Unnecessary Laparotomy Avoidance--Outcome of 257 Consecutive Adnexal Masses of 8 – 13 cm on Pre-Operative Ultrasound Suspected To Be Benign Based Upon ACOG Committee Opinion 280 Selection Criteria Treated with Laparoscopic Adnexectomy, Bagging and Colpotomy

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ABSTRACT

--Study Objective: To demonstrate the safety of minimally invasive surgical treatment of 8 – 13 cm adnexal masses felt to be benign, to confirm the negative predictive value of ACOG Committee Opinion 280 for selecting women whose adnexal masses are unlikely to be malignant and, based on these data, to advocate for acceptance of a new treatment algorithm featuring Minimally Invasive Surgery in the treatment of both benign and malignant ovarian lesions.

Design: Retrospective Chart Review (Canadian Task Force Classification III).

Setting: Community hospitals and private Gynecologic Surgery practice.

Patients: 257 consecutive patients with adnexal masses of 8 – 13 cm on Pre-Operative ultrasound examination meeting criteria set forth in ACOG Committee Opinion 280, "Role of the Generalist Obstetrician-Gynecologist in the Early Detection of Ovarian Cancer."

Intervention: Patients meeting the selection criteria were scheduled for Operative Laparoscopy, Washings, Adnexectomy, Bagging and Colpotomy. Procedures were aborted if frank malignancy was encountered and excluded if the lesion was judged not to be a primary ovarian process. Patients were assessed post-procedure and outcomes monitored.

Measurements and Main Results: Of 257 consecutive cases with stated inclusion criteria, six were found to have disseminated ovarian malignancy at the time of laparoscopy and eleven were judged not to be candidates for inclusion in this study at the time of laparoscopy. A total of 240 patients successfully completed intended treatment (93.38%) and 234 of these did not require admission (97.5%). The procedure is well tolerated with relatively few complications. Intra-operative rupture of the ovarian capsule was extremely rare in our series. Capsular rupture was noted in just 1.25% of cases.

The most common lesions were cystadenomas, endometriomas, cysts and mature teratomas accounting for 85% of all cases. Borderline tumors accounted for 5% while invasive ovarian malignancy represented 3.75% of the specimens.

Laparoscopies abandoned based on presumption of disseminated disease had significant findings at the time of definitive staging by Gynecologic Oncologists: Stage I- 0%, Stage II – 16.67%, Stage III – 50% and Stage IV – 33.33% In the nine cases we treated that later returned invasive carcinoma on final pathology, all were believed to be Stage I disease at the time of referral to Gynecologic Oncologists. No

capsules had excresences, there was no disease noted elsewhere in the abdomen and pelvis, but six had positive washings. Definitive staging upstaged four of the nine lesions or 44.44%

Finally, we examined the relationship of menopausal status and cancer Stage of all fifteen patients found to have invasive ovarian malignancy. Being postmenopausal conferred a greater likelihood of having any ovarian malignancy (8 / 88 or 9.09%) compared with pre-menopausal women (7 / 158 or 4.43%). The Negative Predictive Value of ACOG Committee Opinion 280 as a de-selector for having invasive ovarian malignancy in our population was 95.57% for premenopausal and 90.91% for postmenopausal women.

Conclusions: Laparoscopic adnexectomy, bagging and colpotomy is a desirable goal for patients meeting selection criteria affording a minimally invasive approach with attendant benefits including out-patient treatment, few complications, low likelihood of iatrogenic rupture of the ovarian capsule and low necessity for re-operation after final pathology is evaluated. Negative predictive value of ACOG Committee Opinion 280 is confirmed in a community GYN practice and is recommended to form basis of new treatment algorithm for women with adnexal masses.

Key Words: Early ovarian cancer: Laparoscopy: Staging:Treatment

It is our belief that the days of laparotomy in mainstream gynecology should be over. Various organizations have expressed positions on the benefits of Minimally Invasive Surgery in hysterectomy [1-3]. It is our suggestion that a management algorithm be implemented to assure both adherence to standard of care recommendations regarding referral of adnexal masses likely to represent ovarian cancer to Gynecologic Oncologists and treatment of adnexal masses felt to be benign using Minimally Invasive Surgical techniques while carefully observing standard principals of oncologic surgery. We selected masses in this size range because, just as with larger uteri, many Gynecologic Surgeons view increasing size of an adnexal mass as an important de-selector of the patient as an appropriate candidate for laparoscopic surgery.

