymph node dissection. After a midline abdominal incision and entering the peritoneum, she had right ovarian large mobile thin walled multi-locular mass, with normal left ovary and uterus. There were also small and large bowel adhesions, the appendix was adherent to the ovary, with mucus extruding through its tip, however the base looked normal. The liver, spleen, kidneys were normal on palpation, with no peritoneal nodules.

Appendectomy was undertaken for the adherent appendix alongside the hysterectomy and bilateral salpingo-oophorectomy. This was undertaken by an experienced surgeon. Intra-operative frozen section was not done due to its reported controversy with the frequent diagnostic discordance between the frozen section and final pathology. Post-operative period was uneventful and the patient recovered smoothly, pain management accomplished via morphine patient-controlled analgesia (PCA) which was stopped on day 2, she started full diet on day 3, and was discharged on post-operative day 4 with no complaints.

Her histopathology report showed a right ovarian mucinous neoplasm (13 × 12.5 × 7 cm), but the origin was surprisingly from the appendix (5.6 × 5 × 4 cm low-grade appendiceal mucinous neoplasm). The appendicular tumor had invaded all the wall layers and penetrated the serosa but without neurovascular invasion and resection margins were not involved (pT4aNxMx) [8]. The Gastroenterology MDT decision was to seek overseas center for hyperthermic intraperitoneal chemotherapy (HIPEC) treatment as this treatment was not available in Qatar. The patient was followed up for 3 years with no recurrence.

3. Discussion

AM is a category of rare gastrointestinal cancers [4]. Although rare, AM is more common among postmenopausal than reproductive age women [9]. In terms of presentation, the clinical manifestations of AM are often non-specific. Patients can present as acute appendicitis; a palpable right iliac fossa mass; atypical symptoms (e.g. abdominal pain); or mimic of a tubo-ovarian abscess [3]. Our case was post-menopausal at presentation consistent with others [9], presenting with vaginal bleeding, in agreement that AM could have non-specific presentation or is incidentally discovered [9].

As for the investigations, preoperative evaluation may initially suggest an adnexal mass, but intraoperative findings could diverge

Table 2Literature review: pre-op adnexal mass, intra-op abnormal appendix, normal ovaries.^a

Report ^b	Age (y)	Presentation	D	Past history	BT	TM	Examination	US	CT	MRI	Surgery	Findings	Histo	Follow up/Rec
Cristian 2015 Romania [3]	61	Moderate R lower Abd pain not radiating	2m	UR	N	N	Firm right latero-uterine mass	Adnexal cystic lesion	Well defined mass, thin wall, tubular, homogeneous, 11 × 3.5 cm	NR	ELap, LA	M, tip & middle Apdx; IG normal	LAMN	1 y, no disease; no Rec
Paladino 2014 Italy [6]	79	No complain of any symptoms	I	AF	N	N	Palpable mass, right vaginal fornix	Oblong mass RA region, capsulated, unilocular, dishomogeneous, not vascularized	NR	Mimic adnexal cyst	ELap, LA	Apdx mass, diameter 9 cm; IG normal; resection margins negative	AM	Not necessary; Rec NR
Akman 2014 Turkey [9]	81	Abd pain	Few m	UR	N	N	Tenderness, semi- mobile palpable mass 10 cm in R lower quadrant; subtotal U prolapse	normal U, left adnexa. 11 × 9 cm cystic mass in RA location	NR	12 × 10 cm cystic, hetero-echogenic, no solid components	L; AP, R H; HS, BSO due to U prolapse	10 cm mucinous tumoral mass of Apdx; N U & OV	AMN	1y; No Rec

^a Evidence based on case reports.^b For space considerations, only the first author is cited; Abd: Abdominal; AF: atrial fibrillation; AM: appendiceal mucocele; AP: Appendectomy; Apdx: appendix; BSO: bilateral salpingo-oophorectomy; BT: Blood tests; D: Duration; d: day; ELap: Exploratory laparoscopy; H: hemicolectomy; Histo: Histology; HS: hysterectomy; I: incidentally detected; IG: internal genitalia; intra-op: intraoperative; L: Laparotomy; LA: laparoscopic appendectomy; LAMN: low-grade appendiceal mucinous neoplasm; M: Mucocele; m: months; N: normal; NR: not reported; OV: ovary/ies; pre-op: pre-operative; R: right; RA: right adnexa; Rec: Recurrence; U: uterus/uterine; UR: unremarkable; y: years.

