



Radical appendectomy as an alternative to right colon resection in patients with epithelial appendiceal neoplasms



Santiago González-Moreno ^a, Paul H. Sugarbaker ^{b, *}

^a *Surgical Oncology, MD Anderson Cancer Center, Madrid, Spain*

^b *Program in Peritoneal Surface Oncology, Center for Gastrointestinal Malignancy, MedStar Washington Hospital Center, Washington, DC, USA*

ARTICLE INFO

Article history:

Received 15 September 2016
Received in revised form
18 January 2017
Accepted 31 January 2017

Keywords:

Mucinous appendiceal neoplasms (MAN)
Low-grade mucinous appendiceal neoplasms (LAMN)
Mucinous adenocarcinoma of the appendix (MACA)
Disseminated peritoneal adenomucinosis (DPAM)
Peritoneal mucinous carcinoma (PMCA)
Cytoreductive surgery
Hyperthermic intraperitoneal chemotherapy (HIPEC)
Early postoperative intraperitoneal chemotherapy (EPIC)
Sentinel lymph node

ABSTRACT

Objective: Appendectomy is an extremely common surgical procedure usually performed for an inflammatory process within this organ. Upon occasion, the pathology within the appendix is a neoplastic process which requires definitive oncologic management.

Methods: The optimal management strategies for appendiceal neoplasms were reviewed and pertinent literature critically evaluated. The technology for appendectomy for an inflammatory process and an appendectomy for a neoplastic process were compared and contrasted.

Results: A new surgical procedure called “radical appendectomy” was described and its merits for optimizing the management of an appendiceal neoplasm enumerated. The technology of radical appendectomy was described. The possible shortcomings that may be encountered in performing a new surgical methodology for appendectomy was presented and the results of a technically perfect radical appendectomy enumerated. The integration of a radical appendectomy with perioperative hyperthermic chemotherapy was described.

Conclusions: When a malignancy exists as the cause of appendiceal pathology, the radical appendectomy will provide the maximal amount of information required for optimal decisions regarding patient management.

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1. Introduction

Appendiceal epithelial neoplasms are rare and often show low-grade histologic features. Symptoms and signs related to peritoneal metastases most commonly results in a diagnosis. Historically, epithelial appendiceal neoplasms have routinely been treated by a right colectomy. However, in 2004, Gonzalez-Moreno and Sugarbaker reported that in mucinous appendiceal neoplasms (MAN) with peritoneal spread, right colon resection with ileocolic lymph node dissection did not confer a survival advantage over appendectomy alone [1]. Other groups have made a similar observation [2,3]. These reports have modified the surgical management of mucinous appendiceal neoplasms (MAN). These revised recommendations apply not only to patients with peritoneal metastases

from MAN but to MAN in the absence of peritoneal metastases. In order to assist in a knowledgeable decision to perform a right colon resection versus an appendectomy or caecectomy, the “radical appendectomy” procedure should be considered. This manuscript provides the rationale for radical appendectomy, provides a rationale for limiting the number of right colon resections, describes the radical appendectomy procedure, and summarizes the clinical utility of this approach to the management of MAN.

2. Rationale for radical appendectomy

The radical appendectomy procedure for mucinous appendiceal tumor is indicated for several reasons. First, the histologic diagnosis of the neoplastic process is almost never known at the time of appendectomy. In order to avoid spillage of cancer cells, an appendiceal tumor must not be disrupted by the appendectomy procedure. In order to meet this requirement, a laparoscopic approach may require conversion to a generous open procedure.

* Corresponding author. MedStar Washington Hospital Center, 106 Irving St., NW, Suite 3900, Washington, DC 20010, USA.

E-mail address: Paul.Sugarbaker@medstar.net (P.H. Sugarbaker).

Resection of the appendix through tissue planes away from the wall of the appendix will facilitate complete clearance and complete containment of the neoplasm and prevent iatrogenic dissemination of mucinous tumor cells.

Second, resection of the soft tissues and lymph nodes adjacent to the appendix will provide valuable information about the appendiceal tumor crucial for pathologic staging at a later time. This more extensive specimen will facilitate the accurate histopathologic assessment of invasion of tumor into or through the wall of the appendix (T stage). Also, resection of adjacent lymph nodes in the mesoappendix will help determine the extent, if any, of lymph node involvement (N stage) [4].

3. Rationale for using radical appendectomy as an alternative to right colon resections

Ronnett and colleagues in 1995 examined the histopathologic specimens from 109 patients with multifocal peritoneal mucinous appendiceal tumors [5]. They were able to separate patients into 2 categories – disseminated peritoneal adenomucinosis (DPAM) and peritoneal mucinous carcinomatosis (PMCA). This report documented that there is a lower incidence of lymph node metastases with DPAM as compared to PMCA. In the report by Ronnett, 2 of 65 cases of DPAM had lymph node involvement (3%). In contrast, 15 of 30 with PMCA had lymph node metastases (50%). In the cases with discordant features, 3 of 14 (21.4%) had lymph node metastases.