The prevalence of adnexal masses is relatively high in the general population contributing to Gynecologists' office volume and surgical case load. Oppositely, ovarian cancer has a relatively low prevalence. Ovarian cancer has non-specific symptoms and is usually silent in its early stages [4]. Presently we have no reliable screening test for ovarian cancer and we have a limited ability to detect it using current diagnostic strategies [5,6].

Various studies have addressed the likelihood of malignancy within an ovarian mass. This likelihood ranges from 0.38% to 18.67%. (see Table 1) and is population dependent [7-19].

Contemporary pre-operative work-up for an adnexal mass involves history and physical examination, labs including CA 125 and imaging studies usually including transvaginal ultrasound. The risk of encountering an unexpected ovarian malignancy after modern pre-operative screening is 0.9 – 13% [20].

Various models have been devised to select a population of patients at high risk for ovarian cancer. In the present day care algorithm, these patients are referred to Gynecologic Oncologists for treatment. Dating to Jacobs, et al, 1990, [21] and Sassone, et al, 1991, [22] scoring systems have related ultrasound characteristics, CA 125, family history and other variables in predicting likelihood of ovarian malignancy [23-43]. By 2002 the American College of Obstetricians & Gynecologists evaluated the various predictors of ovarian malignancy and published ACOG Committee Opinion 280 setting forth criteria to refer both premenopausal and postmenopausal women for care by Gynecologic Oncologists [44]. These referral criteria are summarized in Table 2. Postmenopausal criteria include a lower CA 125 threshold or a nodular or fixed pelvic mass for referral. Importantly, only one referral criteria must be met for a patient to be referred to a Gynecologic Oncologist.

Two prior studies have looked at the operational characteristics of ACOG Committee Opinion 280 and how it functions in actual practice. In 2005, Im, et al, demonstrated in a multi-center study using criteria in ACOG Committee Opinion 280 in a referral population to identify women at high risk for ovarian cancer yields a positive predictive value of 33.8% in premenopausal women and 59.5% in post menopausal women. Data was not uniform from each of the seven centers and at some centers pelvic masses were only identified retrospectively [45]. These investigators conceded their data did not address how ACOG Committee Opinion 280 would operate in a general population.

In a more elegant study, Dearking, et al, in 2007, demonstrated in a prospectively enrolled cohort using criteria set forth in ACOG Committee Opinion 280 in a non-referred population to identify women at elevated risk for ovarian cancer yields a positive predictive value of 13.6% in premenopausal women and 44.9% in postmenopausal women. In their referral population applying the same selection criteria leads to a positive predictive value of 47.3% in premenopausal women and 90.5% in postmenopausal women [46]. The referral population had a demonstrably higher prevalence of disease, positively influencing assessment of the selection criteria.

By whatever method, once located, the prognosis of an ovarian tumor is determined by surgical staging, histologic subtype and grade of tumor differentiation [47]. Overall, only approximately 25% of patients diagnosed with ovarian cancer have Early Ovarian Cancer (EOC) or Stage 1. These patients have 5-year survival approaching 90% [48,49]. About 20% of EOC actually have microscopic metastatic disease on staging [50]. This is why thorough staging is crucial irrespective of initial surgical perception.

The route of definitive treatment of ovarian cancer has been changing. Initially reported in 1990, by Reich, et al, laparoscopic surgery for staging of ovarian cancer has become more common [51]. Laparoscopy has now become a standard treatment modality for patients with suspected benign adnexal masses [52,53]. Laparoscopy and Robot-assisted laparoscopy have equal efficacy in removal of adnexal mass but masses were small with mean weight of 50 grams and size of 5.4 cm (laparoscopic group) and 28 grams and size of 4.5 cm (in the robotic group) [54].

