Cancer of the rectum

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CANCER OF THE RECTUM

By

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INTRODUCTION

Van Buren(55) in 1871 began his lecture on cancer of the rectum with these words: "We have now reached a subject the consideration of which I would gladly forego, for it involves a detail of hopeless suffering which terminates inevitably in death. For the cure of cancer our science and art are powerless, and we can offer but scanty means of relief by which its progress may be resisted and its symptoms palliated. This disease has been styled the opprobrium medicinae--the disgrace of medicine; how justly I may not say."

Today the attitude toward cancer of the rectum is more optimistic. Lockhart-Mummery(33) states that 75 per cent of carcinoma of the rectum is curable if seen early. Abel's(1) statistics show that 77 per cent of patients are free from recurrence five years after surgical extirpation when the operation is performed early before the glands become involved. This is certainly a hopeful situation. With education of persons affected to prompt consultation and alertness on the part of the physician to the presence of cancer this degree of therapeutic proficiency may be reached.

Cancer is usually spoken of as being a disease of the "cancer age" or period of beginning tissue disuse and degeneration. The majority of cancer does appear after the fourth decade. It does occur sufficiently often below this age to be watched for. Shedden(50) was able to collect 36 definite case of cancer of the rectum in persons below the age of 20 years.
He also had a series of 24 of his own cases between the age of 20 and 35 years. The youngest patient being 11 years. However, on the average cancer appears in the fifth decade and sixth decade.

The incidence of cancer of the rectum as determined by the census reports of the registration area is as follows: In 1914 the registration area included 66.8 per cent of the population, and there were 1992 deaths from cancer of the rectum; in 1917 there were 2043 deaths reported, a rate of 3.2 per 100,000 or 3.9 per cent of the total deaths from cancer. In 1918, the registration area now embracing 77.8 per cent of the total population, there were 2558 deaths or 3.1 per 100,000 or 4 per cent of the total deaths from cancer. In the last available mortality statistics of the U. S. Bureau of Census the total number of deaths from cancer and other malignant tumors was 134,428 or a death rate of 106.2 per 160,000. Of this total 65,476 were of the digestive tract and peritoneum giving a death rate for cancer of this system of 51.7 per 100,000. The rectum and anus accounted for 6740 of these deaths giving a death rate of 5.3 per 100,000. The death rate of cancer of the rectum has been rising. This has been explained by some authorities as being due to better diagnosis so the rise is apparent and not an actual increase in cancer of the rectum.

In this paper an attempt has been made to more completely understand those factors other than the technical aspects of
surgical treatment. The treatment of cancer of the rectum is surgical and to do justice to the subject would require a monograph to itself. Most emphasis has been placed on the biological and pathological aspects because with a thorough knowledge of this the clinical picture becomes understandable.
HISTORY (43)

"The collection of ancient Hindu writings known as the Ramayana, and believed to date back to about 2000 B.C., contains directions for extirpating tumors. Little is to be found in the Hippocratic writings, though the 'Aphorisms' distinguish between hard cancer (skirros), and the open cancer (kankros); and all affections not susceptible of "coction" are reputed incurable, e.g., cancer."

"Thomas states that the term cancer was first reserved by the Greeks to designate certain ulcers of the breast. Later it was extended to all ulcers showing no tendency to heal. It was a common practice in olden times for grateful patients to deposit in the temples, images (ex-votos) of the ailments from which they had recovered, made of various materials: terra cotta, wax, and even the precious metals. In fact this practice still exists, and in a little church near Chicago, the chapel of St. Roche in New Orleans, and especially at the Grotto at Lourdes (France), the walls are covered with canes, crutches, etc. Thousands of terra cotta images have been discovered in Asia Minor, portraying faithfully Pott's disease, dropsy, facial paralysis, and other affections. Buck tells us that among a collection of these from the Temple of Cos, which he saw in the Museum of the History of Medicine (Jena), was one which admirably reproduced on a small scale the characteristics of cancer of the female breast."

"The Roman historian, Cornelius Nepos, refers to an old
gentleman of the time of Julius Caesar, one T. Pomponius Atticus, who had reached the ripe age of 77, and had not needed medical advice for 30 years, when he had tenesmus and other manifestations which lead to the belief he had cancer of the rectum. According to Garrison, Rufus of Ephesus, who lived during the reign of the Emperor Trajan (98-117), was the first to give a description of epithelioma. Not long after this, Galen attributed cancer to 'black bile', hence it is blacker than inflammations, and has no heat. Cancer is incurable because the humor is so thick it cannot be dissipated and purgatives have no effect."

"An Anglo-Saxon MS of about the ninth century contains the following recipe:

'Burn a fresh hounds head to ashes, apply to the wound. If it will not yield to that, take a man's dung, dry it thoroughly, rub to dust, apply it. If with this thou are not able to cure him, thou mayst never do it by any other means.'"

"Wolf states Petroncellus, of the celebrated school of Salerno (end of eleventh century), was the first to mention digital examination of the rectum in carcinoma. Surgeons about this time were almost equally divided between the knife and the cautery for removing tumors. Thus Lanfranc (or Lanfranchi), in his 'Chirurgia Magna', written in 1296, advises that no attempt be made to extirpate an ulcerated cancer, either with the knife or cautery, unless it appears probable that complete destruction of the growth may be affected by such means. Guy
de Chaulisc(1300-70), employed the actual cautery in the fungus type, otherwise he believed in cutting out cancer at an early date."

"The famous Ambroise Pare writing on 'Preternatural Tumors' and alluding to cancer remarks: 'This has taken the name of chancre(i.e., cancer) because it greatly resembles it', and for fear the reader will not know what cancer is naively gives a picture of a crab. Bainbridge quotes the view of Van Helmont (1578-1644), showing the queer ideas of etiology which prevailed in the seventeenth century. This celebrated man asserted that cancer--

'is due to a spiritual being, the Archaeus, in the stomach and spleen, which must be purified and thus prevented from sending its ferments into the wrong parts.'"

"Later on the humoral theory came into vogue again and lasted well into the nineteenth century. While Virchow demolished it in his famous production 'Die Cellular Pathology' he apparently believed it might hold good for tumors, at least in part. However, the investigations of Thiersch(1865) and Waldeyer(1867) on carcinoma seemed to put an end to his doubts; though Robinas far back as 1855 showed that carcinoma of the kidney sprang from the renal epithelium."

