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Original Research

Concordance of adnexal mass laterality: from preoperative imaging to surgical pathologic findings

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Summary

Purpose of Investigation: Adnexal masses identified on imaging are often designated right- or left-sided, but findings at surgery can be different from what was described preoperatively. The objective was to assess laterality concordance between preoperative imaging modalities and operative findings/final surgical pathology. Secondary outcomes included analysis of: mass size, patient age, histological diagnosis, and imaging modality on delineation of adnexal mass sidedness. *Materials and Methods:* This was a retrospective chart review from a single sub-specialty provider and 705 patients were reviewed from January 2015 through October 2017. There were 280 patients with an admission diagnosis of pelvic Mass included in the final analysis. All patients had some form of preoperative imaging consisting of either: CT, ultrasound, or MRI. *Results:* Concordance between imaging and surgical findings was poor at 35.9%. Concordance between imaging modalities themselves was 30.3% for CT and ultrasound, and 50% for MRI and ultrasound. The authors found that the larger the mass size, the lower the sensitivity for correctly assessing laterality (47.62% for size < 7 cm *vs.* 18.75% for size ≥ 20 cm, $p = 0.0378$). Age had some effect on mass size with those ≤ 30-years-old having significantly larger masses $p = 0.0167$. For those with ovarian type cancers, there was a significant difference between mass size and age ≤ 30-years compared to > 30-years-old ($p = 0.046$). A benign versus cancer diagnosis did not increase the ability to discern sidedness (Fishers test $p = 0.3110$). The size discrepancy between preoperative imaging and final pathology ranged from 0-14.9 cm with an average of 2.45 cm. Of the 72 women with high grade serous tubo-ovarian cancer (HGSTOC), 34.7% were found to not have specific "adnexal" masses, but other pelvic mass findings were identified. *Conclusions:* Preoperative imaging does not confer significant concordance of laterality with surgical findings in any patient subset. This can become an issue with consent forms and compliance with national and local administrative guidelines regarding wrong-side, wrong-site surgeries. Counseling for patients can be inclusive and stated as such on the consent forms. A high suspicion for HGSTOC should be held when a peri- or postmenopausal patient presents with abdominal/pelvic symptoms and no adnexal mass specifically identified.

Key words: Adnexal mass; Concordance; CT scan imaging; Laterality; MRI; Pelvic mass; Ultrasound.

Introduction

Patients with pelvic masses present with numerous symptoms to include: pain, bloating, pelvic pressure, changes in bowel or bladder habits, and abdominal distention. Imaging usually follows to elucidate etiology. In the United States, it is estimated that there is a 5-10% lifetime risk for women undergoing surgery for a suspected ovarian neoplasm [1]. When masses are identified, surgery is often recommended. Consent forms have become stricter as patient safety concerns for wrong site and wrong side surgeries have increased. Preoperative specified laterality with skin marking or side-banding prior to surgical invention has been recommended to potentially improve patient outcomes. The present authors undertook this study to evaluate concordance of laterality between imaging and surgical findings.

Materials and Methods

All 705 patients from a single practice sub-specialty provider were reviewed from January 2015 to October 2017. Admission diagnosis on 666 surgical candidates was complete, 285 patients with a diagnosis of pelvic or adnexal mass were identified, and 280 had final data for review. All patients had surgery within two weeks of subspecialty consultation. Data was abstracted and variables for review included: age, imaging study (ultrasound, CT, MRI) imaging dimensions, imaging laterality, pathologic findings to include histology, pathologic dimensions, and surgical laterality. Volume was attempted to be calculated for both imaging and pathologic data. Three-point data was not available in the majority of imaging studies and pathology reports, therefore the largest dimension recorded had to be used as the final data-point. The authors performed subset analyses of patient age, imaging modality, concordance of imaging modalities within themselves, effect of mass size, and a cancer diagnosis and compared these variables to surgical findings. Data was entered into Excel. Statistical analysis was performed using Graphpad 2018 and Socscistatistics 2018. A p value of ≤ 0.05 was considered significant. All tests were two-tailed and confidence intervals (CI) were set at 95%. IRB approval was requested from the Group Health Research Institute and it was determined that this review was exempt on June 16, 2017 as a Quality Improvement project.