Surgical treatment of adnexal masses suspected to be benign on pre-operative ultrasound has also evolved over time. In each of these studies one anesthesia was used, usually with conversion to laparotomy , if frozen section diagnosed malignancy. Definitive staging was performed at the time of initial operation by Gynecologic Oncologists.

Havrilesky, et al, reported on 396 patients treated over seven years by laparoscopy for adnexal masses thought to be benign pre-operatively at a teaching center [55]. No clear statement of criteria used to discriminate benign from malignant masses pre-operatively is contained in the paper. Median preoperative mass size was 5.2 cm (0.5 to 17 cm): < 4 cm 26%, 4-8 cm 57.4%, >8 cm 16.6%. If a mass was drained within a bag it was not counted as ruptured. Ninety-seven percent of masses were benign on pathology. Intra-operative rupture of the capsule occurred in 25% of cases. Conversion to laparotomy occurred in 25% of cases. CA 125 levels were not predictive of malignancy but levels were not stratified based on menopausal status.

Smorgick, et al, reported on 263 women undergoing laparoscopic adnexectomy or cystectomy between 2002 and 2006 [56]. No clear statement of criteria used to discriminate benign from malignant masses pre-operatively is presented. Mean cyst size was 6.6 cm. A collection bag was used if a cyst was suspected to contain irritating fluid or possible malignant cells. Of these 263 cases, 93.5% were benign. Cyst rupture occurred in 16.6% of cases ranging from 7.4% in adnexectomy cases to 29.5% for cystectomy procedures.

Panici, et al, reported on sixty eligible patients aged 18 – 45 years, randomized to laparoscopy or laparoscopically directed mini-laparotomy for 7 – 18 cm adnexal cysts. Inclusion criteria included no

ultrasonographic suspicion of endometriosis or malignancy, CA 125 within normal range, BMI < 29 kg/m2, ASA score 0 – 2, no previous laparotomy and no contralateral cyst > 7 cm (amongst other criteria). A collection bag was used to containerize the mass if possible, during aspiration and removal. Frozen section was always performed and the case was converted to laparotomy if definitive staging was required. Uncontrolled rupture occurred in 87% of the laparoscopy patients and in 29% of the laparoscopically assisted, mini-laparotomy patients. No data on malignancy rate was included [57].

Sagiv, et al, reported on 21 patients with cystic or complex adnexal masses extending at least cephalad to the umbilicus with "low probability of malignancy" managed laparoscopically. Inclusion criteria included no suspicion of malignancy on imaging, no enlarged pelvic lymph nodes and CA 125 < 130 U / ml. Masses were aspirated without containerization. If frozen section was positive for malignancy the Gynecologic Oncology team immediately performed laparotomy and definitive staging. One of 21 patients had malignancy (adenocarcinoma) or 4.76%. These investigators state they could not contain spill from such large masses so they proceeded to laparotomy at the same setting if cancer was found [58].

An important consideration in adnexal mass surgery is inadvertent opening of the ovarian capsule. Likelihood of cyst rupture either during laparotomic or laparoscopic removal ranges from 10.5 – 41.8% in published studies [55,56,59-61].

Spillage affects recurrence rate for some benign lesions including mucinous cystadenoma [62].

In cases of ovarian malignancy where disease is confined to the ovary, rupture of the ovary increases the Stage to IC.

Vergote, et al, in 2001 reported on over 1500 patients with Stage I Epithelial Ovarian carcinoma and found intra-operative rupture worsened disease-free survival [63]. Various other retrospective multicenter studies support intra-operative cyst rupture as an independent predictor of disease free survival [64-66].

Alternatively, another group of publications failed to demonstrate a difference in disease free survival based on intra-operative cyst rupture [67-71]. Limitations of both groups of older studies assessing long-term outcome of patients with inadvertent, intra-operative capsular rupture involve: inclusion of non-staged or incompletely staged cases, lack of consistent adjuvant treatments for women positive for malignancy and lack of separate analysis of Stage IC cases.