The more recent history has been dramatic and far reaching. It includes transplantation, the detailed determination of the effect of hereditary factors, and in the field of prophylaxis a far reaching and successful campaign for the
early recognition and treatment of the precancerous condition. There are now 240 cancer diagnostic clinics throughout the country in which patients may be reasonably assured of complete examination, accurate diagnosis and the best treatment that can be offered. The following States have free diagnostic services for all residents: New Hampshire, Massachusetts, New York, Delaware, Georgia, and the District of Columbia. The American College of Surgeons, which maintains a registry for such facts, has records of 29,195 persons who have recovered from cancer.
ETIOLOGY

Influence of Heredity

Lockhart-Mummery(30) reported three cases of multiple adenomatosis in which he was able to find a definite familial history. He claims to have observed this tendency sufficiently often to lend support to an heredity tendency. His cases developed cancer at a relatively early age and the number of cancer deaths is striking. This has been the consensus of opinion of most present day writers on cancer of the rectum. Inasmuch as adenomatosis is a precancerous lesion its effect here is indirect.

Macklin(36) after a review of some 3500 papers on the factor of heredity in disease, has a good argument in favor of the presence of an heredity factor in tumors. She claims that the reason for the lack of acceptance of the heredity factor is due to faulty reasoning that because cancer has been produced in mice in this fashion it does not necessarily follow that it operates the same in man. These results are transferable to man if the evolutionary theory has any value at all. Much of the world has ignored the results of the geneticists because there is lack of agreement on the mechanism of transmission.

She claims that a second group who do not believe in its heredity nature are the statisticians. Their argument is: "One in every eight persons dies of cancer. Therefore it is almost inevitable that one will find many families in which
more than one person will have died of cancer. To attribute this to heredity and not chance is false reasoning". They have attacked the problem in another manner. They have investigated the families of those dying from cancer and those not dying from cancer and have found approximately the same percentages of cancer cases in both sets of relatives.

She attacks the argument in this fashion: Although one in eight persons dies of cancer when one investigates the family history, it is found that it is one particular type of cancer involved. In one family it may be cancer of the breast, in another it may be cancer of the rectum, etc. Also, the members of the family tend to die at approximately the same age although that age may be far removed from the usual age of death from that disease. As an example, the usual age of death from cancer of the breast is between 50 and 55 years. Yet in one family a mother and her two daughters died at 70, 74, 76 years. In another family a mother and her two daughters died from it before the age of 22 years. Therefore, if the disease were due to chance and not to heredity one would expect to see it not in four women in the same family but once in 1,000,000,000,000,000. Because although one in eight die of cancer, not one in eight die of cancer of the breast, instead one in 10,000 women die of cancer of the breast before the age of 22 years. If heredity is the explanation one would expect to find it again in members of a family, if chance is the explanation it would be almost impossible for it to
affect another member of the same family.

Another criticism of the statistical method is that the statisticians have selected or studied cancer as though it was one disease and not a group of diseases. She claims this is about as sensible to consider how many cases of scarlet fever developed from contact with smallpox. If none developed then smallpox would not be contagious.

When the family history is investigated for the same type of tumor, one finds that it is much more frequent in the ancestors of those with that tumor, than in the ancestors who do not have that type of tumor. Thus if the patient has cancer of the breast, cancer of the breast will be found more frequently in her ancestors than will cancer of the breast be found in the ancestors of a patient with cancer of the uterus. This appears to hold true of other types of tumor also, for instance cancer of the rectum. Frequently the type of tumor will differ and the father may die of cancer of the stomach and the son of cancer of the lip. This is to be explained by the probability that the mother may have carried the gene for lip cancer and passed it on to her son without developing it, or the father could have carried both genes and inasmuch as gastric cancer develops earlier he died before lip cancer could develop. This tendency is for the same type to develop, but there are many instances where different tumors develop.

Another statistical error is in using groups who show
cancer, and groups who do not as controls. The greatest fallacy here is that life insurance statistics are used, which have a predominance of men, and 35 per cent of cancer is present in the female generative organs. When a separation of the sexes is made a much different result is obtained.

She feels that the factor of chronic irritation has been overemphasized. It has been shown that not all rabbits whose skin is painted with tar develop cancer, not all chimney sweeps develop scrotal cancer; not all smokers develop lip cancer. Chronic irritation only succeeds in producing cancer where there is an inherited susceptibility. It acts as an accelerator, speeding up a process that would develop eventually if the person lived long enough. For proof of this statement the case of a pair of identical twins is cited. One twin developed a sarcoma of the right testis at age 26 following trauma a few months previously. His twin brother had never received any trauma to his right testis but at the age of 31 he too developed a sarcoma of the right testis. The injury in this case speeded up the development of the tumor by five years.

In summary it may be said that cancer is inherited. It is dependent upon factors, some of which are recessive and hence will show up in families in which there is no history of it. There is a striking tendency for members of the same family to develop the same type of tumor, at the same age, and in the same site. This would suggest the presence of a dominant
factor as well which regulates the site of growth. It has been suggested that there are two factors concerned with tumor formation; a pair of recessive factors for abnormal tissue proliferation, and a dominant pair responsible for the organ in which this takes place. Macklin(37) has suggested that the recessive is located in the sex chromosomes.

If some factor other than heredity were responsible for tumor formation it would be extremely seldom that members of the same family would develop the same tumor at the same place, and at the same age. Unrelated persons such as husband and wife would show it with the same frequency as parent and child or brother and sister. Irritation no doubt is a factor but only operates where there is an inherited susceptibility. Sometimes the susceptibility is so weak that the irritation factor appears to be the predominating mechanism.

Precancerous Lesions

Relation of polyps to rectal carcinoma: Perhaps one of the most important aspects of rectal carcinoma lies in the relationship of benign polyps to the development of carcinoma. Karsner and Clark(27) cite the work of Verse and Westheus who state that 100% of rectal cancers originate in polyps. Westheus states that 40% of the rectal carcinomas observed in the Schmieden Clinic still show polyps.

