

THE SURGICAL PATHOLOGY OF RECTAL CANCER

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The end-results of surgical treatment of rectal cancer are much better than is generally supposed. Expressed in round numbers the following records at St. Mark's Hospital, London, show that almost half the patients who survive the operation of excision of the rectum for cancer are alive after five years. This is particularly satisfactory in view of the fact that surgeons at this hospital adopt a bold and enterprising policy towards rectal cancer, and their operability rate has now reached the astonishing figure of more than 80 per cent. The general operability rate for rectal cancer in other London hospitals has been variously estimated as being below 50 or even below 30 per cent.

The object of this paper is to show how dependent five-year survival rates are upon pathology, especially on the histology of the primary tumour and on the extent of local and lymphatic spread. The present analysis is based on 716 cases treated by radical excision between 1928 and 1941 inclusive. Only twelve of this series of 716 patients could not be traced for a period of five years. These have been regarded as having died, which is weighting the scales unfavourably, but being few in number their effect either way is slight. No distinction has been made between deaths due to recurrence and those due to other causes. Therefore the figures are true survival rates: they record only the number of operation survivors still alive after five years.

The general results of the surgical treatment of rectal cancer at St. Mark's Hospital in the years 1928 to 1941 inclusive were that 337 out of 716 patients were alive after five years—that is 47.1 per cent (Table I). Approximately half these patients were treated by perineal and half by a

combined operation. In cases without lymphatic metastases the percentage of five-year survivors was approximately the same whatever the operation, but for patients with lymphatic metastases the combined operation results were approximately 16 per cent better than those for perineal excision.

No doubt there are many factors which influence the end-results of the surgical treatment of rectal cancer, such as the skill of the surgeon, the nursing facilities available, the after-treatment, and also social and individual factors which need not be mentioned, but in a large series of cases like this it is easy to show that the chief factor affecting five-year survival rates is the pathology of the disease at the time of operation, especially the extent of local, venous, and lymphatic spread.

Histological Classification of Rectal Cancer

According to its histology, rectal cancer can be divided into three main groups—adenocarcinoma, colloid carcinoma, and carcinoma simplex. Each of these has a distinctive histological pattern which is of significance in relation to prognosis. The chief features of each group are given in the following paragraphs.

Adenocarcinoma (non-mucinous columnar-celled carcinoma).—This growth is composed of columnar or cubical cells arranged for the most part in a tubular or acinar pattern surrounding glandular spaces which may be irregular in shape and either empty or partly filled with cellular debris. The distinctive feature of this variety of carcinoma is that there is no sign of mucus secretion either in the cells or glandular spaces. This is the commonest variety of rectal cancer. It may be further subdivided according to the degree of differentiation of the tumour cells into three subgroups: (1) low grade of malignancy, (2) average, and (3) high grade of malignancy. Follow-up records show that approximately 60 per cent of the patients marked low grade have survived five years, whereas less than 30 per cent of the patients marked high grade have lived for this period after operation. One reason for the influence of histology on prognosis becomes obvious when we compare the incidence of lymphatic metastases in various grades.

TABLE I
RESULTS OF SURGICAL TREATMENT OF RECTAL CANCER*

Operation survivors	Untraced (regarded as dead)	Died in less than 5 years (from any cause)	Alive at 5 years	% of 5-year survivors
716	12	367	337	47.1

* All cases operated on at St. Mark's Hospital 1928 to 1941 inclusive (operation deaths excluded).

TABLE II
RELATIONSHIP OF HISTOLOGICAL GRADES TO INCIDENCE OF
LYMPHATIC METASTASES (1,807 CASES)

Grade of tumour	Total cases	Cases with metastases	% with metastases
Low grade ..	190	35	18.4
Average grade ..	1162	515	44.3
High grade ..	455	356	78.2

The figures for 1,807 cases of rectal cancer are set out in Table II, from which it will be seen that metastases were found in only 18.4 per cent of "low grade" tumours but were present in 78.2 per cent of "high grade" tumours.

Colloid carcinoma (mucoid, or mucus-secreting carcinoma).—This has a similar basic structure to adenocarcinoma but differs in that mucus is secreted. When stored in individual cells the mucus gives rise to a "signet ring" appearance, but if secreted into glandular spaces the epithelial cells often seem to be relatively few in number, being found only at the margin or floating in the secretion. The secretion is not actually "colloid," but the tumour has long been known as a "colloid carcinoma," and it would be confusing to abandon this name. Three histological grades of malignancy may be distinguished in this tumour also, though the grading is not so easy nor the prognostic significance so clear-cut as with non-mucinous adenocarcinoma. Colloid carcinoma is the second commonest variety of rectal cancer, composing about 20 per cent of all cases.

