

Incidental appendectomy at the time of gynecologic surgery

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Summary

Purpose of Investigation: This study was performed to evaluate the safety and feasibility of incidental appendectomy in a high risk gynecologic and gynecologic oncology patient population. **Materials and Methods:** This was a retrospective review evaluating 3,210 patients. Data reviewed included: age, preoperative diagnosis, route of surgery, procedure performed, length of stay, BMI, complications, and final diagnosis. Data was abstracted and analyzed; Mann-Whitney U and *t*-test were used to calculate outcomes. Significance was set at a $p < 0.05$ for each statistical test. **Results:** This study included 1,876 appendectomies that were performed at the time of gynecologic surgery. Eighty-two percent of procedures were performed laparoscopically. A high rate of abnormal pathology was identified: there were 32 (1.7%) primary appendiceal cancers identified, gynecologic cancer metastasis was identified in 71 (3.8%) patients, 12 (0.6%) patients had metastatic other cancer to the appendix, 40 (2.1%) patients had appendiceal endometriosis, and 25 (1.3%) patients had appendicitis. The total number of patients with significant appendiceal pathology was 221 (11.8%). No complications were attributed to the appendectomy procedure itself. BMI was not related to the ability to perform appendectomy (*t*-test, $p = 0.9960$), nor was route of surgery (*t*-test, $p = 0.9256$). Length of stay in the laparoscopic cohort was shorter for those who underwent appendectomy. **Conclusions:** Incidental appendectomy during gynecologic surgery is safe and feasible. This study documents that safety in an especially high risk gynecologic and oncologic patient cohort. This procedure can be routinely offered to address the increasing rate of acute appendicitis, occult malignancy, contribute to cancer debulking, and diagnose etiology of chronic pelvic pain in women concordant with their gynecologic surgery.

Key Words: Appendectomy; Incidental; Gynecology; Cancer; Feasible; Safe.

Introduction

Appendicitis is one of the most frequent indications for emergency abdominal surgery worldwide [1]. The rate has increased among adults over the past 20 years by 10-15%, now occurring in 94/100,000 Americans annually [1]. Pelvic pain in female patients is often attributed to a gynecologic etiology to include ovarian cysts, torsion, fibroids, or endometriosis. Misdiagnosis of acute or chronic appendicitis, inflammation from endometriosis, or occult gastrointestinal tumor may occur.

Obstetricians and gynecologists perform nearly five million pelvic surgeries yearly [2], and have the opportunity to stem the increasing rate of acute appendicitis by performing incidental appendectomy. The present authors undertook this review to assess the safety and feasibility of appendectomy performed by gynecologic oncologists at the time of gynecologic surgery in a combined high-risk gynecologic and oncology practice.

Materials and Methods

Two single practice gynecologic oncology providers with concordant practice patterns merged their data after independent local Investigational Review Board approval. The data was abstracted from medical records at each site. Data captured included patient age, BMI, preoperative diagnosis, route of surgery, surgical procedures performed, length of stay, and final pathologic diagnosis. Appendectomy was offered to patients at the time of informed consent for the indicated gynecologic procedure. All surgeries were performed by the two authors (KAO'H, and MFB) from September 5, 1996 to November 30, 2016.

The technique for appendectomy was performed by either 1) laparoscopically incising the mesoappendix with a bipolar sealing device or monopolar electrosurgical device to the base of the appendix at the cecum, then ligating the base of the appendix with one to two 0-Vicryl pre-tied loop sutures on a plastic knot pusher. The appendix was then transected at the base with scissors, or a vessel sealing device. The appendix was removed either in an endocatch bag or via ring forceps through the vagina; 2) at laparotomy where the mesoappendix was clamped with a hemostat, transected, and secured with 0-Vicryl suture. The base of the appendix was crushed three times with a hemostat, two 0-vicryl ties were placed in the crush site, and the appendix was severed using

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Table 1. — *Surgico-pathologic findings and incidence.*

Surgico-pathologic findings	Incidence (%)
Appendiceal cancer/precancer	32 (2.7%)
Mucinous cystadenoma	8 (0.4%)
Schwannoma	1 (0.01%)
Polyp	12 (0.6%)
Gynecologic cancer metastasis	71 (3.8%)
Metastatic other cancer	12 (0.6%)
Endometriosis	40 (2.1%)
Appendicitis	25 (1.3%)
Endosalpingosis	7 (0.3%)
Melanosis	1 (0.05%)
Appendiceal diverticulum	2 (0.1%)
Nematode	1 (0.05%)

the scalpel. No appendiceal stumps were imbricated. The average time for appendectomy was evaluated and ranged between two to four minutes for each provider, for both surgical approaches.