This transformation of polyps to cancer has been observed for a great many years. Hullsieck(26) collected 127 cases from the literature and found a malignancy rate of 34.6 percent. He reports that Menzel first reported a case in 1721
and in 1832 Wagner, and in 1839 Rokitansky both reported cases. Lebert's case of a woman of 32 years is the first description of the polypi themselves. In the same year Luschka reported a case in which the entire rectum and colon was involved and carcinomatous degeneration had set in.

Soper(51) in an analysis of 61 cases, which were all that had been reported in the literature up to 1916, found 26 cases or 43 per cent showed the presence of carcinoma. The carcinoma was adenocarcinoma. The most frequent site was in the rectum, sigmoid, and splenic flexure. In five cases of benign adenoma, carcinomatous degeneration was observed in various polypi at different places in the colon. The rectum and sigmoid are involved in 95 per cent of all cases of polyposis of the colon.

Coffey(10) reports a case of polyposis that had small pea-sized polyps distributed throughout the colon and rectum which on pathological examination following complete colectomy showed two areas of carcinoma, one in the rectosigmoid and one in the splenic flexure. Doering(14) reported a malignancy incidence of 43 per cent in a series of 50 collected cases. Beeler(4) reports four cases of rectal polyps in which three of them showed recent carcinomatous degeneration. The fourth showed extensive infiltration of the muscle.

Larson and Nordland(28) in a review of 210 cases of carcinoma of the large bowel found polyposis present in either a localized or diffuse form in sixteen cases, and in all of...
these cases there was evidence that malignant change took place in a previously benign polyp.

Lawrence(29) in a series of seven thousand autopsies of all types of cases found 232 or 3.3 per cent had polyps. Of these 30 cases had polyps in the rectum, an incidence of .42 per cent and 16 of these had polyps elsewhere. Five of these polyps proved to be malignant. White males showed polyps 6.9 times more frequently than females when over forty years, but under forty years only 1.4 times more frequently. The number of polyps more closely approaches the number of malignancies than in any other part of the gastro-intestinal tract.

Yeomans(57) reported seven cases of rectal polyps all of which showed carcinomatous degeneration. He also cited 219 cases, collected by Dewis, of benign intestinal tumors. 101 of these tumors were in the rectum and of these 81 were adenomas.

Rankin and Fitzgibbon(45) in a study of 13 cases of polyposis found evidence of carcinomatous change in 11 and found a total of 24 carcinomas in these cases. All of these tumors were in the rectum and sigmoid except one which was at the splenic flexure. They were able to classify the polyps into three groups. Group I, included small nodular or smooth masses varying from tiny knobs 3mm. in diameter to masses with a diameter of 2cm. or more, without papilla formation or branching of crypts. These constitute the only group entitled
to the benign implication of the term polyps. They are no more likely to become malignant than is normal mucosa. In Group II, are polyps which may attain great size, with failure of cell groups to differentiate into normal units producing multilayered buds which into lumens and into connective tissue, and tend inevitably to become malignant. In Group III, are polyps which never exceed 1 mm. in diameter. The cells attain only the most rudimentary character and proliferate so rapidly that the connective tissue cannot keep pace, the resulting being a mass of epithelial complexes and tangled skeins of disorganized gland tubules, an immediate precancerous condition. These authors seem to feel after an examination of the literature and from their own experience that the evidence argues "persuasively for the extremely plausible contention that the histogenesis of carcinoma of the colon is mediated through precancerous polyp formation and not otherwise."

Ribbert(46) believed that the polyp originates from displaced embryonal cells of the gut which may remain unaltered until an advanced age, but may be stimulated to activity at any time by irritation. These groups of cells are small and isolated. He pointed out that a polyp does not become malignant as a whole, but only in part, and believed this to be due to conditions that permit invasion rather than an alteration in the epithelial cells themselves.

Erdmann and Morris(18) in their review of polyposis state
that it appears to be a uniform, non-specific mucous membrane reaction, variable only in degree to a chronic irritant in the presence of a preternaturally sensitive mucous membrane. It has a predilection for the large gut and rectum, the predilection increasing in direct proportion from the ileo-colic sphincter downward. Two types of polyposis can be determined clinically, namely, an adolescent type occurring in early in youth and having a tendency to involve members of the same family; and an adult type coming later in life. The two types have much in common in that they show a marked predilection for the large gut, and they have a malignancy incidence of 40 per cent.

Lockhart-Mummery and Dukes(34) have taken the excised tissue which was removed at operation for carcinoma of the rectum, and immediately after fixing it, pinned it out flat so that it could be closely examined with a hand lens. They discovered small irregularities on the surface not noticeable to the naked eye. These small irregularities were particularly noticeable in two conditions: multiple adenomatosis and carcinoma of the rectum. When these cases were examined microscopically they showed a localized epithelial hyperplasia or the first step toward the formation of a visible adenoma. They observed that this condition was found most often in association with multiple polyposis and carcinoma; that it is more likely to be found in the neighborhood of a small malignant tumor than a large malignant ulcer; that it affects an extensive area
of the bowel several inches above and below the carcinoma.

They divided the developmental process into four stages. The first stage consists of localized patches of hyperplasia invisible to the naked eye but discoverable with the microscope, and affecting an extensive area of the bowel. In the second stage there is the appearance of a crop of sessile adenomata scattered over as wide an area as was affected by the initial hyperplasia. In the third stage there is the development of cancer either in one of these pre-existing adenomata or in the neighboring epithelium. In the fourth stage there is a progressive enlargement and dissemination of the malignant tumor accompanied by retrogression of the hyperplastic changes and benign tumors surrounding the growth.

Hemorrhoids and fistula have been mentioned as possible factors predisposing to carcinoma of the rectum. Moon(41) reported two cases of rectal carcinoma which were thought to have developed in ano-rectal fistula tracts. Hawe(23) found an area of carcinomatous degeneration in a pile at operation. He felt that instead of the pile resulting from the malignancy the reverse was true in this case. Hirschman( and Rosenblatt(25) report a case of a colloid carcinoma developing in a hemorrhoid which was examined microscopically following hemorrhoidectomy.