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Table 1. — *Histopathology.*

Histopathology	Number of patients	Average age	Age range
LMS	2	70.5	65-76
TOA/Crohns	2	33	26-40
Torsion	5	55	39-67
Serous cystadenoma	39	61.4	25-84
Serous cystadenofibroma	6	70.3	65-87
Seromucinous cystadenoma	7	50.8	33-67
Mucinous cystadenoma	28	49.8	18-84
Hydrosalpinx	2	59	53-65
Hemorrhagic cysts	2	39	26-52
Fibrothecoma	5	66.4	60-72
Fibroma	8	61.4	35-74
Fibroid	11	51.2	28-66
Fibroangioleiomyoma	1	45	NA
Endometriosis	24	44.6	21-61
Dermoid	12	42.8	19-69
Borderline ovarian cancer (13 mucinous)	19	52.4	18-76
LGSTOC	4	56.8	41-69
HGSTOC	72	66.6	41-91
Endometrioid ovarian cancer	6	68.2	58-86
MMMT Ovarian cancer	1	68	NA
Sex cord stromal cancer	3	51.3	27-70
Clear cell ovarian cancer	4	58.3	46-58
Brenner tumor	3	73.3	61-87
Metastatic uterine cancer	5	57.2	47-68
Metastatic GI cancer	8	69.1	49-73
Metastatic breast cancer	1	53	NA

NA: not applicable, LMS: leiomyosarcoma; LGSTOC: low-grade serous tubo-ovarian cancer; HGSTOC; high-grade tubo-ovarian cancer, MMMT: mixed Müllerian mesodermal tumor, GI: gastrointestinal.

Results

In this study, 280 patients were confirmed to have a pelvic mass after review of their records. The average age for all patients was 58.1 years. Twenty-two patients were ≤ 30 years old and the average age of this subset was 23.4 years. Seventy-nine patients were >30- to ≤ 50-years-old with an average age of 37.9 years. The average age for the patients over the age 50 was 65.79. The average age for those without cancer was 53.1 years. The average age for those with cancer was 63.

Preoperative imaging was performed in all patients and denoted laterality in 186 of 352 (52.8%) imaging procedures . CT scan was performed in 220 patients and denoted laterality as right in 44 patients, left in 34 patients, not denoted in 117 patients, and bilateral in 21 patients (4 not reported). Ultrasound was performed in 119 patients and denoted laterality as right in 39 patients, left in 26 patients, not denoted in 44 patients, and bilateral in ten patients. MRI was performed in 13 patients and denoted laterality as right in five patients, left in two patients, not denoted in five patients, and bilateral in one patient. Preoperative imaging was not specified in 166 (47.2%) procedures in total.

Surgical-pathologic laterality was right-sided in 101 patients, left-sided in 90 patients, bilateral in 69 patients, and not adnexal in 20 patients. Concordance between preoperative imaging and surgical findings was 35.9% between all imaging procedures and surgical-pathologic findings giving a sensitivity = 35.87% (CI 0.3092-0.4114). Of the 220 patients who had a CT, 66 of these were concordant with surgical findings yielding a sensitivity of 30.0% (sign test, p = 0.0769; CI: 22.93-34.9361). Of the 119 patients who had an ultrasound, 54 were concordant with surgical findings yielding a sensitivity of 45.37% (sign test, p = 0.3153; CI 0.3306-0.5051). Thirteen patients had a MRI and of these patients, seven were concordant with surgical findings yielding a sensitivity of 53.33%, (sign test, p = 0.7744; CI: 0.2859-0.8350). Of the total 182 imaging studies that denoted laterality: 21 (12%) of patients were found at surgery to be the exact opposite laterality. Thirty-two imaging reports described bilateral pelvic masses (13 CT, 18 ultrasound, one MRI), but at surgery 69 were found to be bilateral providing a sensitivity of 24.64%, a specificity of 90.96%, a PPV 68.31%, and a NPV of 60.41% (sign test, p = 0.6305).

Dual imaging was performed in 72 (25.7%) patients. Sixty-six patients had both CT and ultrasound and six patients had both a MRI and ultrasound. No patients had both CT and MRI. Imaging concordance between studies was evaluated. Imaging was concordant with laterality between CT and ultrasound in 20 patients yielding a sensitivity of 30.3% (sign test, p = 0.4614; CI: 0.1991-0.43). MRI and ultrasound were concordant in three patients yielding a sensitivity of 50% (sign test, p = 0.25; CI 0.1394-0.8605). Thus, even between imaging studies, laterality was often not concordant and outcomes not statistically significant.