In perhaps the most definitive work on this topic, Bakkum-Gamez, et al, reported a retrospective study to specifically address outcomes related to intra-operative capsule rupture (stage IC) in treatment of stage I epithelial cancer between 1991 and 2007. Of 161 cases meeting inclusion criteria, intra-operative capsule rupture occurred in 61 or 38%. All patients were treated in one anesthesia with definitive staging performed based on positive frozen section results. For patients whose only stage IC qualification was intra-operative capsular rupture there was found to be significantly higher recurrence and mortality rates [61].

In the old algorithm, women thought to be at high risk for ovarian cancer were referred to Gynecologic Oncologists while women at low risk were often treated by General Gynecologists under the supposition their adnexal masses were benign.

ACOG Committee Opinion 280 sets forth the Standard of Care for pre-operative discrimination of suspected malignant vs. suspected benign adnexal masses. But how successful is application of Committee Opinion 280 in selecting a population of women at low-risk for ovarian malignancy and how should these women be optimally treated?

Im, et al, in 2005, showed that strict adherence to ACOG Committee Opinion 280 in a referral population yields a negative predictive value (NPV) of 92.0 % % for all cases of ovarian cancer in premenopausal women and an NPV of 91.1% in post menopausal women [45].

Dearking, et al, in 2007, demonstrated that with strict adherence to ACOG Committee Opinion 280 in a non-referred population arising from their primary catchment area yields an NPV of 97.7% for all cases of ovarian cancer in premenopausal women and an NPV of 95.0% in post menopausal women [46]. In their referral population NPV was 91.0% in premenopausal and 90.5% in postmenopausal women, or essentially identical to the Im, et al, data [45]. Of the women not referred based on ACOG Committee Opinion 280 who were later found to have ovarian cancer, 8 of 10 premenopausal and 11 of 14 postmenopausal women were found to have Stage I or II disease at the time of definitive surgery. In other words, the majority of women predicted to have benign adnexal lesions who actually had malignant lesions, had early stage ovarian cancer the majority of the time.

Virtually all women with adnexal masses thought to be benign are managed by General Gynecologists. Some of these women are managed expectantly while others are taken directly to surgery. Regrettably, many women with adnexal masses are treated without appropriate work-up. Many Gynecologists do not operate in medical centers where there is instant availability of Gynecologic Oncologists for intra-operative consultation and continuation of care under the same anesthesia. Because of the supposition that the adnexal mass is benign washings are not obtained, appropriate care may not be exercised in removing the mass leading to spillage, frozen section is not ordered and thorough examination of all peritoneal surfaces for disease is not accomplished. As a consequence, many adnexal masses are not found to be malignant until well after the procedure is concluded. Timely re-evaluation and definitive staging is required for these patients [72-76].

Definitive staging of ovarian cancer includes: 1.) cytologic washings, total hysterectomy, bilateral salpingo-oophorectomy, peritoneal surface biopsies, total omentectomy and retroperitoneal lymphadenectomy from the pelvis and paraaortic regions to the left renal vessel [77]. Laparoscopy and laparotomy have equal efficacy in both early and advanced stage ovarian cancer [78]. The initial study on laparoscopic surgical staging in patients with early ovarian cancer was published in 1990 [51,79,80].

Because a final pathology report returning a diagnosis of invasive ovarian cancer is often a surprise, a subsequent surgical procedure is often performed for definitive staging of disease. Frequency of upstaging in patients with EOC at initial examination is in the range of 10 – 35.7% (see Table 3) [72,73,79-87].

Stier, et al, in 1996, reported on 45 patients being re-staged by laparotomy 12 – 161 days (mean 56 days) after initial surgery. Pre-staging work-up howed no radiographic evidence of metastasis. Seven patients had their disease upstaged or 15.56% [81].

Colomer, et al, in 2006, reported on 20 patients undergoing either primary treatment or completion of staging. Interval between initial operation and staging procedure was 4.7 weeks (range 2 – 11.4 weeks). Nineteen cases (95%) had successful laparoscopic surgical staging with one converted to laparotomy. In this series four patients were upstaged or 20% [72].

Nezhat, et al, in 2009, reported on 36 patients laparoscopically staged for early-stage ovarian and fallopian tube cancers over a twelve year period. Nine were referred for staging and 27 with adnexal masses. In all cases a specimen retrieval bag was used to remove tissue. All cases were accomplished laparoscopically. Seven patients were upstaged or 19.4% [73].