Lockhart-Mummery and Dukes(34) in their survey of precancerous conditions in the rectum state that it has long been
surmised that long existant piles either internal or external might give rise to cancer but they had never come across cases that would lend credence to such a view. It seems possible that chronic pruritis ani might lead to development of an epithelioma of the anal skin but they rarely have a case in which this has occurred although epithelioma of the vulva is not an uncommon result of pruritis vulvae. Chronic fistula does occasionally appear to act as an exciting cause of cancer and they have two cases where a cancer arose at the inner opening of the fistula tract. On the other hand they have seen chronic fistulas that have existed for as long as fifty years without any development of cancer.

Chronic constipation has been indicted as a cause operating as a means of chronic irritation. Pennington(43) made the statement that if this were true one would expect to find a much higher incidence of cancer in the female, while actually the male shows the condition most frequently. Also, the accumulation of fecal material in constipation is much higher in the sigmoid than the rectum, the latter acting as an expulsive organ and not a storage organ. At present there is no convincing evidence to implicate constipation.
According to Pack (42) the majority of tumors of the rectum are adenocarcinomas. The lumen of the bowel is always narrowed by the growth, and this stenosis is most apparent at the recto-sigmoidal junction where the tumor tends to form an annular stricture. Miles (40) states that most of them are found on the posterior wall and this is the general finding of others.

Pack classified carcinoma of the rectum into four types as follows: 1. papillary carcinoma; 2. malignant adenoma or adenoma destruens; 3. gelatinous or colloid carcinoma; 4. scirrhous or fibrocarcinoma.

The papilliferous or papillomatous carcinoma resembles the benign papilloma somewhat except for the invasive nature of its base. This tumor may be frankly malignant from its onset, or it may be a malignant degeneracy of the benign papilloma. It produces a bulky exuberant tumor before the bowel is infiltrated.

Adenoma destruens is the most common type of cancer of the rectum. It may appear early as a cancerous plaque, later forming a malignant ulcer due to necrosis of the overlying surface. The transition from normal to cancerous mucosa may be surprisingly abrupt. This pseudonymous adenoid carcinoma sometimes forms a sessile, circumscribed growth. The tubules and their component cells may be quite similar to normal tissue in some instances, insomuch as there is much variation
in the histologic character and malignancy of these tumors. Only too frequently they penetrate the muscularis mucosa, early and deeply, with the formation of solid medullary or cord-like masses of cells or irregularly arranged acini within the submucosa. Secondary infection and trauma cause ulceration, which hastens the dissemination of the tumor. The malignant ulcer is crater-like with indurated, elevated edges, occurring for the most part in the lower part of the rectum and times encroaching on the sphincter. The ulcer may be associated with other non-ulcerating adenomata, existing higher up in the rectum and sigmoid.

The colloid or gelatinous (mucoid) type is a degenerative stage of adenocarcinoma and is extremely malignant. It forms a bulky massive growth in which gelatinous or mucoid material replaces the tumor tissue.

The scirrhous or fibrocarcinoma is a peculiar type of rectal adenocarcinoma exhibiting desmoplastic tendencies, in which the atypical and anaplastic cancer cells are growing diffusely and are nestled among wide strands of new connective tissue. The ulcer formed is indurated due to this fibrosis, and the length as well as the diameter of the lumen is lessened by the consequent cicatricial contraction.

The pathological classification as given by Ewing (19) and stated in a modified form is as follows:

1. Adenoma destruens: A broad, medullary, superficial ulcerating tumor producing obstruction and having a microscopic
anatomy characteristic of a rapidly proliferating adenocarcinoma.

2. Stenosing fibrocarcinoma: A circumscribed fibrotic tumor with a tendency to become annular and presenting a microscopic picture of invading atypical cells with an excessive amount of newly formed connective tissue.

3. Gelatinous adenocarcinoma: A bulky gelatinous tumor with or without obstruction, but having a tendency to peritoneal extension.

4. Polypoid carcinoma: A pedunculated growth developing from a pre-existing polyp and having a histological structure resembling an adenocarcinoma in which the acini contain mucus.

5. Squamous-cell carcinoma: A tumor arising from the anus or lower rectal, having a tendency to ulcerate and having the microscopic picture of an acanthoma.

6. Melanoma of the rectum: A pedunculated, ulcerated rectal growth producing obstruction, having the histological features of melanomas elsewhere in the body.

Classifications of the rectal carcinomata vary but in general those given here are most commonly seen. There is still some controversy over certain types. A further clarification of this matter will be given in the section on grading.

Rankin and Broders(44) state that most growths occur in the ampullary portion or higher at the rectosigmoidal junction. The smallest percentage of growths are in the anal canal and around the anal orifice, and these are usually epitheliomata so that they can reasonably be found on a most superficial
examination although cases are seen where the growth is of several years duration. Carcinoma of the rectum as carcinoma of the other parts of the gastro-intestinal tract is adenocarcinoma. Sometimes epidermoid carcinoma or squamous-cell epithelioma are found but these are situated at the anus.

Brindley(5) in a series of 167 carcinomas found the following distribution: rectosigmoid 42, upper rectum 23, ampulla 61, lower rectum 37, anal margin 4. The pathologic type varies with the location in the different parts. The smallest caliber of the large bowel is at the rectosigmoid. The cancer often grows along the blood and lymph vessels around the inside of the intestinal wall, producing annular, constricting growths. The small caliber of the bowel and the nature and development of the neoplasms here fortunately tend to a rather early manifestation of symptoms. Owing to these facts, the first symptoms of a rectosigmoidal cancer are frequently those indicative of a partial obstruction. Sometimes patients with malignant growths in this region first consult a physician because of an acute obstruction. Neoplasms of the rectal ampulla, owing to the large size of the lumen, rarely cause marked obstruction and then only when the lesion is far advanced. Cellular, fungoid growths which are prone to early ulceration and bleeding are the type of tumors often seen here and in the lower part of the rectum. Blood and mucus in the stools are the usual first signs of a malignant condition of this part. Cancers of the anus are
usually epitheliomas. They early become fissured, ulcerated and infected. Because of this and the resulting spasm and contraction of the sphincter muscles a discomfort or even pain is frequently and early a manifestation of neoplasms of this location.

Mode of Spread

Carcinoma of the rectum being principally adenocarcinoma the mode of spread will deal with that particular type. An adenocarcinomatous tumor of the rectum when observed early is confined to the mucous membrane and submucous tissue. The tumor is sessile and easily movable on the subjacent muscular coat of the bowel. As it grows it tends to spread in three ways as follows: by direct extension through the continuity of the tissue, by means of the lymphatics, by means of the venous system (40).

