



Laparoscopic versus open resection for appendix carcinoid

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Abstract

Background: Since an increasing number of appendectomies are performed via laparoscopy, it is crucial to determine the impact of this approach on appendix carcinoid (AC) outcome. The goal of this study was to compare results of laparoscopic (LAP) versus open (OP) appendectomy for AC according to intend to treat approach.

Methods: A retrospective review (1991–2003) identified 39 patients (median age, 36 years; range, 12–83) treated by laparoscopy (LAP) or laparotomy (OP) for AC in a single institution. Follow-up was complete for all patients (median, 67 months; range, 4–132).

Results: Most cases had associated acute appendicitis (64%). Median carcinoid size was 1.1 cm (range, 0.3–5) and 0.4 cm (range, 0.2–3) in the LAP and OP groups, respectively. LAP and OP were performed in 21 (54%) and 18 (46%) patients, respectively. Surgical margins were positive in two patients in the LAP group and one patient in the OP group ($p = 0.6$). Right colectomies were performed for AC >2 cm in five patients after LAP and in four patients after OP ($p = 0.9$). Actuarial 5-year survival rates were 100 and 94% in the LAP and OP groups, respectively ($p = 0.2$). Two patients died in the OP group, one due to metastatic carcinoid and the other due to metachronous colorectal cancer. Synchronous or metachronous colorectal carcinomas developed in six patients (15%).

Conclusion: Laparoscopic appendectomy is a safe procedure for AC, with carcinologic and long-term results similar to those of conventional appendectomy. Thus, pre- or per-operative suspicion of AC is not a contraindication to LAP. Prognosis of AC appears more dependent on carcinoid malignant potential or associated tumors. Risk for developing colorectal adenocarcinoma is high in AC patients and warrants follow-up of all patients with colonoscopic screening.

Key words: Carcinoid — Appendix tumor — Appendicitis — Appendectomy — Laparoscopy — Port site metastasis — Right colectomy — Colorectal tumor — Associated tumor — Screening colorectal cancer

Appendectomy is one of the most common abdominal operations [7], accounting for approximately 50% of emergency operations. This procedure is most often performed for the sudden onset of clinical acute appendicitis by nonspecialized or in-training surgeons. While evidence of the benefits associated with laparoscopic appendectomy continues to accumulate, an increasing number of appendix resections are being performed via laparoscopy instead of the classical McBurney approach [6, 14, 19].

Appendix tumors are encountered in approximately 1% of all appendectomies [3, 5]. Carcinoid tumors are the most frequent appendix neoplasm [3, 13] and are often discovered incidentally at the time of operation, frequently in association with acute appendicitis [5, 13].

Although laparoscopic appendectomy has become widespread, there is a paucity of data regarding the feasibility and safety of this approach in the management of appendix carcinoid. This study was therefore undertaken to compare laparoscopic versus open appendectomy for appendix carcinoid with respect to quality of carcinologic resection and long-term survival.

Materials and methods

A retrospective review identified 39 patients treated by laparoscopy or laparotomy for appendix carcinoid in a single institution between January 1991 and December 2003. Some of these patients have been previously reported in a paper relating to appendix tumors [2]. Laparoscopic (three-trocar technique) and open appendectomies were performed according to standard hospital techniques. During laparoscopic appendectomies, no specific measures, such as laparoscopic port suture to prevent gas leak, were used. Appendix section was performed using laparoscopic scissors after closure of the appendix basis at its origin with Endoloops (Ethicon, Spreitenbach, Switzerland). A bag system (Endocatch, Tyco Healthcare, Wollerau,

Table 1. Clinical data of patients treated by first intention laparoscopy or laparotomy for appendix carcinoid

	Laparoscopy (n = 21)	Laparotomy (n = 18)	p value
Median age, yr (range)	34 (12–67)	42 (16–83)	0.007
Male:female ratio	1:1	1:1	1.000
Median carcinoid size, cm (range)	1.1 (0.3–5)	0.4 (0.2–3)	0.069
> 2 cm carcinoid	5 (24%)	2 (11%)	0.548
Lymph node invasion	1	1	0.911
Surgical margin of appendectomy invaded ^a	2 (11%)	1 (5%)	0.643
Conversion to open surgery	2	0	
Appendectomy alone	16	14	0.907
Right colectomy	5	4	

^a All patients with surgical margin invasion had tumors >2 cm

Switzerland) was used for all specimen retrieval. Pneumoperitoneum disinflation was performed through trocars before their removal. Clinical data were retrieved from patients' hospital and pathology charts. Postoperative data were collected by review of patients' in-hospital charts. Long-term follow-up information was collected through direct interview and physical examination of patients as well as questionnaires sent to their primary care physicians. Follow-up was complete for all patients, with a median duration of 67 months (range, 4–132). For disease-free survival and survival analysis, intervals were calculated from the date of first intention surgical treatment according to intend to treat approach to the last month of follow-up, tumor recurrence, or death, when appropriate.