The purpose of this study is three-fold. First, to demonstrate the safety of minimally invasive surgical treatment of 8 – 13 cm adnexal masses felt to be benign. Second, to confirm the negative predictive value of ACOG Committee Opinion 280 for selecting women whose adnexal masses are unlikely to be malignant. Third, based on these data, to advocate for acceptance of a new treatment algorithm prominently featuring Minimally Invasive Surgery in the treatment of both benign and malignant ovarian lesions.

We propose a new treatment algorithm with initial triage based on ACOG Committee Opinion 280 (see Figure 1). Women having adnexal masses suspected to be malignant are immediately referred to Gynecologic Oncologists, while women with masses not suspected to be malignant are treated laparoscopically with careful attention to standard oncologic surgical principals. If disseminated disease is encountered at initial laparoscopy in patients felt to have benign disease, pelvic washings, biopsies of appropriate surfaces, and photo documentation is conducted. Laparoscopy is then abandoned and the patient immediately referred to Gynecologic Oncologists for definitive surgical staging. If after the initial laparoscopic procedure in women felt to have benign disease pathology returns invasive ovarian cancer, the patient is referred to Gynecologic Oncologists for definitive staging and treatment. In all cases where technically feasible, Gynecologic Surgeons and Gynecologic Oncologists are urged to perform Minimally Invasive Surgery either laparoscopically or laparoscopically with robotic assistance.

Following this strategy, all women having adnexal masses will receive appropriate care and optimal attention will be focused on masses not initially suspected to be malignant.

MATERIALS AND METHODS

A retrospective Chart Review study was conducted on patients treated by a private Gynecologic Surgery practice in a community hospital setting. Two-hundred fifty-seven consecutive patients with adnexal masses of 8 – 13 cm on Pre-Operative ultrasound examination not meeting criteria set forth in ACOG Committee Opinion 280 for referral to Gynecologic Oncologists were treated with operative laparoscopy, adnexectomy, bagging and colpotomy.

Conventional closed laparoscopy was performed with Verres needle insufflation. An eleven mm bladed trocar is placed at the bottom of the umbilicus. Location of additional ports is dictated by the clinical situation encountered. Washings are obtained. Inspection of all peritoneal surfaces is conducted. If disseminated frank malignancy is encountered biopsies are performed, photo documentation is conducted and laparoscopy is terminated. The patient is referred immediately with her records to our Gynecologic Oncology associates for definitive surgery.

If inspection demonstrates an intact ovarian capsule and no evidence of other disease, oophorectomy (152 patients), salpingo-oophorectomy (68 patients) or ovarian cystectomy (20 patients) is performed. If cystectomy was performed the collection system is introduced into the pelvis from a cephalad port and the ovary containerized in the event of cyst rupture. Otherwise the ovary or the tube and ovary were dissected free as necessary, infidibulopelvic ligament divided with a bipolar energy source (most often Ligasure from Covidien or Enseal from Ethicon Endo Surgery) and the mass containerized within the collection system (Endo Catch from Ethicon Endo Surgery or Anchor Tissue Retrieval System from Anchor Products Company). The collection system is closed and the carrier is removed.

With the uterus in place colpotomy is performed by elevating the posterior lip of the cervix, tenting the posterior vaginal mucosa on the midline and transecting this tissue with the Mayo scissors. In patients status post removal of the uterus additional care is taken to assure the bladder is not injured. A device (formerly a Heaney retractor handle, currently a Sacro-colpopexy Tip on the Rumi handle from Cooper Surgical) is used to distend the vaginal barrel. The bladder is filled with 300cc of sterile saline to demonstrate its location then drained. Parietal peritoneum posterior to the bladder reflection is incised with the endoscopic scissors then forced caudad on the vaginal barrel with an endo-Kitner device. Once sufficient space is developed, a semi-circular incision is created using the endoscopic scissors and 50 watts of cutting current at the vaginal apex.