Taking these modes of spread in order the first will be by direct spread. This takes place in two directions, namely, on the mucous surface of the bowel progressively from its entire margin, and through the thickness of the bowel wall. The marginal increase is usually greater and more rapid in the transverse than in the longitudinal axis of the bowel. So accordingly growths may extend around the circumference of the bowel and extend only one or two inches longitudinally forming an annular ring. The growing edge undermines the more normal mucous membrane extending in the submucous tissue deep to the muscularis mucosa. Such surface extension is
usually slow, and Miles(40) states that in the ampulla it probably takes six months for the growth to travel around a quarter of its circumference. While this surface extension is taking place deep infiltration of the muscular coat of the bowel is taking place. This appears to be a slow process. As soon as the bowel wall has been completely penetrated, the growth invades the perirectal fat through which it extends until it reaches the fascia propria of the rectum. By this time the growth has existed about eighteen months and three fourths of the circumference of the rectum is involved. It is only after penetration of the fascia that invasion of the neighboring structures such as sacrum, uterus or vagina, the prostate, or bladder can take place, and would tend to indicate that involvement of adjacent structures does not take place until a year afterward.

An unusual case of direct extension is reported by Stein and Hantsch(52). They report a case of primary carcinoma of the rectum which by direct extension had involved the penis and produced an intractable priapism. They were able to find only two other cases of this type of spread in the literature. This type of extension cannot be explained on either an anatomical or physiological basis as having reached this area by way of the vascular or lymphatic system. They assumed the extension to be direct into the corpus cavernosum by way of the ischio-rectal fossa and through the junction of the deep and superficial triangular ligaments with the fascia of Colles.
into the superficial perineal space.

The second mode of spread is by the lymphatics. This mode of spread is by far the most important, especially in relation to the surgical treatment. As in carcinoma of the breast a thorough knowledge of the lymphatics is necessary for adequate surgery.

The lymphatics (40) are divided into three groups, namely, intramural, intermediary, and extramural. Taking these in order the first is the intramural group. The intramural group are contained in the wall of the rectum and consist of two networks, one situated in the submucous tissue, and the other in between the muscular layers. The two networks communicate freely with one another by means of short radial channels which pass through the circular muscular coat. The submucous network of the ampulla is said to be continuous with that of the pelvic colon above, and below with a similar network in the anal canal. The latter is also in communication with the lymph plexus in the subcutaneous tissue of the perianal skin, from which collecting stems pass forward in the furrow between the perineum and the inner aspect of the thigh, to terminate in the innermost of the horizontal set of inguinal glands. The intermuscular network of the rectum is also said to communicate above with that of the pelvic colon, and below with the lymphatics of the external sphincter muscle. The collecting stems traverse the external muscular coat of the rectum and terminate in the lymph channels of the intermediary
The second division of lymphatics is the intermediary group. This portion consists of two parts, namely, a subserous network in the portion of the rectum which is covered by peritoneum, and a lymph sinus, the perirectal fat, in that part of the rectum which does not possess a peritoneal investment. The lymph space is occupied by a delicate wide meshed reticulum of fine strands of connective tissue and can always be demonstrated in any specimen of the rectum which has been removed together with its covering of perirectal fat. The collecting stems from the intermuscular network after traversing the external muscular coat, empty themselves directly into the lymph sinus so that a detached cancer cell after entering the sinus may wander to any part of it before entering the extramural lymphatic system.

The third division of lymphatics is the most important of the three. This is the extramural lymphatic system. The collecting stems from the lymph sinus form an extensive plexus and enter into relation with the ano-rectal glands of Gerota, which are scattered over the surface of the rectum among the branches of the superior hemorrhoidal vessels. The efferents from this plexus and from the ano-rectal glands pass to their ultimate destination in three directions, namely, downward, laterally and upward.

The downward efferents traverse the fatty tissue of the ischiorectal fossa in company with the inferior hemorrhoidal vessels.
vessels, enter into relation with a small group of lymph nodes situated close to the exit of Alcock's canal, then pass through the canal and empty themselves into the internal iliac glands. The lateral efferents enter a plexus situated between the levator ani muscles and the pelvic fascia from which collecting vessels pass to the obturator glands at the upper border of the obturator foramen. The efferents from the obturator gland pass to the internal iliac glands and to the innermost of the group of glands accompanying the external iliac vessels.

The upward main efferents accompany the superior hemorrhoidal veins, enter the lowermost mesocolic glands, then accompany the inferior mesenteric vein as it lies in the parietal border of the pelvic mesocolon, and finally enter the group of glands situated at the bifurcation of the left common iliac artery and also the median lumbar (aortic) glands.

The tissues through the lymphatics pass are liable to be invaded by cancer cells which have become detached from the primary growth. These detached cancer cells are responsible for the formation of metastases. Miles (40) states that, "whereas, metastases are commonly met with in tissues outside of the rectum, they are never seen in the wall of the rectum. Now, if there were a continuous submucous plexus of lymphatics, such as has been described anatomically, we should expect, in cancer of the rectum, that visible metastases in the mucosa, either singly or in chains, would be of frequent occurrence both above and below the growth."
The inference then is that the spread of cancer cells in the submucosa is very limited in extent and does not extend more than a few lines beyond the microscopical edge of the neoplasm. So he suggests that the lymphatics of the mucosa do not exist as a continuous plexus, but are arranged as decussating arborescents from which collecting stems pass straight through the muscular coat to join the intermuscular plexus. "Spread in the latter is just as limited so that we may conclude, from clinical as well as histological findings, that the intramural spread of cancer of the rectum is always of comparatively trivial extent. It is also probable that detached cancer cells pass through the bowel wall somewhat rapidly by means of the intramural lymphatic system, and gaining access to the external lymphatic system give rise to extramural metastases scattered over a fairly wide area long before the muscular coat has been penetrated by direct extension of the growth."

Cancer cells having become detached from the growing edge of the primary growth pass through the submucous and intermuscular systems and so gain access either to the subserous network or to the lymph sinus. In the subserous network these cancer cells form plaques in the peritoneum covering the bowel; when they enter the lymph sinus they find their way into the extramural lymphatic system and are scattered over a wide area.

