Total mesocolic excision versus traditional resection in right-sided colon cancer – method and increased lymph node harvest

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ABSTRACT

INTRODUCTION: Rectal surgery has followed a steady trend towards improved surgical techniques over the past 15 years. Danish colon cancer surgery has not witnessed similar progress. Hohenberger described a comprehensive method involving complete excision of all mesocolic tissue which is equivalent to right-sided hemicolectomy. The present work describes the difference between the traditional surgical method and the comprehensive method, and provides detail on the outcome in 11 patients with regard to morbidity, mortality and lymph node status.

MATERIAL AND METHODS: Eleven cases with tumours located orally to the right flexure were included in the study. Surgery was performed using the comprehensive method. After excision of the specimen, the surgeon determined and marked-up the extra central part of the mesentery which had been excised. A pathologist examined the specimen. The extra mesentery segment was independently examined, described and embedded for microscopy.

RESULTS: Lymph nodes were found in the extra segment of all specimens, and in two patients the extra segment contained malignant lymph nodes. We found twelve or more lymph nodes in all specimens. Without the extra specimen segment, this would not have been possible in five of the patients.

CONCLUSION: Our finding of centrally located lymph nodes confirms Hohenberger's claim that the probability of successful macro-radical removal increases with the removal of such lymph nodes, and removal of as many lymph nodes as possible should generally be considered beneficial to the patient.

Rectal surgery has followed a steady trend towards improved surgical techniques which has led to improved surgery outcomes over the past 10-15 years [1, 2]. Danish colon cancer surgery has not witnessed a similar progress [2].

Hohenberger described a method for comprehensive excision of all mesocolic tissue that was equivalent to right-sided hemicolectomy [3-5]. The new comprehensive method differs from the traditional surgical method mainly owing to [5, 6]:

1. More centrally located excision of tissue along the tumour-draining vessels, and therefore an increased potential for removal of lymph nodes.
2. Increased attention to dissection in the embryological planes to facilitate removal of an intact mesocolon.

We here briefly describe the surgical techniques in right-sided hemicolectomy [3-6] and our own results from 11 patients with regard to morbidity and mortality. Furthermore, we report the lymph node status observed in the traditional and the comprehensive specimens.

MATERIAL AND METHODS

Two traditional surgical methods are used in right-sided hemicolectomy:

1. Medial access (''no touch'')
2. Lateral access

In medial access, the surgeon applies a lateral pull to the caecum to facilitate presentation of the ileocolic vessel. Without mobilising the central structures, the surgeon makes the incision as centrally in the above-mentioned vessel structures as seems expedient. These vessels are then sectioned in accordance with the principle that any manipulation of the tumour should be avoided prior to vessel ligature. If the surgeon decides to approach the vessel structures as centrally as possible, the superior mesenteric vessel should be exposed using an anterior approach. Such exposure is likely to compromise preservation of an intact mesocolon in the central parts of the specimen. Following vessel ligation, the right half of the colon is mobilised and bowel resection is performed.

In lateral access, the surgeon mobilises the right half of the colon in the embryonic planes facing the retroperitoneal structures (renal fascia, duodenum, pancreas) and then proceeds to sever the two resection sites of the colon and the terminal ileum. Next, the mesocolon is severed, in a V-shape-like fashion, towards the central vessel structures, and, finally, the ileocolic

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TABLE 1

Lymp node harvest.

Patient number	Total/positive, n		
	conventional specimen	extra segment	total
1	10/0	5/0	15/0[b]
2	6/0	6/0	12/0[b]
3	28/2	3/2[a]	31/4
4	12/0	2/0	14/0
5	10/1	2/0	12/1[b]
6	20/1	2/0	22/1
7	11/0	2/0	13/0[b]
8	12/1	7/0	19/1
9	14/0	6/0	20/0
10	25/0	9/0	34/0
11	7/0	6/1[a]	13/1[b]

a) The extra segment contained positive lymph nodes; b) lymph nodes in the extra segment contribute to the harvest of 12 or more lymph nodes.

vessel and the right colic vessel are severed as centrally as possible.