The authors categorized mass size by Society of Gynecologic Oncology (SGO) guidelines for oncologic risk at 5, 7, and 10 cm, and from there on in 10 cm increments to > 50 cm. There was a wide range of surgical pathology. Table 1 shows a comprehensive list of histopathologic diagnoses. The average size of all masses was: 12.28 (range 0.5-65) cm. There were 53 masses with a size ≤ 5 (average size 2.92, range 0.5-5) cm, 84 masses with a size ≤ 7 (average 3.91, range 0.5-7) cm, 46 masses with a size 7.1-10 (average 8.91 cm, range 7.8-10) cm, 106 masses with a size 10.1-20 (average 14.4, range 10.5-20) cm, 37 masses with a size 20.1- 30 (average 25.1 cm, range 21-30) cm, six masses with a size 30.1-40 (average 31.36, range 30.1-33) cm, 0 masses with a size 40.1-50 cm, and one mass with a size ≥ 50 cm that was 65 cm.

The authors also investigated if there was a size difference between age ranges stratified by ≥ age 30, age > 30 to ≤ 50, and > 50-years-old. They used 30 as a cut off as there are often significant fertility preservation goals in this age group and counseling may be different for those aged 30 and younger. The average size for those patients ≤ 30 (average age 23.4) was of 18.7 (range 6.2-33) cm. The average size for those patients aged > 30 to ≤ 50 (average age 43.2) was 12.3 cm. The average size for those patients > 50 (average age 65.9 years) was 11.3 (range 0.5-32) cm. There was a difference in size between ages ≤ 30 and 30- ≤ 50, *t*-test, $p = 0.0167$ (CI: 0.5542-9.9888). There was no difference in size between ages >30 to ≤50 and > 50, (*t*-test, $p = 0.1218$; CI: 32.393- 33.393). There was a difference in size between the age group ≤ 30 compared to > 50 (*t*-test, $p = 0.000059$; CI 0.4372-8.7342). Thus, age had some correlation with regard to mass size.

The authors reviewed if age was related to concordant laterality. We investigated the subgroup of those ≤ 30-years -old and found that eight of 22 patients had surgical concordance with imaging giving a sensitivity of 40% (sign test, $p = 0.5034$; CI: 0.1997-0.6358). There were 258 patients aged > 30-years-old; of these, 95 patients were found to have imaging concordant with surgical laterality, yielding a sensitivity of 36.82% (sign test, $p = 0.0414$; CI: 0.3098-0.4305). When comparing the two age groups on concordance between imaging and surgery, there was no difference (sign test, $p = 0.4535$; CI: -246.28-159.28). Concordance of laterality between age groups had a low sensitivity. For younger patients with fertility preservation concerns, the authors are still not able to preoperatively delineate sidedness with certainty.

The authors were also interested if size had any effect on the ability to predict laterality: for the 84 patients who had a pelvic mass size ≤ 7, 40 imaging studies were concordant with surgico-pathology providing a sensitivity of 47.62% (sign test, $p = 0.7436$, CI: -0.3671-0.5874). The authors were interested if preoperative size ≥ 20 cm had any effect on predicting laterality: 44 patients had a size > 20 cm and of these, nine were concordant with surgico-pathology providing a sensitivity of 18.75% (sign test, $p = 0.0872$; CI: 0.0943-0.3310). It appears that the larger the size of the mass, the less sensitive imaging is for determining laterality.

Size discrepancy obtained from the preoperative imaging report was compared to the dimensions on the final pathology report. The size discrepancy averaged 2.45 cm in all patients, but ranged from 0-14.9 cm. Subset analysis of average size discrepancy for the 22 patients aged ≤ 30-years-old was 3.15 cm range (0-10.4) cm. For the patients > 30- to ≤ 50-years-old, the average size discrepancy was 1.99 (range 0.2-10.4) cm. For the patients aged > 50, the average size discrepancy was 2.46 (range 0.1-14.9) cm. When comparing the size discrepancy between ≤ 30 and >30- to ≤ 50-years-old a difference was found (*t*-test, $p = 0.0199$). Comparing sizes between the subset ages of > 30- to ≤ 50- and > 50-years old, there was no difference, (*t*-test, $p = 0.2511$). Comparing the groups of age ≤ 30- and > 50-years-old, there was some significance of size discrepancy between age groups (*t*-test, $p = 0.0286$).

There were 126 patients who had a cancer diagnosis. Of these, 109 patients had a gynecologic cancer diagnosis. The average age of all patients with a cancer diagnosis was 63.35-years-old (range of 18-91). There average age for the gynecologic cancer patients was 63.1-years-old (range 18-91). The size range for those with ovarian type cancers was 0.4-65 cm and averaged 11.11 cm.

The authors compared the ability to discern laterality between those with a cancer diagnosis and those who were found to have benign masses at final pathology. There was no difference between a cancer diagnosis and laterality (Fishers test, $p = 0.3110$).