The path taken by the cells is determined by the current
in the lymphatic channels invaded. The course taken is not controlled entirely by anatomical considerations. Cancer cells may traverse them in a downward, upward, or lateral direction or all of them simultaneously. The various tissues through which the lymphatics pass are prone to metastatic deposit and so lead to formation of nodules.

The extramural paths by which spread may take place may be considered in three zones:

1. The zone of downward spread comprises the perianal skin, the ischiorectal fat, and the external sphincter muscle.

2. The lateral zone of spread comprises the lymphatics of the levator ani and the coccygeus muscles, the pelvic peritoneum, the prostate gland, the base of the urinary bladder, the cervix uteri, and the base of the broad ligaments enters into relation with the network of lymphatics which is situated between the levator ani muscles and the pelvic fascia.

3. The upward zone of spread comprises the retrorectal glands, the pelvic mesocolon in its entirety, the paracolic glands, the glands situated at the bifurcation of the left common iliac artery, and the median lumbar glands.

Gabriel, Dukes, and Bussey(21) graded cancers on the basis of lymphatic involvement as A, B, and C. Briefly this grading is as follows: In A cases the growth is limited to the wall of the rectum; in B cases there is extension by direct continuity to the extrarectal tissues, but no glandular metastases; in C cases their is metastasis to the regional lymph glands. In follow up studies the survival periods of
each group is as follows: In the A group there was a five year survival of 91 per cent; in the B group there was a five year survival of 64 per cent; and in the C group only 16 per cent survived five years of more.

The frequency of glandular metastasis in 62 C cases was as follows: with one gland only affected 13; with two glands only affected 11; with three glands only affected 7; and with four or more glands affected 31. From the surgical point of view this is encouraging because even when lymphatic spread has taken place there is usually a considerable period before the cancer spreads from gland to gland, or beyond the limits of surgical removal.

According to these authors the course of lymphatic spread is an orderly one. They found the first glands to be involved were those situated in the perirectal tissues on the same level or immediately above the primary growth. The next to be affected are the chain of glands accompanying the superior hemorrhoidal vessels. As a rule these are invaded in sequence from below upward. In an advanced case the metastases form an unbroken chain from the regional lymph glands to the gland situated at the point of ligature of the inferior mesenteric vessels. In only a few cases were the glands not involved in a chain-like arrangement. The paracolic glands were only involved in one case and this was an advanced case where all where all of the rectal and hemorrhoidal nodes were involved and the ascending vessels were permeated by a continuous growth.
of cancer cells. Later or downward spread is only found when the hemorrhoidal lymphatics are blocked. These findings correspond more closely with the type of spread one would expect from the anatomical arrangement of the lymphatics of this region and disagrees somewhat from the findings of Miles.

Another point of importance here is the difficulty involved in attempting to determine the degree of involvement of the lymph nodes by gross examination. In gross appearance of the enlarged nodes there was a high percentage of error in judging malignancy; malignancy was misdiagnosed in 61 per cent of the cases. This would tend to indicate that a large number of glands will be enlarged because of an inflammatory hyperplasia and not from metastasis.

McVay (38) in a study of 100 operative specimens of carcinoma of the rectum, classified lymph gland metastasis into three groups. In Group I was placed all of those not showing lymph gland metastasis. In Group II all of those where less than one half of the nodes were involved. In Group III all of those where more than one half are involved. In Group I there were 53 per cent, in Group II there were 30 per cent, in Group III there were 17 per cent. He concluded from his studies that metastasis to the glands takes place slowly, and the liver is the organ most affected by secondary growths, and the other organs are only rarely affected. He felt that systematic examination of the lymph nodes with the microscope was one of the best aids to an accurate prognosis.
The third mode of spread is by means of the venous system. Microscopic specimens often show direct invasion of the interior of venous radicals by cancer cells. These cells become detached from the main body, and may be swept into the venous system. As the rectal veins belong to the portal system, cancer cells penetrating them are carried straight to the liver. This is single and usually situated in the right lobe of the liver and in the middle of the substance. Consequently the presence of growths in the liver may be the first evidence of spread. This mode of spread however is not an early one and spread to the liver is seen quite late in the disease, so that by the time liver metastasis has taken place the case is quite hopeless as far as operation is concerned.

Brown and Warren(9) in a series of 170 cases in which resection was performed in 71 and colostomy in 76 cases found visceral metastasis present in 70 cases or 41 per cent. The most common sites of metastasis in order of frequency are liver, lung, adrenal, and bone. The tendency to visceral metastasis varied with the degree of differentiation. In relation to type there were metastases in malignant adenoma in 23 per cent, adenocarcinoma in 49 per cent, and carcinoma simplex in 56 per cent. Mucinous carcinoma has a marked tendency to metastasize by way of the lymphatics.

They found in general that the longer the duration of growth the greater the tendency to metastasis; 61 per cent of the cases showed local intravascular invasion, and 67 per
cent of these showed visceral metastasis, and only one case with visceral metastasis failed to show local vascular invasion. The authors suggest that the primary growth should be sectioned and carefully scrutinized for intravascular invasion. Its presence frequently means metastasis; and its absence, provided sections from three parts of the tumor are taken, nearly always rules out metastasis.

Harding and Hankins (22) found in their series of cases when cancer of the rectum had a tendency to metastasize it tended to involve the viscera more often in the rectum than in the sigmoid. For their entire series of 118 cases of cancer of the large bowel the liver was involved in 39 per cent and in the rectal cases in 33 per cent.

An unusual site of blood stream metastasis was reported by Stein and Hantsch (52). In this case the first discoverable metastasis was on the dorsum of the foot. They were unable to find a similar case in the literature or by communications.

The first case of skeletal metastasis was reported by Gurling (11) in 1870. A post-mortem examination revealed a cancer of the rectum invading the posterior wall of the pelvis and sacral plexus. "A large tumor had formed at the right elbow, which seemed to be a deposit of soft cancer in the upper part of the radius distending the bone".