Table 3Literature review: pre-op adnexal mass, intra-op abnormal ovary, normal appendix.^a

Report ^b	Age (y)	Presentation	D	Past history	BT	TM	Examination	US	CT	MRI	Surgery	Finding	Histo	Follow up/Rec
Van Rompuy 2018 Belgium [13]	55	Vague stomach pain, weight loss, fatigue, backache	NR	Asthma, Hepatitis A, Hypercholesterolemia	NR	NR	NR	Enlarged R OV, partially cystic/solid, hyperechogenic mass 4 cm with high Doppler flow. Lt OV: smaller cyst with hyperechogenic borders	PET-CT: hypermetabolic R OV, lungs, bones, and several lymph node regions	NR	Lap BSO	R OV pedunculated nodule 5 cm. Lt OV: normal dimensions containing multiple small cysts	MC	NR
Tosuner 2015 Turkey [14]	75	Groin pain	NR	AP 57 y ago Chole 14 y ago 30 y post menopause	NR	N	Adnexal mass	NR	NR	8 × 7 cm mass in R OV compatible with CyT	R SO	Cystic mass 10 × 9.5 × 8 cm, contains viscous sebaceous material Cyst wall contain bony structures	C tumor arising in wall of mature CyT	No Rec after 11 m
Price Australia 1990 [15]	63	Lower Abd pain, swelling, urinary symptoms	6 W	TAH for menorrhagia	N	N	Large Abd swelling from umbilicus to pelvis	Multicystic pelvic mass	NR	NR	L BSO	R multilocular OV cyst fixed to pelvic floor, inflammatory adhesions	Mucinous and granulosa cell tumor	No Rec for 3 y follow up

^a Evidence based on case report.^b For space considerations, only the first author is cited; Abd: Abdominal; BSO: bilateral salpingo-oophorectomy; BT: Blood tests; C: carcinosarcoma; Chole: cholecystectomy; CyT: cystic teratoma; D: Duration; Histo: Histology; intra-op: intraoperative; L: Laparotomy; Lap: Laparoscopy; Lt: left; MC: Mucinous carcinosarcoma; N: normal; NR: Not reported; OV: ovary/ovarian; pre-op: pre-operative; R: right; Rec: Recurrence; SO: salpingo-oophorectomy; TAH: Total abdominal hysterectomy; W: Week/s; y: years.

Table 4Literature review: pre-op adnexal mass, intra-op abnormal appendix and ovary, origin in appendix.^a