Carcinoma simplex (anaplastic polygonal-celled carcinoma).—This term is used to describe an anaplastic type of carcinoma composed of polygonal or spheroidal cells destitute of any glandular arrangement and not showing any mucus secretion. The tumour cells are scattered about singly or in small clusters, or they may be arranged in a solid trabecular or alveolar pattern. It may be difficult at first to decide whether the growth is a sarcoma or a carcinoma, but some part of the tumour generally has features characteristic of carcinoma. These anaplastic tumours show a special tendency towards metaplasia, and though the growth has originated in columnar epithelium there may be regions resembling squamous-cell or transitional-cell carcinoma. These tumours are all of a high grade of malignancy, have generally caused widespread lymphatic metastases, and have a bad prognosis.

Influence of Local Spread

The extent of local spread in rectal cancer can often be decided by cutting a thin slice with a

sharp knife through the region in which there appears to be deepest penetration into the bowel wall or surrounding tissues. The boundaries of local spread are most clearly seen when a malignant tumour begins to spread into the fatty tissue. The final decision as to extent of spread must of course depend on the result of the microscopic examination of sections, but the only cases in which there is likely to be much discrepancy are septic growths or highly anaplastic tumours, or those cases in which there is an abscess at the margin, or fibrosis is found following infection or radiation.

It is useful to have a simple method of recording the extent of local spread and of correlating this with lymphatic or venous spread. The system we have used at St. Mark's Hospital for many years is to classify patients who have been treated by radical excision into four groups according to the extent of spread of the disease as revealed by the examination of the operation specimen. In the first or initial stage the growth is limited to the bowel, and the patient at this stage is described as an "A" case. The prognosis after surgical treatment of such cases is excellent. The second stage is reached when the malignant tumour has spread by direct continuity into adjoining structures but not yet given rise to lymphatic metastases. At this stage a patient is described as a "B" case, and experience has shown that such patients also have a relatively good prognosis after surgical treatment. The third stage is reached when the malignant growth has spread still further and given rise to lymphatic metastases. Patients at this stage are known as "C" cases. If the malignant growth has spread to distant organs such as the liver, this is described as the fourth stage.

The examination of operation specimens of rectal cancer has shown that in about 15 per cent of cases the growth is still at the first stage and confined to the rectum only. In approximately 35 per cent there is some local extra-rectal spread but no lymphatic metastases, and in the remainder the tumour has reached a later stage and lymphatic metastases are present. These proportions have remained fairly constant from year to year though varying slightly with the operability rates at different periods. The influence of local spread can be shown in a very convincing way by comparing the prospects of patients in the first and second stages of the disease—the so-called A and B cases. Between 80 and 90 per cent of A patients have survived five years, but only 60 to 70 per cent of the B cases.

Influence of Venous Spread

When operation specimens of intestinal cancer are dissected, evidence of extension within veins may be found in 10 to 15 per cent of cases, and this usually assumes the form of a solid cord extending a short distance only. The intravascular growth preserves its continuity with the primary tumour and is no more than a special form of direct local extension. It is as if the malignant tumour, having found a path of least resistance, has pushed a root-like process along the lumen of the vein. This is much the commonest manifestation of venous spread, but occasionally one finds also a massive permeation of the haemorrhoidal veins accompanied by thrombosis. In both types of venous spread the growth within the veins has obviously been derived from the primary tumour and still remains in contact with it. Veins may also be secondarily invaded from neighbouring lymphatic metastases, but evidence is rare.

Intravascular spread is most often found in anaplastic varieties of carcinoma, being present in more than 30 per cent of tumours reported as high-grade but in less than 3 per cent of those marked low-grade of malignancy. The veins are seldom invaded until the tumour has spread by direct continuity through the wall of the bowel.

It is not easy to express the prognostic significance of venous spread. The presence of carcinoma cells within the veins of an operation specimen would seem at first to be of very sinister significance, but it has not proved to be as bad as might be expected. All that can be said is that the finding of clumps of carcinoma cells within a vein certainly makes it more likely but does not definitely prove that spread to the liver or other viscera has already taken place. Post-mortem examinations on patients who have died soon after operation for rectal cancer have shown that extension to the liver has occurred in only half the cases in which the dissection of the operation specimen had shown involvement of veins. On the other hand hepatic metastases have been found when the examination of the operation specimen failed to reveal any evidence of intravenous extension. We must remember there is this fundamental difference between venous and lymphatic spread. Lymphatic metastases remain fixed in the glands, and if lymphatic spread has occurred it leaves a permanent footprint, so to speak. Venous emboli on the other hand may leave no track behind them.

Concealed and unsuspected hepatic metastases account for many deaths in the first year or two after operation for intestinal cancer. On the other hand there is ample evidence that patients may

remain in good health for many months or even years in spite of hepatic metastases.