The abstracted data was uploaded to Excel and analyzed using GraphPad and SPSS 22.0 programs. Mann Whitney-U tests were used for the nonparametric quantitative comparisons. *T*-test was used to compare continuous variables. All tests were considered significant at a $p < 0.05$.

Results

In this study, 3,210 women underwent gynecologic surgery and 77 procedures were excluded as they were lower genital tract or palliative; 2,632 (81.99%) patients underwent laparoscopic approach and 516 (16.07%) had a laparotomy. There was no difference between the ability to perform appendectomy based on surgical route, either laparoscopic or laparotomy (t -test $p = 0.9256$) The number of appendectomies performed totalled 1,876. Eighteen percent of patients reviewed had a prior appendectomy.

Significant appendiceal final pathology occurred in 221 (11.8%) specimens. There were 32 (1.7%) primary appendiceal cancers/precancers identified: of these: 16 (0.85%) were invasive carcinoid tumor, eight (0.4%) invasive mucinous adenocarcinoma, and there were eight (0.4%) with precancerous hyperplasia. There were eight (0.4%) mucinous cystadenomas, one (0.01%) schwannoma, and 12 (0.6%) polyps. Gynecologic cancer metastasis was identified in 71 (3.8%) patients, in which appendectomy contributed to accurate staging and optimal debulking in all. In 12 (0.6%) patients, metastatic other cancer (breast, colon, pancreas, neuroendocrine, cholangiocarcinoma, lymphoma) to the appendix was identified. Forty (2.1%) patients had appendiceal endometriosis, 25 (1.3%) patients had appendicitis, seven (0.3%) patients had endosalpingosis identified, one (0.05%) patient had melanosis identified, two (0.1%) patients had an appendiceal diverticulum, and one (0.05%) patient had a nematode. Data is listed in Table 1.

The average age of those with appendiceal cancer was

56.22 years, ranging between 25-72 years. The average age of those with appendicitis was 45.06 years, ranging from 16-86 years.

Indication for surgery was: pelvic mass in 994 (30.96%) patients, uterine cancer or endometrial intraepithelial neoplasia (EIN) in 920 (28.66%) patients, fibroid uterus in 582 (18.13%) patients, cervical cancer or carcinoma in situ (CIS) in 139 (4.33%) patients, high risk breast ovarian cancer (HRBOC) in 132 (4.11%) patients, pelvic pain in 154 (4.79%) patients, prolapse in 92 (2.87%) patients, and female to male (FTM) in 97 (3.02%) patients. Postoperative diagnosis correlated well with preoperative diagnosis, with 900 (28%) having residual uterine cancer/EIN (t -test, $p = 0.9879$), 334 (20.4%) having ovarian cancer (t -test, $p = 0.9161$), 135 (4.2%) having cervical cancer/CIS residual (t -test, $p = 0.9801$), 892 (27.78%) having fibroids or adenomyosis (t -test, $p = 0.7942$), 172 (5.35%) with endometriosis/pain (t -test, $p = 0.9801$), 96 FTM (3.02) (t -test, $p = 0.9967$), and 659 (20.53%) having benign final pathology from ovarian cysts, prolapse, or HRBOC (t -test, $p = 0.9348$).

No complications were attributed to the appendectomy procedure itself. The number of urologic complications to include ureteral transection, kink, or cystostomy was 39 (1.21%); 38.78% of all patients had a cystoscopy at the time of laparoscopic procedure. No urologic complication was related to appendectomy. There was one vaginal cuff dehiscence unrelated to appendectomy (early coitus). There were 38 (1.1%) total postoperative infectious complications to include: cuff abscess, pneumonia, urinary tract infection, pelvic abscess from diverticulitis rupture, and anastomotic breakdown of bowel resection. Of these 38 patients, 16 (0.8%) had a concordant appendectomy, and all infections were unrelated to appendectomy itself.

BMI was not related to the ability to perform appendectomy. Fifty-six percent of patients with a BMI underweight to ideal had an appendectomy. Sixty percent of those with a BMI overweight to Class 3 had an appendectomy. The authors compared appendectomy procedures completed in those with a BMI of underweight and ideal to those with a BMI of overweight to Class 3, and no difference was identified (t -test $p = 0.9660$).