Report ^b	Age (y)	Presentation	D	Past history	BT	TM	Examination	US	CT	MRI	Surgery	Finding	Histo	Follow up/Rec
Current Case Qatar	58	Minimal intermittent vaginal bleeding, no Abd pain	5d	Lt colon cancer, E Lt H, chemo 15y ago; suspicion of adeno-myosis/mural fibroid	N	N	Soft Abd, no tenderness/guarding; mobile non-tender 15 × 10 cm mass; bulky U, fullness around adnexa	Complex septated pelvic cystic mass 21 × 11 cm, multiple solid areas, pushing U anteriorly	NR	R Adnexal complex cyst 21.4 × 10.3 × 16.2 cm, suggest R OV epithelial neoplasm	L, TAH with BSO and AP	Large mobile thin walled multi locular mass arising from R OV. N Lt OV and U. Small and large bowel adhesions, appendix adherent to ovary, mucus extruding through its tip	LAMN	No Rec 3 y
Mandai 2000 Jaban [12]	35	Lower Abd mass on annual check-up	NR	NR	NR	CA 125: 86 Others: N	Lower abdominal mass	NR	NR	NR	1st Op: L, TAH, Lt SO, partial resection of R OV. 2nd Op: R SO, AP, Om, Res of colonic nodule, P & para-A Lad	1st Op: large L OV, N R OV. 2nd Op: R OV slightly large and hard	AAC with Bil. Krukenberg Tumor	Later developed peritonitis carcino-matosa. Died 24 m after diagnosis
Klein.1996 US [16]	66	Vaginal spotting Lt lower abd pain	2 m	NR	NR	NR	NR	Lt OV mass (5 cm)	NR	NR	L, TAH with BSO and modified R H, biopsy of peritoneal nodules	Partly exophytic Lt OV mass, 4 cm, distending the cecum, suspicious nodule in cul-de-sac	AMC, both OV involved (R OV microscopic)	Tumor advanced with carcino-matosis, death after 20 m

^a Evidence based on case report.

^b For space considerations, only the first author is cited; 1st: First; 2nd: Second; AAC: Appendiceal adenocarcinoid; Abd: Abdominal; AMC: Appendiceal Mucinous carcinoid; chemo: Chemotherapy; AP: Appendectomy; Bil: Bilateral; BSO: bilateral salpingo-oophorectomy; BT: Blood tests; CA-125: cancer antigen 125 U/mL; D: Duration; d: Day/s; E: extended; H: hemicolectomy; Histo: Histology; L: Laparotomy; Lad: Lymphadenectomy; Lt: Left; m: month; N: normal; NR: Not reported; Om: omentectomy; Op: Operation; OV: ovary/s P: Pelvic; Para-A: Para-aortic; R: right; Rec: Recurrence; Res: Resection; SO: salpingo-oophorectomy; TAH: Total abdominal hysterectomy; U: uterus; W: Week/s; y: years.

Table 5Literature review: pre-op adnexal mass, intra-op abnormal appendix and ovary, origin in ovary.^a

Study ^b	Study Design	Total N of cases	Age (y) M $\pm$ SD	N of grossly abnormal Apdx and OV IO	Cases showed Mets to Apdx from OV
Song 2018 Republic of Korea [17]	Retrospective	473	39.8 $\pm$ 15.8	16	1
Ozcan Turkey 2015 [18]	Retrospective	129	40.2 $\pm$ 14.2	25	1

^a Evidence based on retrospective study.^b For space considerations, only the first author is cited; Apdx: Appendix; IO: Intra-operative; M: mean; Mets: Metastasis; N: number; OV: Ovary; SD: Standard deviation.

[3]. Imaging correctly diagnoses < 30% of appendiceal mucinous cystadenomas prior to surgery [10]. Pre-operative diagnosis of adnexal mass comprise laboratory testing (e.g. tumor markers); and imaging (e.g. transvaginal/transabdominal US, MRI, CT, and positron emission tomography (PET)) [10]. Based on the combination of these investigations, several scoring diagnostic models for adnexal mass were developed with variable accuracy; however, even with such models, diagnosis remains challenging [10]. Our patient's tumor markers were normal, and pelvic US and MRI both suggested an ovarian tumor that subsequently turned out to be appendiceal in origin. Such situation is rare, although others reported similar possible uncertainty [6,9]. It is important to enhance the preoperative diagnosis of AM in order to increase the probability of anticipating it, and hence appropriate management, prevention of rupture at surgery, which may lead to pseudomyxoma peritonei; and also to prompt the intra-operative search for the presence of any synchronous colorectal neoplasm/s [4].