In the comprehensive surgical method, the surgeon takes a lateral approach. Dissection starts with mobilisation of the right colon as in standard lateral access. In non-advanced tumours, it is possible from the onset to perform the procedure in the embryonic planes only. In advanced tumours, the aim is to obtain ''en bloc'' resection that includes any neighbouring structures with tumour ingrowth. After bowel mobilisation, dissection continues centrally in the embryonic plane between the mesocolon and the retroperitoneal structures. Dissection exposes the area up to and including the posterior part of the ileocolic vessel (**Table 1**). This mobilisation was described by Hohenberger [3-5], who also included ''Kocher's manoeuvre" with full duodenal mobilisation. We found no need to apply ''Kocher's manoeuvre" to expose the central vessel structures. After such dissection, the surgeon can precisely sever the ileocolic vessel, the right colic vessel and, in right-sided hemicolectomy, the middle colic vessel at the site of their inflows into the superior mesenteric vessel. Next, bowel resection is performed. By staying in the embryonic plane as far as the superior mesenteric vessel inflows, extra attention is given to the task of ensuring an intact mesocolon – even in the central parts of the specimen.

In the present study, we decided where the ileocolic vessel would be severed and marked the site during the initial phase of surgery, as is done traditionally (see ''medial access''). The subsequent steps were then performed as described under ''comprehensive method''; and after removal of the specimen, the surgeon used the mark-up to decide which extra central proportion of the mesentery had been resected (**Figure 1**). The relevant area was marked with suture. All surgery was performed as open surgery.

The study only included tumours located orally to the right flexure to achieve as homogeneous a material as possible. Resection of more anally located tumours using the comprehensive method has previously been described by Hohenberger [3-5]. Such resection follows the principles described in the present paper, including surgery in the embryonic planes, but the anatomical conditions here call for more extensive tumour resection than in structures located orally to the right flexure.

A pathologist examined the specimen in accordance with the guidelines from the Danish Colorectal Cancer Group [7]. After an initial description of the specimen including any relevant measurements, the extra mesentery segment was sectioned and independently examined, described and embedded for microscopy. Lymph nodes found in the border-area between the conventional and the extra section of the specimen were added to the conventional lymph node count.

RESULTS

A total of eleven patients underwent open surgery using the comprehensive method. All patients had biopsy-verified adenocarcinoma of the colon orally to the right flexure. Four males and seven females underwent surgery. Pato-anatomical examination revealed that all tumours were glandular stage pT3 or pT4 adenocarcinomas; the degree of differentiation was moderate in three and low in eight. Two patients also had venous ingrowth.

Lymph nodes were found in the extra segment of all specimens, and in two patients the segment contained malignant lymph nodes which both demanded re-staging, from pN0 to pN1 and from pN1 to pN2, respectively. We found twelve or more lymph nodes in all specimens. Without analysis of the comprehensive specimen segment, the initial resection would not have yielded twelve or more lymph nodes in five of the 11 patients who underwent surgery.

The mean number of lymph nodes found in the conventional specimen was 13.2, and the corresponding number for the comprehensive specimen was 18.6.

Six patients had an uneventful postoperative recovery period, one experienced wound infection, one pneumonia, two prolonged bowel paralysis and one anastomotic leakage. The 30-day mortality was zero.

DISCUSSION

It is debatable whether the marked area represents the ''true" extra specimen resulting from the use of the comprehensive method. However, marking performed as described above is the best possible approximation to the »real" added specimen that can be achieved in this

context. This study clearly demonstrates the existence of centrally located, resectable lymph nodes. In two cases, we even found lymph nodes with metastasis.

The number of lymph nodes found in colorectal cancer resectates remains an important issue [8, 9]. Factors influencing how many resected lymph nodes are found and then examined include the tissue, the surgeon and the pathologist [9]. The very fact that we performed this study fuelled attention paid to the number of lymph nodes discovered at our Department. The importance of finding as many lymph nodes as possible is generally acknowledged, because survival improves the more lymph nodes are found [10-13]; and in Denmark 12 lymph nodes has been established as a threshold value. We recommend a second resection when the initial resection does not produce 12 lymph nodes. Without such analysis of the comprehensive specimen segment, the initial resection would not have produced twelve or more lymph nodes in five of the 11 patients who underwent surgery. Owing to the centrally located lymph nodes, these five patients had their nodal TNM classification status assessed according to Danish guidelines [7].

The nodal classification of one patient was changed from pN0 to pN1 and the patient was subsequently offered adjuvant chemotherapy. In this case, the surgical method probably improved the patient's chances of survival, as adjuvant chemotherapy is known to increase five-year survival in pN1 patients [14].

The rate of complications in this small study was as expected. In line with the results from other small studies, the rate is subject to considerable risk of type 2 errors.