The authors compared mass size between age groups of those with ovarian type cancers. The size for patients in the age group ≤ 30 with ovarian type cancers averaged 20.2 cm. The size for patients in the age group > 30 with ovarian type cancers averaged 10.61 cm. There was significance between age and size within the ovarian-type cancer diagnosis subset (*t*-test, $p = 0.046$). This was likely related to the larger borderline mucinous type tumors.

There were 72 women with a diagnosis of high-grade serous tubo-ovarian cancer (HGSTOC) and this group had an average age of 66.56 years. Twenty-five (36%) of these patients were deemed to not have any “adnexal abnormalities” (but still had a pelvic mass NOS) on preoperative imaging; 37 (51.4%) were found to not have any laterality identified on imaging. In the 72 patients with a diagnosis of HGSTOC, the average mass size on imaging was 10.08 (range 1.9-14.9) cm and the average mass size at pathology was 7.29 (range 0.6-14.9) cm. The difference in size between imaging and pathology was 3.13 cm. The size discrepancy between those patients with HGSTOC and all others in the study, who had an average size discrepancy between imaging and final pathology of 2.25 (range 0-17) cm, was significant (*t*-test, $p = 0.0382$).

Discussion

Many studies have evaluated the ability to predict malignancy, but there are none predicting sidedness. Bimanual exam alone has a low discrimination for size and laterality [2]. Laterality determined on preoperative imaging was found to be concordant with intraoperative findings in only 35.9% of the present patients. A large number (47.1%) of preoperative imaging reports failed to denote, or commit to any laterality.

The authors did not find any statistical significance between having a cancer or benign diagnosis, size of adnexal mass, or imaging modality, with the ability to predict laterality at the time of surgery. There was varying significance found for ability to predict laterality within age groups. The authors found that 25.7% of patients had dual imaging, and yet there was still no concordance in over half of patients. This remains true even in the age ≤ 30 subset. They also found that a fair number of imaging studies designated unilaterality, but bilateral lesions were found in 24.6%. This is not surprising, as adnexal bilaterality can occur frequently, even with common benign lesions, in up to 15% of patients [3] .

For those patients with HGSTOC, the present authors found that the comment "no adnexal abnormalities" was present in 25 (34.7%) patients but other pelvic masses were identified. A higher suspicion for disease should be held in the situation when a patient presents with abdominal/pelvic symptoms. Workup should include a comprehensive physical examination, use of the ovarian cancer symptom index [4], laboratory evaluation with a CA 125 level, and imaging to primarily include CT of the abdomen and pelvis with contrast. Delay of referral, for the only reason to obtain further imaging, then compromises patient outcomes as the present authors did not find additional benefit of ultrasound.

Concerns about imaging modality can arise when attempting to characterize adnexal masses. CT has shown to help discern adhesions and adnexal sidedness in one study [5]; however discomfort also arises with exposure of the patient to ionizing radiation from CT scans, unlike ultrasound [6]. In this study, dual imaging did not increase the ability to correctly identify laterality, and even between studies there was low concordance. Dual imaging, with respect to healthcare resource use is then not efficient and not cost-effective. Critical thinking by providers can help discriminate which initial test to obtain; i.e. if mass size alone would call for referral to gynecologic oncology, then CT may be the better modality to order for comprehensive analysis of the abdomen/pelvis. If CA 125 level is available and found to be high, then CT alone would again be the better test.

Patient safety advocates at the local and national levels have attempted to decrease wrong-site and wrong-sided surgeries, appropriately [7]. This review has shown that imaging poorly predicts laterality. Options for wording the adnexal/pelvic mass consent can include: unilateral salpingo-oophorectomy (with laterality not specified), removal of affected tube and ovary, removal of pelvic mass with the goal of fertility preservation, and other indicated procedures; all thus not designating laterality. We can achieve the necessary components of informed consent without designating laterality in this patient population. Use of shared decision-making, embracement of cultural competency, and discussion with the patient and her family on the appropriate level for patient healthcare literacy can all contribute to a meaningful preoperative discussion and successful surgical outcome.

Strengths in this study are: the data is from a single provider patient population, there were uniform/consistent radiology and pathology provider pools, and complete and accurate electronic medical records were available for 98.2% of the patients. Patients all had surgery within two weeks of presentation. Weaknesses in this review are its retrospective nature, the lack of pelvic mass volume declared both on imaging and final pathology in a majority of patients, and the low power. This study differs from others in that the authors did not attempt to determine imaging characteristics of potential malignancy.

Conclusion

Preoperative imaging is not absolute enough to determine sidedness and grant definitive laterality, and this can have implications for the preoperative surgical consent.

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