Statistical analysis was performed on a personal computer using Statistica (Statsoft, Tulsa, OK, USA) and GraphPad InStat (GraphPad Software, San Diego, CA, USA). Survival curves were calculated by the Kaplan–Meier method and analyzed with Cox–Mantel tests. Variables were analyzed through two-sided Fischer's exact or two-sided Student *t*-tests, as appropriate. A value of *p* < 0.05 was considered statistically significant.

Results

Study population and pathological diagnosis

Appendix carcinoids were diagnosed in 39 patients among approximately 3,400 appendectomies performed for appendiceal pathology (1.2%). Patient clinical data are summarized in Table 1. Most patients presented with clinical symptoms of acute appendicitis. Tumors were not suspected in any of them preoperatively. None of the patients had carcinoid syndrome. Associated acute appendicitis was confirmed by pathological examination in 64% of the resected specimens: 81% with laparoscopy compared to 44% with open appendectomy. Appendix perforation was detected in eight patients (21%) with a combination of carcinoid and acute appendicitis (six in the laparoscopy group).

Carcinoid localization along the appendix was the apex (23 patients), middle third (15 patients), and proximal third (one patient), whereas repartitions among laparoscopy and open appendectomy were similar. Median tumor size was 0.7 cm (range, 0.3–5). Pathological data are shown in Table 1.

Surgical treatment

Surgical treatment was undertaken in all patients as an emergency procedure based on the clinical diagnosis of

acute appendicitis. Appendectomy was conducted via laparoscopy in 21 patients (54%) and the open technique (McBurney or midline incision) in 18 patients (46%) according to surgeon choice. Among the 21 patients in the laparoscopic appendectomy group, two patients were converted to laparotomy after explorative laparoscopy because of severe peritoneal adhesions. In the open appendectomy group, first intention surgery consisted of right colectomy in two patients because of the intraoperative discovery of synchronous right colon carcinoma associated with acute appendicitis and appendix carcinoid.

Invasion of the surgical margins was detected in two patients in the laparoscopy group (9.5%) and in one patient in the open appendectomy group (5.5%) (*p* = 0.643). Subsequent right colectomies were performed in seven patients, five after laparoscopic resection and two after the open approach. The indication for right colectomy was carcinoid size (lesions > 2 cm) in seven cases, which was associated with invasion of surgical margins in three cases. Lymph node invasion was found after colectomy in two patients with carcinoid > 2 cm in diameter and free appendectomy surgical margins.

Long-term follow-up

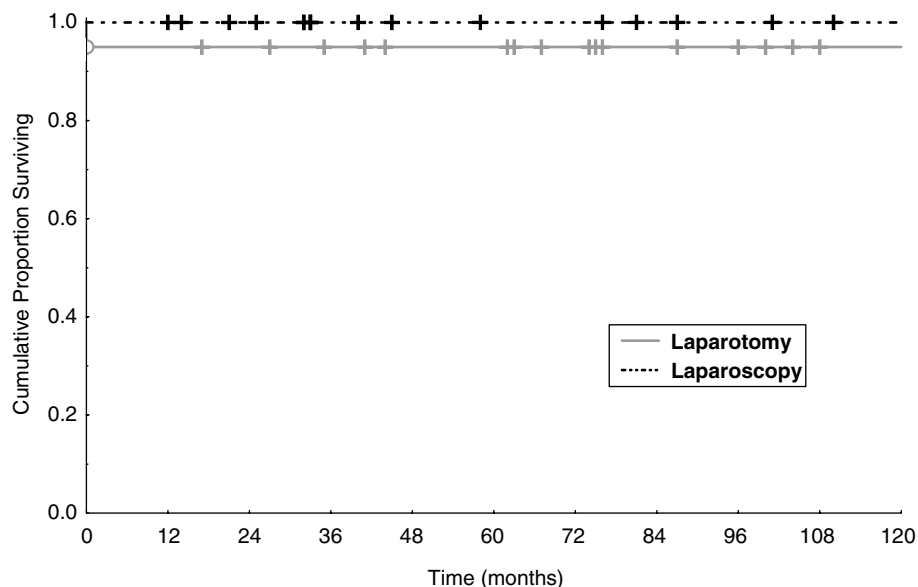
Overall median follow-up was 67 months (range, 4–132). The overall 5-year actuarial survival rate was 97%. Actuarial 5-year survival rates were 100 and 94% after laparoscopic and open appendectomy, respectively (*p* = 0.208) (Table 2). Actuarial 5-year disease-free survival rates were also 100 and 94% in the laparoscopic and open appendectomy groups, respectively (*p* = 0.203) (Fig. 1). No port site metastases were encountered in this series. One patient in the open appendectomy group died of metastatic carcinoid disease after 4 months of follow-up.

