

Primary Carcinoma of the Appendix

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Primary adenocarcinoma of the appendix is rare and less than 200 cases are on record. The present material consisted of 20 cases collected from different hospitals. The cases are described in respect of sex and age-distribution, symptoms, treatment and prognosis. Of 7 patients with malignant mucocele, 6 subjected to appendectomy only, were still alive 5 years after the operation. Of 12 patients with colonic type of adenocarcinoma, 3 had been treated with appendectomy only. Of these, 2 were still alive 5 years after the operation. The remaining 9 patients had undergone right hemicolectomy. Only one of them was alive 5 years after the operation. A compilation of a further 39 cases garnered from the literature, however, showed that 60% had survived at least 5 years after right hemicolectomy, compared with 46% after appendectomy alone. Appendectomy alone is probably a sufficiently radical operation for malignant mucocele provided the tumor has not grown through the submucosa and that it is confined to the tip of the appendix. Right hemicolectomy is indicated for the colonic type of adenocarcinoma.

PRIMARY CARCINOMA of the appendix is rare. It was first described in 1882. The total number of cases since recorded is below 200.^{8,14,16,20} Primary tumors of the appendix have long been classified as carcinoid, malignant mucocele and adenocarcinoma of the colonic type.

Collins (1955)⁷ found adenocarcinoma in 41 of 50,000 appendices examined histopathologically. In 1970 41 cases of malignant tumor of the appendix were reported to the Swedish Cancer Registry. Of these tumors, 31 were carcinoids, 9 were adenocarcinomas and 1 was a malignant mucocele.¹

The series of malignant tumors of the appendix on record consist mostly of only a few cases. This paper concerns an investigation of 20 cases of carcinoma of the appendix, the difficulties encountered in making a firm diagnosis and an endeavor to find the most suitable method of surgical treatment.

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Material

Between January 1959 and May 1970 a total of 20 patients had been treated at various hospitals in the district of Umeå, Sweden because of primary carcinoma of the appendix, exclusive of carcinoids. All of the cases had been confirmed histopathologically. The histological sections, which were still available for every patient were re-examined.

Seven (5 men and 2 women) patients had a malignant mucocele and 13 (9 men and 4 women) a colonic type of adenocarcinoma. The mean age of the patients with malignant mucocele at the time of the diagnosis was 46 years (range 35–57 years) and that of the remaining 13 patients 69 years (range 54–87 years). The age-distribution of the 13 patients with adenocarcinoma, including 165 garnered from the literature, is given in Fig. 1.

In one of our 20 cases the diagnosis had not been made before autopsy, while the other 19 patients were operated upon (Table 1). The preoperative diagnosis was acute appendicitis in 12, tumor of the right lower quadrant of the abdomen in 4, and ileus in the remaining 3 (Table 2). In none of the cases had the preoperative diagnosis been correct. In one patient (No. 5) with a colonic type of adenocarcinoma, the tumor had encroached upon the sigmoid and mesosigmoid. In another patient (No. 2) with the same type of carcinoma the tumor had extended over the anterior abdominal wall. One patient with malignant mucocele (No. 19) had pseudomyxoma peritonei.

In 4 of 7 patients the malignant mucocele was confined to the distal third of the appendix, compared with only 2 of 13 with adenocarcinoma of the colonic type.

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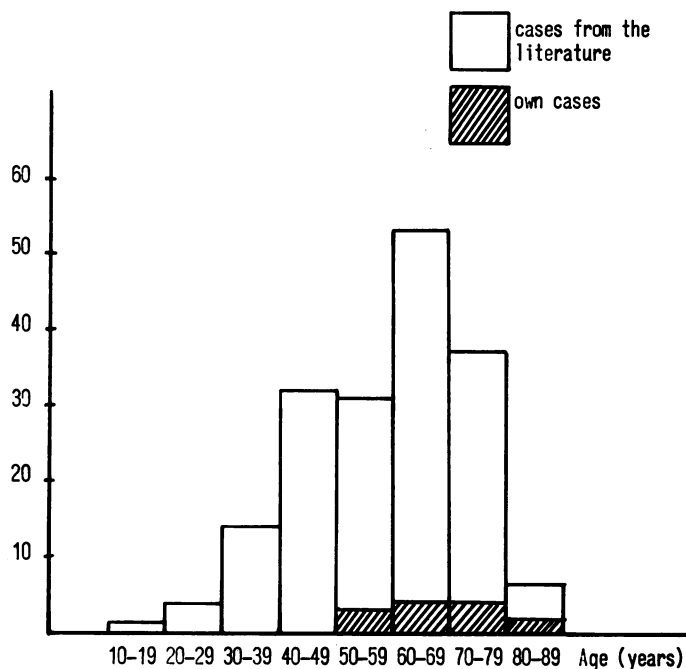


FIG. 1. Age distribution of 178 patients with adenocarcinoma of the colonic type of the appendix.