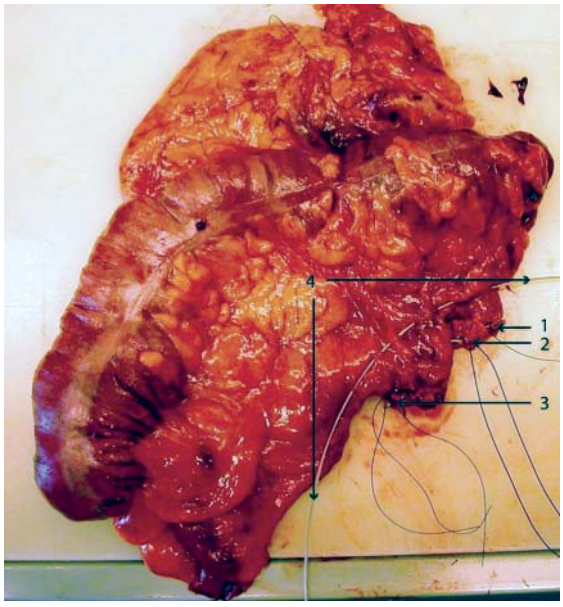
It does not lie within the scope of the present paper to answer the question whether surgery alone will cure more patients or increase survival. This would require a standard randomised trial. We believe, however, that designing and recruiting patients to such a trial would be very difficult as the morbidity and mortality seem not to be increased when the comprehensive method is applied, and it would therefore be unethical not to remove the central lymph nodes in all study subjects.

The described surgical method aims to achieve an intact mesocolon for the very same reasons that rectal surgery aims to achieve an intact mesorectum [15]. We have followed this recommendation, but it is not within the scope of the present study to assess to which extent this actually benefits the patient.

The implementation of this project demanded closer than usual cooperation between surgeons and pathologists in order to be able to obtain the extra central segments. This is in line with the increased level of cross-disciplinary cooperation established at surgical oncology departments during the past years. By adding to

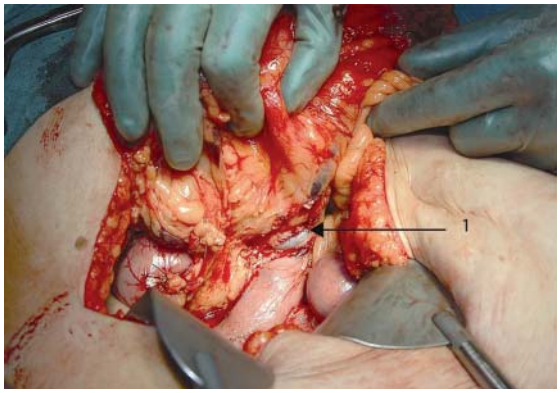
FIGURE 1

Marking of the extra mesentery segment.

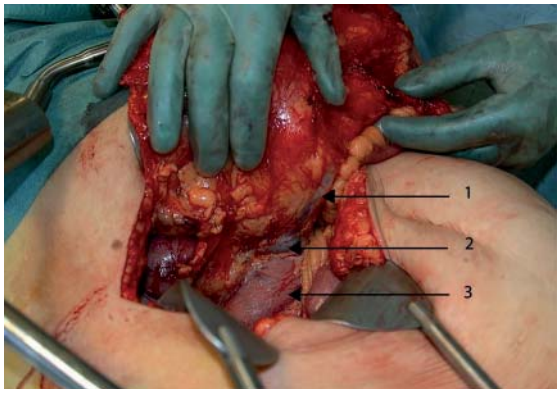


1) Middle colic vessel; 2) right colic vessel; 3) ileocolic vessel; 4) marking of the extra mesentery segment.

1) Central ligation of ileocolic vessel.



1) Ileocolic vessel; 2) superior mesentric vessel; 3) duodenum.



conference-based cooperation an element of practical collaboration, we have discovered the enhanced value of joint efforts in terms of higher quality to the benefit of patients, even beyond the eleven cases who participated in this project.

Recent years have seen an increased focus on laparoscopic surgery for malignant colonic conditions, including right-sided colon cancer. After gaining experience with open surgery using comprehensive resection, our department has now introduced laparoscopic resection for these tumours. Thus, we have had to acquire a technique that comprises adherence to the same resection principles (i.e. surgery in the embryonic planes and central severance of vessel inflows into the superior mesenteric vessel). A description of this technique is available from this article's surgical author upon request.

Comparing the lymph node status in open and laparoscopic surgery is beyond the scope of the present study.

CONCLUSION

Our findings, including the findings of centrally located lymph nodes, confirm Hohenberger's claim that the probability of successful macro-radical removal increases with the removal of such lymph nodes [3-5], and removal of as many lymph nodes as possible should generally be considered beneficial to the patient [1-3, 10-13].

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