Length of stay, when a laparoscopic cohort subset was reviewed independently, revealed that the cohort who had appendectomy had a shorter duration of admission of 1.1 vs. 1.3 days (Mann Whitney U, $p < 0.001$).

Discussion

Review of the present outcomes for incidental appendectomy has documented that this procedure is safe and feasible. A high rate of significant pathology was identified to include appendicitis and cancer, both primary and metastatic to the appendix. The rates for appendicitis and gastrointestinal appendiceal primary cancer have been

noted to be on the rise in recent years. The rate of primary appendiceal cancer was shown to be 0.5% in one study of all appendectomy specimens performed for the initial diagnosis of acute appendicitis in 2009 [3]. A recent study of incidental appendectomy found a 58% rate pathologic changes [4]. In 1990, the estimated lifetime risk of developing acute appendicitis was 6.7% for females [5]. In 2008, the rate of acute appendicitis was shown to have increased across all age groups; with a 6% increment in adults age 30–69 years, from 7.6 to 9.4/10,000 persons/year [1]. Among females of all ages combined, the rate of appendicitis has increased from 6.1 to 7.9/10,000 women, yielding a 9% lifetime risk [1]. While the incidence of appendicitis drops by half from age 50 to age 80 (from 7.4 to 4/10,000), the 22% rate of perforation in that occurs in younger female rises to 50% by the age of 60, and 75% by the age of 80 [1, 6–11]. In senior women, surgical delay in diagnosis results in more wound infections, more multi-system complications, and a longer hospital stay [12]. The diagnosis of acute appendicitis can be confounded in women due to various adnexal pathologies, such as torsion, endometriosis, tumor, and infection; thus incidental appendectomy may mitigate delayed and missed diagnosis.

Prophylactic incidental appendectomy during open abdominal hysterectomy was recommended 50 years ago by Loeffler *et al.* [13]. Kovac and Cruikshank recommended appendectomy incidental to vaginal hysterectomy [14]. Pearce *et al.* recommended elective appendectomy incidental to cesarean delivery [15]. These authors all reported that the appendectomy took 9–12 minutes, and did not increase complications. Song *et al.* reported a series of 772 incidental appendectomies, performed laparoscopically, taking 12 minutes on average [16]. The present authors documented that the procedure took two to four minutes to perform via both laparoscopic and laparotomy approaches, and have likewise shown no increase in complications.

Gynecological indication for performing appendectomy can include management of chronic pelvic pain syndromes [17]. In one study of 190 women undergoing laparoscopic surgery for pelvic pain with concordant appendectomy, 154 (81%) appendices were diagnosed as having one or more abnormal findings, such as endometriosis, carcinoid, chronic appendicitis, periappendicitis, fibrous obliteration, and lymphoid hyperplasia [18]. Among endometriosis patients having appendectomy, appendiceal endometriosis was observed in 31% [19, 20]. This is consistent with the present data in that 63% of the patients with pelvic pain/preoperative endometriosis were diagnosed with appendiceal endometriosis, establishing cause for their pelvic pain. The present data then also confirms that appendectomy is indicated in surgeries for chronic pelvic pain [21, 22].

In 2014, the American College of Obstetricians and Gynecologists (ACOG) Committee on Gynecologic Practice

affirmed that “women 35 years of age and younger would benefit the most from elective coincidental appendectomy,” but ACOG remained uncertain whether the benefits of routine elective coincidental appendectomy outweigh the cost and risk of morbidity associated with this prophylactic procedure [23].

This review is the largest series of incidental appendectomy reported to date. The authors have shown that there is no increased risk with performing appendectomy at the time of other pelvic surgery, despite being performed in a very high risk population. This series of incidental appendectomy has improved the rate of cancer debulking, identified cause for pelvic pain (appendicitis, endometriosis), risk reduced for future appendicitis, and assisted with lower stage migration for gastrointestinal cancer. The present findings also agree with the substantial general surgical evidence confirming no increase in postoperative complications or infections with incidental appendectomy [24]. The present authors also support and provide evidence for further promotion of ACOG’s Practice Statement of appendectomy at the time of pelvic surgery, but in women of all ages. If appendectomy were performed incident to all five million gynecologic surgeries performed yearly, the morbidity and mortality rates due to appendicitis in women would predictably decrease [25].

Conclusion

This report of 1,876 incidental appendectomies is the largest series of incidental appendectomy to date and confirms that complication and infection rates where appendectomy was performed are not increased. The authors highlight the safety and feasibility for performing incidental appendectomy in gynecologic surgery.

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