Gonzalez-Moreno and colleagues in 2004 evaluated the clinical information on 501 patients with an epithelial malignancy of the appendix. For the group as a whole, the rate of regional lymph node positivity was 5%. The incidence was highly dependent upon the histological type with 4.2% positive in DPAM and 66.7% positive with PMCA [1]. Carr and colleagues reported that 11 of 49 patients with mucinous epithelial neoplasms had lymph node metastases [6]. Three of these were from low-grade and 8 from high-grade lesions with a statistically significant increased positivity rate in the PMCA group ($p = 0.037$). In summary, the likelihood that lymph nodes will be involved with appendiceal mucinous neoplasms is directly related to the histologic type of the appendiceal malignancy.

Yan and colleagues further defined the PMCA type of MAN. Well differentiated mucinous adenocarcinoma was composed predominantly of single tubular glands. Atypia was present and an invasive component could be identified. Moderately differentiated mucinous adenocarcinoma showed characteristics between well differentiated and poorly differentiated adenocarcinoma. There were solid sheets of malignant cells admixed with glandular formations. The poorly differentiated adenocarcinoma was composed of highly irregular glandular structures and the polarity of the cancer cells had disappeared completely. In some cases, signet ring cells were seen [7].

Within these categories of PMCA, Sugarbaker recently determined the incidence of lymph node positivity (Table 1). In the total group of PMCA with complete cytoreduction, there were 299 patients; 52 of these patients had positive lymph nodes (17%). In those patients with well differentiated mucinous adenocarcinoma, there

were 3 of 44 patients (6.8%) with positive lymph nodes. With the moderately differentiated PMCA, there were 6 of 107 patients (5.6%) with positive lymph nodes. In patients with poorly differentiated PMCA, 43 of 148 patients (29%) had positive lymph nodes. The PMCA category included patients with signet ring cells. From these data the degree of differentiation of PMCA is important in predicting the likelihood of lymph node involvement from a MAN [8].

It is clear from this data that mucinous appendiceal neoplasms, even if low-grade, can sometimes involve the appendiceal lymph nodes. Also, Ronnett et al. and Carr et al. emphasize that the lesions based in the lymph node sinus can be without obvious lymphadenopathy [5,6]. Also, the disease is mucinous and would be expected to produce a soft infiltration of the lymph node rather than a hard infiltrate as expected in a solid tumor. This is important because the firmness of the lymph node is crucial to the surgeon using palpation to assess appendiceal lymph nodes. The further characterization of PMCA as well, moderately or poorly differentiated has further refined the ability to predict the incidence of lymph node involvement (Fig. 1).

4. Technique of the radical appendectomy procedure

The radical appendectomy can be performed by laparoscopic or open surgery. Midline ports are recommended so that the port sites can be excised if further surgery is required. The surgical approach will be determined by the condition of the appendix and the extent of the tumor. The surgeon should start with a general inspection of the superior and inferior ileocaecal recess and the right paracolic gutter. Care should be taken to localize the ileocaecal fold and the anterior caecal artery which defines the upper aspect of the superior ileocaecal recess. The retrocaecal recess should be probed or digitally explored to help define the inferior aspect of the dissection. The surgeon must remember that the appendix may turn back on itself into the retrocaecal recess as a retrocaecal appendix. Variable degrees of retrocaecal position of the appendix are present in 65% of patients [9].

A crucial technical requirement of an adequate radical appendectomy for an appendiceal tumor is a survey and documentation of the surrounding peritoneal surfaces. A search for cancer implants and/or mucus deposits is necessary. This visual survey should include the right paracolic sulcus, the hepatorenal space and undersurface of the right hemidiaphragm, undersurface of left hemidiaphragm, the mesentery and visceral surfaces of the ascending colon and terminal ileum, and pelvic peritoneum. Especially relevant is the cul-de-sac and ovarian surfaces in the female and rectovesical space in the male. A final structure to visualize is the anterior aspect of the greater and lesser omentum.

After exploration of the right lower quadrant the resection begins. It does not begin with the appendix itself but with the furthest extent of the soft tissue resection and appendiceal lymph node resection. This surgical approach is to construct an intact specimen of the appendix and surrounding tissues. It is often referred to as “Centripetal Surgery”. This surgical strategy proceeds by starting at the furthest extent of the required tissue resection and dissection moves in a circular manner to remove neoplastic process intact [10]. The initial lines of dissection would be through the peritoneum of the right paracolic sulcus near the appendix, division of peritoneum beneath the appendix on the mesentery of the small bowel mesentery and resection of the ligament of Treves on the antimesenteric border of the small bowel. After this centripetal division of peritoneum, localization of the origin at the appendiceal artery posterior to the ileocaecal valve occurs and this vessel is ligated in continuity and then divided. The mesoappendix containing 3 to 5 lymph nodes is resected using the transected

Table 1

Lymph node involvement with appendix mucinous neoplasms. Poorly differentiated includes signet ring cell tumors. (Modified from reference 8 with permission).

Total number of PMCA with complete cytoreduction	299
Number with positive lymph nodes	52 (17%)
Well differentiated PMCA with positive lymph nodes	3/44 (6.8%)
Moderately differentiated PMCA with positive lymph nodes	6/107 (5.6%)
Poorly differentiated PMCA with positive lymph nodes	43/148 (29%)

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