All the patients were followed until death or for at least 5 years.

Of 7 patients with malignant mucocele, 6 were treated with appendectomy only. All were still alive 5 years after the operation. One (No. 19) of these patients with rupture of the mucocele at the time of operation, however, died from a recurrence of carcinoma some 8 years after the operation (Table 3). The remaining patient with malignant mucocele was treated with right hemicolectomy, but died postoperatively from cardiac failure (Tables 1 and 3).

Twelve of the 13 patients with the colonic type of adenocarcinoma were operated upon. In 9 of these 12 cases the operation consisted of right hemicolectomy. One of these 9 patients died postoperatively from pulmonary embolism. Only 1 patient was alive 5 years after the operation. All the others had died from their basic disease (Table 4). Three of the 12 patients were treated with appendectomy alone. Of these, 1 had died from carcinoma. The other 2 were still alive with no signs of recurrence more than 5 years after the operation.

Case Reports

Two of the patients are of particular interest and are described in greater detail below.

Patient No. 1, a woman, was born in 1905. In 1935 she underwent cholecystectomy at which time an apparently healthy appendix was also removed. The appendix was not examined histopathologically. In 1955 she was subjected to gastric resection with gastrojejunostomy (Billroth II) because of a duodenal ulcer. Dumping symptoms developed. In 1962 the patient complained of diarrhea and pain in the right part of the abdomen. Roentgen examination of the colon at that time revealed nothing remarkable except for the invagination after appendectomy. The invagination was unchanged in size at subsequent

examinations of the colon in 1962, 1963 and 1966. In March 1970 the patient's symptoms were more accentuated with pain in the right lower quadrant of the abdomen and alternating constipation and diarrhea. Roentgen examination of the colon then showed that the invagination had increased in size since the last roentgen examination. The patient was therefore operated upon in May 1970 with right hemicolectomy. Operation revealed a soft, polypoid, well defined tumor about 3 cm across at the site of the invagination. Histopathological examination revealed adenocarcinoma in the appendicular invagination without signs of spread. Also an inflammatory reaction was seen around the suture material after the earlier appendectomy. A typical Meckel's diverticulum was removed at the same time. Postoperative examination of the colon in 1970 revealed nothing remarkable. The patient is still alive without signs of a recurrence 5 years after the operation.

Patient No. 2, a man, was born in 1902. In 1922 he was operated upon because of perforated appendicitis with abscess. No details about the actual operation are known. In 1925 he was operated upon because of stone in the left ureter. He was admitted to hospital in 1959 because of loss of weight (10 kg) and of a fistula which he had had for about one month in the old appendectomy scar. A biopsy specimen of the fistula showed growth of mucus producing adenocarcinoma, which was probably a malignant mucocele. The patient was treated with right hemicolectomy and resection of the abdominal wall around the fistula. In the cecal pole, which was adherent to the anterior abdominal wall, was a tumor which histopathological examination showed to be a malignant mucocele. The patient died on the third day after the operation from acute cardiac failure. Autopsy revealed no residual tumor.

Discussion

According to Steinberg and Cohn,²³ adenocarcinomas of the appendix constitute 0.2–0.5% of all tumors of the gastrointestinal tract. The frequency with which primary adenocarcinoma has been found in operative specimens after appendectomy varies between 1 per 5,000²³ and 1 per 30,000.²⁵ In Sweden the frequency has been calculated as 1 per 1,500.¹ The diagnosis is most often not made before routine histopathological examination of the appendix. If only some of appendices removed are examined histopathologically, the frequency of carcinoma of the appendix will be underestimated.

Uihlein and McDonald²⁴ distinguished three types of primary tumors of the appendix: 1) Carcinoma of the carcinoid type; 2) Carcinoma of the cystic type producing pseudomyxoma peritonei; 3) Adenocarcinoma of the colonic type.