Influence of Lymphatic Spread

Success or failure in the surgical treatment of rectal cancer depends very largely on the extent of lymphatic spread. Therefore no pathological report on an operation specimen is complete without examination of the lymphatic glands, and in rectal cancer it adds greatly to the value of a report if the position of metastases is recorded. To do this the glands should be dissected out from the perirectal fat, a scale drawing being made at the same time to indicate their position. The glands are then numbered and blocked in groups. After microscopic examination the position of metastases is marked on the diagram by inking in the affected glands. An alternative method is to remove the glands in two groups: (1) those in the immediate vicinity of the tumour and (2) the topmost glands situated where the vascular pedicle is ligatured. If an operation specimen is dealt with in this way it is possible to say not only how many glands contain metastases but also where these metastases were situated. Our practice at St. Mark's Hospital is to attach to the report two photographs, one of the operation specimen showing the position and size of the primary tumour, the other a photograph of a scale drawing made after a dissection of the glands and blood vessels, and in this the position of the primary tumour is indicated by shading and the extent of local spread by stippling. Glands and blood vessels not containing growth are merely outlined, but cancerous deposits are recorded in black.

The dissection of operation specimens of rectal cancer has shown that the first glands to receive metastases are almost invariably those lying nearest to the primary tumour. In the case of growths of the lower third and ampulla of the rectum the first metastases are found in the pararectal glands on the same level with or immediately above the primary tumour. The next glands to be affected are the superior haemorrhoidal, which are usually invaded in sequence from below upwards. In an advanced case of cancer of the lower third or ampulla the metastases come to form an unbroken chain extending from the regional group of glands to those situated at the point of ligature of the inferior mesenteric vessels. Occasionally a case is met with in which a metastasis is present high up in the chain of haemorrhoidal glands though those at a lower level are free from deposits. This may be due to an anomaly whereby some lymphatic trunks by-pass glands *en route* and pass

directly upwards to reach the glands in the recto-sigmoid region.

The general direction of lymphatic spread for growths situated in the upper third of the rectum and recto-sigmoid region is also upwards, and it is very rare to find metastases in glands below the primary tumour, though this may occur if the upward spread is blocked. Downward spread of this character has been met with in less than 1 per cent of cases. Evidence of lateral lymphatic spread may sometimes be seen in tumours situated in the lower third of the rectum, but even in these situations it would seem that the upward path is the main highway of lymphatic drainage and is the one most commonly taken by cancerous emboli.

The overwhelming influence on prognosis of lymphatic spread in rectal cancer is shown by the fact that the five-year survival rate at St. Mark's Hospital for cases with lymphatic metastases has been only 26.2 per cent whereas 68.1 per cent of the patients without metastases have survived five years (Table III). These figures are for all types of radical excision, but when a comparison is made of the results of perineal and combined operations the unfavourable effect of lymphatic metastases is seen to be much more pronounced after perineal than after combined excision. The five-year survival rate of perineal excision in cases with lymphatic metastases has been only 17.4 per cent compared with the 33.3 per cent for the combined operation (Table IV). The reason for this is because metastases in the upper haemorrhoidal glands may be removed by a combined though not by a perineal excision.

Since survival after operation depends so much on the position of metastases, we have adopted the plan of dividing patients with metastases (so-called C cases) into two groups. A case is

TABLE III
INFLUENCE OF LYMPHATIC SPREAD ON FIVE-YEAR SURVIVAL RATE AFTER EXCISION OF THE RECTUM*

	Operation survivals	Alive at 5 years	% of 5-year survivals
Cases without lymphatic metastases (A and B)	357	243	68.1
Cases with lymphatic metastases (C)	359	94	26.2

* Based on all cases operated on at St. Mark's Hospital 1928 to 1941 inclusive.

described as C1 if the regional glands alone contain metastases, whereas if there is more extensive lymphatic spread involving also the glands at the point of ligation of the blood vessels the case is classified as C2. This has proved useful because patients with only a few regional lymphatic metastases have a moderately good prognosis after radical surgical treatment, but with more extensive lymphatic spread the prospects of cure are not so good. Obviously both the position and number of metastases is important. Patients with less than four or five lymphatic metastases fairly often survive five years, but this fifth anniversary is rarely reached by those with more than five metastases. So here in conclusion is a simple generalization with regard to rectal cancer which it is easy to remember: patients with five or more metastases rarely live for five years.

Summary

A pathological report on a case of rectal cancer should include a description of the histology of the growth and an estimate of the extent of local venous and lymphatic spread. These pathological features are all interrelated, but each also has its own significance in relation to prognosis.

TABLE IV
COMPARISON OF FIVE-YEAR SURVIVAL RATES AFTER PERINEAL AND COMBINED EXCISION*

	Group	Operation survivals	Untraced (regarded as dead)	Died in less than 5 years (from any cause)	Alive at 5 years	% of 5-year survivals
Perineal excision ..	A	59 (16.8%)	2	10	47	79.7
	B	130 (37.1%)	3	48	79	60.8
	C	161 (46.1%)	3	130	28	17.4
	Total ..	350	8	188	154	44.0
Combined excision	A	46 (12.6%)	—	7	39	84.8
	B	122 (33.3%)	1	43	78	63.9
	C	198 (54.1%)	3	129	66	33.3
	Total ..	366	4	179	183	50.0

* St. Mark's Hospital cases 1928 to 1941 inclusive (operation deaths excluded).