Once the colpotomy is developed, the collection system's string is passed out the colpotomy defect and into the vagina. The surgeon then re-positions at the vagina. The mouth of the bag is delivered out the vagina and the volume of the mass reduced to allow the bag to be delivered out the vaginal defect. In principally cystic masses wall suction is used to aspirate fluid. In principally solid masses, ring forceps are used to disrupt the mass and withdraw it piece meal. Traction is maintained on the bag both to preserve the pneumoperitoneum (laparoscopic surveillance of debulking helps insure the bag is not performated) and to deliver the bag once the volume of the lesion has been sufficiently decreased. The colpotomy is then closed in one layer encompassing both peritonem and vaginal mucosa.

New gloves are donned and after inspection and copious irrigation the laparoscopy is terminated. Thirty cc of 0.25% marcaine without epinephrine is instilled to assist in postoperative analgesia. A Carter - Thomasson closure system is used to close the fascial defect for all large ports (> 8 mm).

Patients were assessed post-procedure and discharged to home if no complications were noted and pain status was amenable to treatment with oral analgesics. Otherwise, patients were admitted for pain control and re-assessed regularly.

RESULTS

Of 257 consecutive cases with stated inclusion criteria, six were found to have disseminated ovarian malignancy at the time of laparoscopy (see Table 4). Eleven cases were judged not to be candidates for inclusion in this study at the time of laparoscopy (see Table 5). A total of 240 patients successfully completed intended treatment (93.38%). Of patients successfully completing treatment 234 did not require admission (97.5%). One patient had an inadvertent bowel injury secondary to adhesiolysis requiring re-operation during the admission. One patient developed deep vein thrombosis well after discharge. Nine patients (3.75%) required re-operation by Gynecologic Oncologists after final pathology was available.

Laparoscopic surgery combined with posterior colpotomy has a low incidence of significant complications. Outcome data shows that by observing the principals of Minimally Invasive Surgery, 97.50% of women were successfully treated as out-patients and enjoy the benefits associated with this surgical route as compared with those of laparotomy.

Intra-operative rupture of the ovarian capsule was extremely uncommon in our series. Capsular rupture was noted in just 1.25% of cases.

Distribution of pathologic results is not surprising (see Table 6). The most common lesions were cystadenomas, endometriomas, cysts and mature teratomas accounting for 85% of all cases. Borderline tumors accounted for 5% of lesions while invasive ovarian malignancy represented 3.75% of the specimens.

Laparoscopies abandoned based on presumption of disseminated disease had significant findings at the time of definitive staging by Gynecologic Oncologists: Stage I- 0%, Stage II – 16.67%, Stage III – 50% and Stage IV – 33.33% (see Table 7). In the nine cases we treated that later returned invasive carcinoma on final pathology, all were believed to be Stage I disease at the time of referral to GYN Oncology. No capsules had excresences, no disease was noted elsewhere in the abdomen and pelvis, but six had positive washings. Definitive staging upstaged four of the nine lesions or 44.44% (see Table 7).

Finally, we examined the relationship of menopausal status and cancer Stage of all fifteen patients found to have invasive ovarian malignancy (see Table 8). Being postmenopausal conferred a greater

likelihood of having any ovarian malignancy (8 / 88 or 9.09%) compared with pre-menopausal women (7 / 158 or 4.43%). The Negative Predictive Value of ACOG Committee Opinion 280 as a de-selector for having invasive ovarian malignancy in our population was 95.57% for premenopausal and 90.91% for postmenopausal women.

DISCUSSION

Laparoscopic adnexectomy, bagging and colpotomy is a desirable goal for patients with adnexal masses meeting selection criteria for suspected benign lesions outlined in ACOG Committee Opinion 280 affording a minimally invasive approach with attendant benefits including out-patient treatment, decreased incidence of capsular rupture, few complications and low necessity for re-operation after final pathology is evaluated. This study convincingly extends the size range for adnexal masses safely treated laparoscopically to the 8 to 13 cm range.

In suggesting a new treatment algorithm for adnexal lesions in general, we stipulate the goal can not be to promote sloppy care—non-Gynecologic Oncologists should not be encouraged to ignore surgical principals, perform laparotomy, cause rupture of these lesions, make no attempt to stage the cancer and cause the patient to be exposed to the additional morbidity of a second major surgery all in the spirit of operating laparoscopically.