The carcinoids are the most common and constitute up to 90% of all primary tumors of the appendix.²² Histologically, a malignant mucocele is regarded as a well differentiated adenocarcinoma.^{11,13,15} Since the malignant mucocele differs by a therapeutic and prognostic point of view from the colonic type of adenocarcinoma, these patients are accounted for separately in the present report.

Malignant mucocele rarely spreads lympho- or hematogenically.^{10,15,19} Only rarely has such spread been reported.^{3,5,11,21} The absence of lymphogenic spread suggests that appendectomy alone is a sufficiently radical operation.

In 7 patients with malignant mucocele in the present

TABLE 1. *Data on 20 Patients With Primary Carcinoma of the Appendix*

Patient No.	Sex, Age	Present Complaints and Findings	Operative Findings	Treatment	Microscopic Findings*	Results
1	F, 65	See Case report	Cecal tumor with a diameter of 3 cm	Right hemicolectomy	A	No recurrence (5 yrs)
2	M, 57	See Case report	Big cecal tumor adherent to abdominal wall	Right hemicolectomy and abdominal wall resection	M	Died of cardiac failure (3 days)
3	F, 56	Melena Right lower quadrant mass. Ovarian tumor?	Appendiceal tumor with a diameter of 10 cm	Appendectomy	M	No recurrence (9 yrs)
4	F, 54	Typical for acute appendicitis	Appendiceal tumor with a diameter of 7 cm	Appendectomy Radiotherapy	M	No recurrence (11 yrs)
5	F, 82	Constipation. Colicky abdominal pain. X-ray: Ileus	Appendiceal adenocarcinoma with metastases to sigmoid and mesentery	Appendectomy and resection of sigmoid	A	Died of metastases (6 mon)
6	M, 45	Typical for acute appendicitis	Appendicitis with perforation	Appendectomy	M	No recurrence (6 yrs)
7	M, 44	Typical for acute appendicitis	Appendiceal tumor with a diameter of 3 cm	Appendectomy	M	No recurrence (5 yrs)
8	M, 72	Ascites	Autopsy: Appendiceal adenocarcinoma with carcinosis peritonei	No operation	A	—
9	F, 67	Typical for acute appendicitis	Appendiceal abscess	1. Appendectomy 2. Right hemicolectomy	A	Died of metastases (1 yr, 7 mon)
10	M, 57	Typical for acute appendicitis	Appendiceal abscess	1. Drainage 2. Appendectomy	A	No recurrence (5 yrs)
11	M, 69	Typical for acute appendicitis	Appendiceal tumor with a diameter of 10 cm	Right hemicolectomy	A	Died of metastases (1 yr, 11 mon)
12	F, 72	Colicky abdominal pain, vomiting. X-ray: Ileus	Appendiceal tumor with a diameter of 7 cm	Right hemicolectomy	A	Died of pulmonary embolism (2 wks)
13	M, 80	Typical for acute appendicitis	Appendiceal tumor with a diameter of 2 cm	1. Appendectomy 2. Right hemicolectomy	A	Died of metastases (8 mon)
14	M, 33	Typical for acute appendicitis	Appendicitis with perforation	Appendectomy	M	No recurrence (11 yrs)
15	M, 72	Typical for acute appendicitis	Appendiceal tumor with a diameter of 2 cm	1. Appendectomy 2. Right hemicolectomy	A	Died of metastases (6 mon)
16	M, 77	Colicky abdominal pain X-ray: Subileus	Appendiceal abscess	1. Appendectomy 2. Right hemicolectomy	A	Died of metastases (6 mon)
17	M, 55	Right lower quadrant mass	Appendiceal tumor	Appendectomy	A	No recurrence (5 yrs)
18	M, 67	Typical for acute appendicitis	Appendiceal abscess	1. Appendectomy 2. Right hemicolectomy	A	Died of metastases (2 yrs)
19	M, 53	Typical for acute appendicitis	Appendiceal tumor with perforation and pseudomyxoma peritonei	Appendectomy Radiotherapy	M	Died of metastases (8 yrs, 2 mon)
20	M, 54	Typical for acute appendicitis	Appendicitis	Appendectomy	A	Died of cardiac infarction (1 yr, 10 mon)

* A: adenocarcinoma of the colonic type. M: malignant mucocele.

material right hemicolectomy was done in one, who subsequently died from acute cardiac failure. The remaining 6 patients were subjected to appendectomy alone and all of them were still alive 5 years after the operation.