Skeletal metastasis appears to occur infrequently in cancer of the rectum. Various estimates of the frequency are given, from 10.5 per cent to 6 per cent or less (2). It is said that
metastasis to the bone is not due to the embolic blocking of a vascular channel in the bone by a large mass of malignant cells, but is caused by the periaxial stagnation of the neoplastic cells as they pass from the blood vessels outside of the boney structure into the vascular bed situated within the bone. The blood vessels around the bone are of changeable size, depending on stimuli such as temperature and activity, while the vessels within the bone are of fixed caliber. In this manner the blood is carried from a narrowed peripheral vessel into a wider vessel within the bone marrow. This change in size of the vascular bed would tend to stagnate the neoplastic cells and to favor their multiplication. After they have multiplied sufficiently, they would block the vascular channel and then extend outward to the periosteum through the foramina without necessarily eroding the cortex.

Owing to this manner of formation, bone metastasis should occur most frequently in those bones subject to the greatest strain and stress as well as to changes in temperature. Von Recklinghausen(2) claimed that according to this theory, the frequency of bone metastasis in various parts of the skeleton would be as follows: vertebrae, femur and pelvis, ribs and sternum, humerus, skull, tibia, radius and ulna. Almost all statistics have born out this theory.
Grading

Grading of carcinoma was introduced by Broders(6,7,8) in 1915. At its beginning it was used to indicate the degree of malignancy in epithelioma. The principle on which this grading is based is that the more a carcinoma tends to differentiate the lower is its degree of malignancy. The method consists of grading on a basis of differentiation and mitosis, with special emphasis on differentiation. The grading is made from I to IV and is absolutely independent of the clinical history.

If an epithelioma shows a marked tendency to differentiate, that is, if about three fourths of its structure is differentiated epithelium and one fourth undifferentiated epithelium, it is graded I; if the differentiated and undifferentiated epithelium is about equal it is graded II; if the undifferentiated epithelium forms about three fourths and the differentiated about one fourth of the growth it is graded III; if there is no tendency of the cells to differentiate it is graded IV. The number of mitotic figures and the number of cells with single large deeply staining nucleoli(one-eyed cells) play an important part in grading and are used as a further guide for the degree of anaplasia.

These groups are not distinct and tend to merge into one another. A description of the various groups in relation to the histology present is given by Stewart and Spies(53) and is as follows:

Grade I: Under Grade I are placed those tumors with malignant features, yet structurally approaching the benign
adenoma. In tumors of this type the epithelial cells line distinct glandular cavities. A papillary arrangement is frequently, almost uniformly present. Invasive tendencies so far as determinable from the biopsy specimen, are negligible features. The epithelium contains two or three layers of nuclei, elongated, of rather uniform size, without distinct hyperchromatism; mitoses are present but not numerous. The cell polarity is preserved, and the nuclei occupy the basal regions of the cells, leaving a cytoplasmic zone bordering the lumen of the gland. Secretory activity may or may not be present.

Grade II: In Grade II the tumor cells still line definite glandular cavities; these cavities are more irregular; there is a marked tendency toward the production of papillary ingrowths and outpocketings of varying sizes and shapes. The walls of the glandular cavities are thicker; nuclei are arranged in three or more layers; they are more hyperchomatic, larger, more elongated, and are situated through the entire thickness of the epithelium; no very distinct cytoplasmic border separates the nuclear layers from the gland lumina; evidences of ulceration and infection are quite common; these tumors are classified as adenoma malignum or adenoma destruens. The beginning distribution of nuclei throughout the thickness of the gland wall may be interpreted as being an early expression of loss of cell polarity. Mitoses are often numerous.

Grade III: Tumors classified as Grade III show in addition
to glandular cavities resembling those seen in Grade II, solid areas where glandular tendencies are either lost or are represented by abortive attempts at tubule formation; the cells may be small with hyperchromatic nuclei, or they may be quite large and spindle-shaped. In either case there is definite loss of cell polarity. Papillary characters are poorly marked or absent. The stroma is frequently markedly increased, whereas in the two preceding groups it is a less prominent feature. Often the strands of tumor cells present a marked elongated, drawn-out appearance suggestive of infiltrating tendencies. Ulceration and infection are common, and the feeling exists that when infection is marked the tumor grade for clinical purposes should be increased. "Why infection should alter the clinical course in the direction of increased malignancy is not known; we do not know nor do we see any way of determining from our material whether the infection hastens the lethal termination by means of increased metastases or merely through the local and constitutional effects of such infection, for example hemorrhage and toxemia."

Grade IV: Grade IV comprises a heterogeneous group of tumors; "some of these suggest that with the accumulation of more material a fifth grade might profitably be introduced, but at the present time it is felt unwise to multiply grades."

These show various structures ranging between adenocarcinoma and diffuse carcinoma; they may contain fairly uniformly small cells with small, round or spindle-shaped hyperchromatic
nuclei, with an imperfect alveolar arrangement; they may consist of closely packed masses of tubulo-alveolar structure again with small cells, hyperchromatic nuclei and little stroma reaction. In the very diffuse type the carcinomatous structure may be determined with difficulty. Gelatinous adenocarcinomas characterized by diffuse infiltration with closely packed signet ring cells are likewise included in Grade IV. "The above description indicates that the group as studied comprises a heterogeneous collection of tumors, no one of which has been met with sufficient frequency to estimate its prognosis as a single type."

Dukes(17) made a study of the histologic grading on 600 patients with carcinoma of the rectum. He described the essential points in the grading as follows: Grade I tumors closely resemble a benign growth and can only be distinguished as malignant because of the evidence of invasion. In Grade II the tumor cells are less differentiated but grouped in fairly regular acini. In Grade III there is evidence of more rapid epithelial proliferation, the tumor cells being arranged in irregularly folded rings or clumps. In Grade IV the malignant cells are very anaplastic and do not form gland-like structures, but pervade the tissues singly or in small irregular clumps.

In Dukes' series the commonest growth is adenocarcinoma Grade II, and includes approximately half of the malignant growths of the rectum; Grade III is next with 26 per cent and colloid growths 12 per cent; Grade I was 6 per cent; and
Grade IV was 2 per cent.