Associated neoplasms

Seven of 39 patients with appendix carcinoid (18%) developed an associated synchronous or metachronous cancer; among these, six were colorectal adenocarcinomas (15%). Their median age was 68 years (range, 40–

Table 2. Follow-up of patients treated by first intention laparoscopy or laparotomy for appendix carcinoid

	Laparoscopy (<i>n</i> = 21)	Laparotomy (<i>n</i> = 18)	<i>p</i> value
Median follow-up, mo (range)	45 (12–132)	72 (4–132)	0.157
Actuarial 5-year survival (%)	100	94	0.208
Actuarial 5-year disease-free survival (%)	100	94	0.203
Actuarial 10-year survival (%)	100	87	0.207
Died of disease	0	1	0.938
Died free of disease	0	1	0.938

**Fig. 1.** Disease-free survival after appendix carcinoid resection by laparoscopy or laparotomy.

83). Synchronous colon cancer was demonstrated in three patients, and metachronous colon carcinomas eventually developed in three patients (8%). One of these patients died from metachronous colorectal malignancy. One 40-year-old patient had a synchronous papillary carcinoma of the right ovary.

Discussion

In this study, we analyzed long-term results of surgical treatment for appendix carcinoid. The data indicate that laparoscopy is a safe alternative to open appendectomy for appendix carcinoid because the minimally invasive approach seems to have similar carcinologic and long-term results as laparotomy. This series also confirms that appendix carcinoid patients have a high risk for synchronous and metachronous colorectal adenocarcinoma.

Appendix carcinoids are relatively rare entities, reported in < 1% of appendectomies [6, 8]; our rate was slightly higher (1.2%). Appendectomy is one of the most common abdominal operations [7, 9]. Appendix carcinoids are relatively indolent neoplasms, rarely associated with carcinoid syndrome [16, 20], that are usually discovered in association with acute appendicitis [3, 8], as was the case in 64% of our patients. Diagnosis is usually done either during operation or mainly during pathological examination of the resected appendix [2, 8], which is corroborated by our results.

As evidence of the benefits associated with laparoscopic appendectomy has accumulated, this approach has become widespread [19]. Recent data indicate that laparoscopy cancer resection does not increase the risk of local recurrence or wound metastasis compared to that associated with open surgery [4, 11, 17]. However, Paolucci et al. [18] observed high rates of abdominal wall metastases (port site metastases) after the laparoscopic resection of occult gallbladder carcinoma. These data on occult cancer are of particular relevance to the role of laparoscopic surgery for appendix neoplasms, which are nearly always resected as occult tumors.

There are few, if any, data regarding the role of laparoscopy in the management of appendix carcinoid. Although a literature search found a few cases of appendix carcinoid resection via laparoscopy [1, 2, 12], it has never been compared to open appendectomy [7]. Heller et al. [12] reported a small series of such resections during laparoscopy for gynecologic indications and concluded that this technique could be suitable for incidentally discovered appendix carcinoid. The results of our series of 39 patients who underwent laparoscopic appendectomy for appendicitis with incidental finding of carcinoid are therefore of interest. Our data clearly indicate that laparoscopy is a safe alternative to a McBurney incision, with similar and good long-term results for appendix carcinoid resection. Although no specific carcinologic measures were undertaken for appendectomy in the laparoscopy group, no port site or

peritoneal recurrence was encountered. However, the median follow-up is slightly shorter (not significantly) in the laparoscopy group in relation to the development of laparoscopic appendectomy during the study period and may represent a bias. Two cases of surgical margin invasion were encountered after laparoscopic resection, whereas there was only one such adverse event after open resection, all in patients with carcinoid >2 cm. Finally, the need for subsequent right colectomy, in accordance with international guideline [8, 10, 13], was indicated with similar frequencies after both laparoscopic and open appendectomy.

Although our data suggest that the prognosis of patients treated for appendix carcinoid is similar after laparoscopic and open appendectomy, diagnostic confirmation is seldom available before pathological examination of the specimen. It must be acknowledged that experience with the laparoscopic resection of appendix cancer is mostly anecdotic [2], and the risk of type II error, in relation to the rarity of this pathology as well as the small incidence of tumor recurrence or progression after surgery, could not be neglected. Therefore, we continue to recommend open appendectomy in the case of preoperative suspicion of appendix cancer.

Patients treated for appendix carcinoid have an increased risk of second cancer [2, 8, 15, 20, 21], which was the case in 18% of our patients. The increased risk of second cancer in patients with carcinoid may be related to a genetic predisposition to certain cancer, including neuroendocrine and nonneuroendocrine tumors [21]. In our series, six of 38 patients (15%) developed colorectal adenocarcinoma. Thus, colonoscopic examination plays an important role in patients with incidentally discovered appendix carcinoid; this diagnostic modality seems to be particularly indicated in patients in their fifth through eighth decades. Moreover, all patients treated for appendix carcinoid require follow-up, which should include an endoscopic surveillance program.

In conclusion, our results suggest that laparoscopic appendectomy has similar carcinologic results as open appendectomy for appendix carcinoid. The prognosis of patients with appendix carcinoid does not seem to be related to the appendectomy approach but mainly depends on carcinoid malignant potential and an increased risk of associated tumors. Due to a high risk of synchronous and metachronous colorectal adenocarcinoma in patients with appendix carcinoid, we recommend follow-up for all patients, even those with a small tumor, and postoperative screening with colonoscopy.

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