One of them with a perforated mucocele, however, died from a recurrence of the carcinoma 8 years after appendectomy. In another patient there was perforation of the mucocele. That patient has been free from recurrences for

TABLE 2. Preoperative Diagnosis in 19 Cases

Acute appendicitis	12
Ileus	3
Carcinoma of the cecum	2
Right lower quadrant mass	1
Ovarian tumor	1

6 years after the operation, which consisted of appendectomy alone. Otto et al.²⁰ reported that perforation of the mucocele has not any notable effect on the prognosis. Edmondson and Hobbs,⁹ however, recommend right hemicolectomy for perforated malignant mucocele. But, judging from the present material, appendectomy alone is sufficient for malignant mucocele confined to the tip of the appendix and not invading the submucosa.

The mean age of the patients with malignant mucocele in the present material was 46 years, compared with 69 years for patients with colonic type of adenocarcinoma. Lower mean ages for malignant mucocele than for colonic type of adenocarcinoma have also been reported by other authors.^{19,29} Both groups of our patients were older than those published.

Like Sieracki and Tesluk,²² but unlike Otto et al.²⁰ we found both groups of malignant tumors of the appendix to be more common among males.

The colonic type of adenocarcinoma is often localized to the base of the appendix.¹⁸ In our material only 2 of 13 such carcinomas were confined to the distal third. The colonic type of adenocarcinoma spreads lymphogenously or hematogenously, besides which it penetrates the wall of the appendix.

The main lymphatic and venous drainage of the appendix is essentially that of the cecum and terminal ileum. Thus, almost any node of the entire upper or lower ileocolic chain may be a primary drainage area for the appendix. Once a primary lesion is found in the appendix, the drainage areas of the anterior surface of the third portion of the duodenum and above the origin of the ileocolic artery should be checked for gross involvement.¹⁵

Because of the mode of spread of adenocarcinoma right hemicolectomy should be performed in all cases of the colonic type of adenocarcinoma.^{12,23} Hesketh¹² studied 95 patients. Adequate followup data were, however, available for only 50 of these patients, who had been collected from a large number of publications. In those patients

TABLE 3. Seven Cases of Malignant Mucocele of the Appendix

Operative Procedure	No. of Cases	Primary Deaths	5-year Survival
Appendectomy	6	0	6
Right Hemicolectomy	1	1	0

TABLE 4. Twelve Cases of the Colonic Type of Adenocarcinoma of the Appendix

Operative Procedure	No. of Cases	Primary Deaths	5-year Survival
Right Hemicolectomy	9	1	1
Appendectomy	3	0	2

operated upon by appendectomy alone, the 5-year survival rate was 20%, compared with 63% in the group subjected to right hemicolectomy. We have collected 39 cases of primary adenocarcinoma of the appendix of the colonic type from the literature between the years 1956–1973.^{9,10,14,17,20} Together with 12 personal cases the material consisted of 51 cases. Of 26 patients treated with appendectomy alone, 12 (46%) were still alive 5 years after the operation, compared with 15 (60%) of 25 subjected to right hemicolectomy. Right hemicolectomy should always be performed for carcinoma of the appendix of the colonic type.

In one (No. 1) patient, carcinoma of the appendix developed in an invaginated stump of the appendix. At repeated roentgen examination of the colon during a 4 year period 27 years after appendectomy, the size of the invagination and its appearance were still unchanged. After a further 4 years examination because of abdominal pain and melena the invagination was found to have increased in size and the patient was operated upon. The possibility of carcinoma in the appendicular invagination, which increases in size should be borne in mind. Also occult blood in the stools together with an appendicular invagination, when no other source of bleeding can be found, is reason enough to suspect carcinoma of the invagination.

In 8% of the cases the appendicular invagination caused a filling defect in the cecum at roentgen examination of the colon.² Polyps in the cecum,³⁰ like foreign body granuloma in the stump of the appendix,²⁸ can produce a similar picture. Carcinoma in the appendicular invagination has been described by Vidal.²⁶ Such an invagination should also be distinguished from lipomatosis of the ileocecal valve.⁴ Roentgenologically, an appendicular invagination cannot be distinguished with certainty from a cecal polyp.³⁰

A late complication of appendicular invagination is inflammation with abscess-formation.^{6,27} This complication may occur in those cases where appendectomy has been incomplete. This may occur if the appendix is removed en passant in association with other abdominal operations with a less suitable surgical technique for appendectomy and less suitable incision resulting in poor access to the base of the appendix. In our case the adenocarcinoma of the appendix occurred in an appendicular stump after appendectomy en passant at cholecystectomy.

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