It is, however, not reasonable to think every woman with an adnexal mass can have surgery in a center affording immediate intra-operative consultation with Gynecologic Oncologists or that all women with adnexal masses should be referred to Gynecologic Oncologists for primary treatment. Despite the reasonableness of these statements, numerous papers have suggested modifying referral criteria to increase sensitivity at the direct expense of specificity in selecting patients likely to have ovarian cancer. [24,45] Changing the CA 125 cut-off to increase sensitivity of referral criteria identifying more cases of ovarian malignancy leads to more false positives: women who are caused unnecessary anxiety, forced to travel to unfamiliar surroundings for care and who may well be over-treated as a consequence undergoing laparotomy in the hands of some Gynecologic Oncologists' only to hear post-operatively pathology was benign.

One of the goals of our new algorithm is to develop a Staged process focusing additional attention on adnexal masses not thought to be malignant and improving care within this subset of patients. This approach seems feasible, particularly after this study demonstrated the safety of treating larger adnexal masses laparoscopically.

The negative predictive value of ACOG Committee Opinion 280 selection criteria for encountering malignancy in suspected benign cases are set forth in Table 9. Data from the present study is consistent with other reports in the literature. Although re-operation is required 6.09% of the time (15 out of 246 patients) in our algorithm for women with suspected benign lesions, this risk is substantially

outweighed by saving laparotomy in 93.91% of patients successfully operated found to have benign disease and in reducing 234 of 240 patients' treatment to a single out-patient encounter with decreased pain, less morbidity, enhanced satisfaction and lower cost through judicious application of principals of Minimally Invasive Surgery.

Another benefit of operation by experienced Minimally Invasive Surgeons is the lower observed incidence of capsular rupture of 1.25% compared to reported rates ranging from 10.5 – 41.8% during both laparotomic and laparoscopic surgeries reported in the literature [55,56,59-61]. Implementing our treatment algorithm now will lead to fewer laparotomies, fewer women unnecessarily upstaged as a consequence of inadvertent capsular rupture and heightened ability to offer out-patient treatment for women with presumed benign adnexal masses.

To substantially increase the appropriateness of referrals to Gynecologic Oncologists, we will have to commensurately increase the precision of our diagnoses of ovarian cancer. This will require advent and testing of new technologies to boost diagnostic precision used in tandem with established modalities [21-24,88] , or even development of high-sensitivity and high specificity screening tests for early stage ovarian carcinoma [89].

Until that day arrives, we propose acceptance and testing of our new treatment algorithm for adnexal masses using ACOG Committee Opinion 280 for initial triage of patients, focusing additional care and attention on women with suspected benign lesions while encouraging Minimally Invasive Surgical care for all affected women. This systematic approach to evaluation and treatment of adnexal masses utilizing the skills of Minimally Invasive Surgeons and Gynecologic Oncologists will lead to enhanced outcomes for women with both benign and malignant disease.

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Table 1. Likelihood of Malignancy in Adnexal Masses

Mage et al [7] 1990	433	9	2.08%
Mecke et al [8] 1992	773	11	1.42%
Nezhat et al [9] 1992	1011	4	0.40%
Hulka et al [10] 1992	13793	411	2.98%
Canis et al [11] 1994	757	19	2.51%
Marzana et al [12] 1994	527	2	0.38%
Wenzl et al [13] 1996	16601	108	0.65%
Childers et al [14] 1996	138	19	13.77%
Canis et al [15] 1997	230	15	6.52%
Hidlebaugh et al [16] 1997	405	8	1.98%
Malik et al [17] 1998	292	11	3.77%
Mettler et al [18] 2001	493	8	1.62%
Valentin et al [19] 2006	1066	199	18.67%
present study, 2011	257	15	5.84%
Total	36776	839	2.28%

Table 2. ACOG Committee Opinion 280 Referral Criteria [44]

Premanopausal Women

CA 125 > 200 U/ml
Ascites
Evidence of abdominal or distant metastases
Family history 1st degree relative(s) with breast or ovarian cancer