Given that the pre-operative diagnosis and differentiation of adnexal mass from an AM is difficult, intra-operatively, the definitive diagnosis is either by the gross appearance or by histopathologic tissue diagnosis. Based on our literature review, the final (intra or post-operative) diagnosis of adnexal mass can be classified in relation to two (gross and histopathological) criteria, namely: a) whether the appendix, ovary or both is/are abnormal; and, b) whether the origin of the mass is the appendix or ovary. The intersection of these two criteria (Table 1) generates a matrix of 4 mutually exclusive groups.

The four mutually exclusive groups highlighted in Table 1 are further exemplified and summarized in Tables 2–5. Collectively, these four tables suggest that it is extremely difficult to definitively exclude the appendix, pre-operatively, as a potential mimic of an adnexal mass. Such uncertainty could exist despite the use of advanced imaging (MRI and/or CT) in some cases (Table 2). Likewise, tumor markers could be a useful assistance to suggest the potential source (origin), where CEA and CA19-9 are usually higher in colonic or appendiceal sources [11], while CA 125 rises with epithelial ovarian tumors [11]. Nevertheless, tumor markers remain inconclusive, as observed by in Table 4, where others [12] reported slightly elevated CA 125 and the source turned to be appendiceal metastasis to the ovaries.

Hence, AM should be considered in the differential diagnosis of women presenting with adnexal mass on ultrasound in order to choose the best surgical approach [6]. The gynaecologist might benefit from more accurate investigational methods (e.g. advanced imaging and complex diagnostic models) to decrease the likelihood of misdiagnosis. Patients undergoing surgery for adnexal mass should be counselled pre-operatively regarding the possible alternative intraoperative findings and the possible consequent change in surgical plan. Moreover, the hospital and surgical team need to consider preparing appropriate staff and tools for such possible alternative scenarios that could be uncovered intraoperatively, like prompting a general/colorectal surgeon in case a suspected adnexal mass turned out to be appendiceal in origin. Thorough pre-operative MDT discussion of such cases could contribute to minimize the possibilities of intraoperative surprises.

Treatment of AM is surgical, and although some advised against the laparoscopic approach due to risk of rupture [19], however

other reports showed its feasibility despite the need for conversion in specific circumstances like AM rupture [20]. The type of surgical treatment is related to the dimensions and histology of the AM. After accurate exploration of the abdomen, appendectomy is appropriate for simple AM, when the appendiceal base is intact; cecal resection for cystadenoma with a large base; and right hemicolectomy for adenocarcinoma [21]. At the time of laparoscopy or laparotomy for AM, any mucinous fluid within the abdomen should be carefully harvested for thorough cytologic examination, and if epithelial cells are found outside the appendix within the mucoid fluid, then a diagnosis of pseudomyxoma peritonei of appendiceal origin is established [19]. Cytoreductive surgery (CRS), HIPEC, and early postoperative intraperitoneal chemotherapy (EPIC) may be indicated for pseudomyxoma peritonei [19]. In case of malignancy, some authors advice routine oophorectomy at the time of surgery, since the ovaries represent a common organ for metastases [20]. In our case, laparoscopic approach was not attempted as the patient has already history of previous midline laparotomy. The patient had appendectomy alongside the hysterectomy and bilateral salpingo-oophorectomy as the appendicular mass was adherent to the internal genitalia.

4. Conclusions

Variable pathologies of the abdominal (e.g. appendix) or pelvic organs (e.g. ovary) can present as adnexal mass. A range of pre-operative diagnoses should be considered, and definitive management need to be based on the final intra- and post-operative findings. A variety of potential scenarios could be encountered with overlapping pre-operative findings, hence proactive preparation is imperative. There could be a possible need to involve general or colorectal surgical teams in case of an appendicular tumor. Such patients should be counselled about the possible findings and subsequent change in intra-operative plan, and better to be operated upon in facilities with appropriate teams and equipment.

Declaration of Competing Interest

Nothing to declare.

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Ethical approval

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Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Ali Toffaha: Data collection, interpretation, writing the paper. Walid El Ansari: study concept, data interpretation, writing the paper. Ammar Aleter: study concept, data interpretation, writing the paper.

Registration of research studies

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