Postmenopausal Women

Elevated CA 125
Ascites
Nodular or fixed pelvic mass
Evidence of abdominal or distant metastases
Family history 1st degree relative(s) with breast or ovarian cancer

Table 3. Frequency of Upstaging at Definitive Procedure

Pomel et al [79] 1995	10	1	10.00%
Childers et al [80] 1995	14	5	35.70%
Stier et al [81] 1996	45	7	15.56%
Tozzi et al [83] 2004	24	5	20.80%
Leblanc et al [84] 2004	44	8	18.20%
Spirtos et l [85] 2005	58	6	11.00%
Chi et al [86] 2005	20	2	10.00%
Ghezzi et al [87] 2007	15	4	26.70%
Colomer et al [72] 2008	20	4	20.00%
Nezhat et al [73] 2009	36	7	19.44%
present study	9	4	44.44%
Total	295	53	17.96%

Table 4: Outcome Data

Total Patients in study period	257	
–surgery ends with laparoscopy	6	2.33%
–failed inclusion at laparoscopy	11	4.28%
total patients successfully completing	240	93.38%
--out-patient only	234	97.50%
--one hospital day	5	2.08%
--two or more hospital days	2	0.84%
–inadvertent rupture of mass	3	1.25%
--Cuff Cellulitis	0	0.00%
--febrile morbidity	9	3.75%
--injury to bowel	1	0.42%
--injury to bladder	0	0.00%
--injury to ureter	0	0.00%
--injury to major vessels	0	0.00%
--deep vein thrombosis	1	0.42%
--pulmonary embolism	0	0.00%
--port site hernia	0	0.00%
--re-operation this admission	1	0.42%
--death	0	0.00%
Washings Positive for malignancy	6	2.50%
Re-operated later by GYN Oncology	9	3.75%

Table 5. Patients Not Meeting Inclusion Criteria (eleven patients)

--Adhesions prevent laparoscopic visualization	3	27.27%
--Frozen pelvis	2	18.18%
--Fallopian Tube Cyst / Hydrosalpinx	3	27.27%
--Fallopian Tube Cancer	1	9.09%
--Fibroid Uterus / Pedunculated Myomas	1	9.09%
--GI Malignancy	1	9.09%

Table 6. Pathology Results

--Ovarian Cystadenoma	64	26.67%
--Functional Cyst	47	19.58%
--Endometrioma	34	14.17%
--Simple Cyst	32	13.33%
--Mature Teratoma	27	11.25%
--Ovarian Fibroma	5	2.08%
--Other Benign Ovarian Lesions	10	4.17%
--Borderline Ovarian Tumor	12	5.00%
--Invasive Ovarian Cancer	9	3.75%

Table 7. Cancer Staging From GYN Oncology

INVASIVE OVARIAN CANCER ON INSPECTION—LAPAROSCOPY TERMINATED: six patients		
--Stage I	0	0.00%
--Stage II	1	16.67%
--Stage III	3	50.00%
--Stage IV	2	33.33%
INVASIVE OVARIAN CANCER—OVARY REMOVED AND LATER DIRECTED TO GYN ONCOLOGY: nine patients		
--Stage I	5	55.56%
--Stage II	3	33.33%
--Stage III	1	11.11%
--Stage IV	0	0.00%

Table 8. Cancer Stage Based On Menopausal Status

ALL CASES OF INVASIVE OVARIAN CANCER (6 Initially excluded and 9 positive on final pathology)

	PREMENOPAUSAL	POSTMENOPAUSAL
Stage I	3	2
Stage II	2	2
Stage III	1	3
Stage IV	1	1
Total Patients	7 / 158 (4.43%)	8 / 88 (9.09%)
NPV ACOG 280	151 / 158 (95.57%)	80 / 88 (90.91%)

Table 9. Negative Predictive Value of ACOG Committee Opinion 280

	Premenopausal	Postmenopausal
Im et al [45] 2005	92.00	91.10
Dearking et al [46] 2007		
--overall	93.10	91.70
--referral population	91.00	90.50
--general population	97.70	95.00
Present Study	95.57	90.91