Dukes also graded his series according to the degree of spread as A, B, and C. In A cases the growth was limited to the wall of the rectum. In B cases there was extension by direct continuity to the extrarectal tissues, but no glandular metastasis. In C cases there were metastases to the regional lymph nodes. This was further studied in an attempt to determine the value of grading as a prognostic index. He found that in cases designated by surgeons as operable it has been found that approximately 15 per cent are A cases, 35 per cent are B cases, and 50 per cent are C cases. An analysis of the distribution of A, B, and C cases in each grade shows a great relative increase of A case in Grade I, and a virtual disappearance of A cases from Grade III and IV; on the other hand, the C cases which form a relatively small fraction of Grade I tumors become the main constituents of Grade III and IV. This indicates a high degree of correlation between grade and degree of spread, the degree of spread, roughly, being in direct proportion to the grade.

Shedden (50) collected 36 definite cases of carcinoma of the rectum in persons below 20 years of age. He also had a series of 24 cases between the ages of 20 and 35 years. In grading the series between the age of 20 and 35 years he found 35 per cent were Grade I, 40 per cent were Grade II, 12 per cent were Grade III, and 12 per cent were Grade IV. In the series below 20 years he found 14 per cent Grade I,
33 per cent Grade II, and 39 per cent Grade IV, and the balance just designated as "cancer" which may or may not have placed them in the higher grades of malignancy. This indicates a tendency toward the higher, less differentiated tumors in the younger age groups.
SYMPTOMS AND DIAGNOSIS

Hayden and Shedden(24) after a study of 303 cases of cancer of the rectum state that with early cancer of the rectum one usually sees a normal, healthy appearing individual, who comes in because he has seen a little blood in his movements, or he has had a little rectal discomfort, or some increase in constipation, or a tendency to move his bowels a little more often than usual. As a rule he has one or two formed movements a day, and perhaps several additional stools daily of only blood, pus, and mucus.

Steps in the diagnosis should include: a careful history, digital rectal examination, speculum examination of the anal canal, proctoscopy, two to three hours following a cleansing enema, and a barium enema only if the proctoscopy is negative. In 95 per cent of the cases in this series the lesion was within 10 cm. of the anus which would make them accessible to digital rectal examination.

Because bleeding is a common symptom of internal piles, doctors too often make a snap diagnosis of hemorrhoids and treat them as such. In this series 34 patients said they had bleeding piles, 24 others had been receiving medical treatment on that assumption, and 20 others had been operated on for piles comparatively recently before entrance to the hospital. Bargen(3) states that 95 per cent of all carcinoma of the rectum is within reach of the examining finger, and that one of the chief factors in the poor prognosis of cancer of the
rectum is delay by the physician in making a digital examination of the rectum.

Yeomans(59) in a study of 320 cases of cancer of the rectum lists the following symptoms in their order of frequency:

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constipation</td>
<td>104</td>
</tr>
<tr>
<td>Constipation and pain</td>
<td>29</td>
</tr>
<tr>
<td>Constipation and bleeding</td>
<td>13</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>10</td>
</tr>
<tr>
<td>Diarrhea and pain</td>
<td>19</td>
</tr>
<tr>
<td>Diarrhea and bleeding</td>
<td>19</td>
</tr>
<tr>
<td>Bleeding</td>
<td>70</td>
</tr>
<tr>
<td>Bleeding and pain</td>
<td>25</td>
</tr>
<tr>
<td>Bleeding and protrusion</td>
<td>1</td>
</tr>
<tr>
<td>Vaginal bleeding</td>
<td>1</td>
</tr>
<tr>
<td>Hematuria</td>
<td>1</td>
</tr>
<tr>
<td>Pain in back</td>
<td>5</td>
</tr>
<tr>
<td>Pain in abdomen</td>
<td>13</td>
</tr>
<tr>
<td>Pain in anus</td>
<td>6</td>
</tr>
<tr>
<td>Nausea and vomiting</td>
<td>1</td>
</tr>
<tr>
<td>Dysuria</td>
<td>1</td>
</tr>
<tr>
<td>Fullness in rectum</td>
<td>1</td>
</tr>
<tr>
<td>Swelling in buttocks</td>
<td>1</td>
</tr>
</tbody>
</table>

320

These findings are in accord with other authors that the earliest symptoms are constipation, bleeding, and pain.

Lynch(35) in a study of 491 cases states that the important
symptoms in order of diagnostic and therapeutic importance are as follows:

1. Constipation: This is believed to be the earliest of symptoms. It is undoubtedly protective in type being perhaps the result of biologic reaction to the presence of the new growth. There are, however, several hypotheses as to its origin depending upon the path of inhibitory transmission rather than upon its origin or occurrence. Of the latter and of its protective nature there can be no doubt. Certainly it is not due to mechanical obstruction of the new growth.

2. Stomach symptoms: "We have repeatedly referred to these as esoteric as contrasted to hemorrhage and the like which is exoteric. Chronic indigestion, so frequently a sign of peripheral pathology, is just as significant of rectal cancer as of a chronic appendix."

3. Blood or bloody stools: This is usually the first exoteric sign. It can occur without ulceration, in which case it may be due to a blocking of the circulation in the valveless veins leading to the liver. In any event hemorrhage so commonly associated with cancer, (which was found in 10 per cent of the 491 cases and interpreted as hemorrhoids before this author saw them) is a frequent source of blood. In a large proportion it is due to ulceration.

4. A frequent and imperative desire to move the bowels, followed by explosive discharges of gas, blood and mucus. This symptom is usually spoken of as the diarrhea of cancer.
It is not in reality a diarrhea in that feces are rarely passed.

In this series the duration of symptoms was eight months.

Brindley(5) in his series found that 80 per cent of his patients gave a history of bleeding and a complaint of rectal discomfort was given by 68 per cent. He states the time at which a diagnosis is made is a vital factor because it determines the extent of the carcinoma. This is the one factor about which most can be done toward increasing the number of cures, so an attempt should be made to diagnose early.

"The symptoms and signs of early disease should be remembered. Blood in the stool is the most important first indication of cancer, and a mild rectal discomfort is next. The patient describes this as an uneasiness, a heaviness, a weighty feeling, a soreness or a mild cramping. Intense pain is practically never an early manifestation of this disease. A change in bowel habit may be the earliest symptom. These few signs and symptoms are sufficient to cause rectal cancer to be suspected, and, when suspected, a careful digital and proctoscopic examination should be made. Practically all rectal cancers can be diagnosed by these two simple procedures.

Differential Diagnosis(49)

Change or irregularity of bowel habit, vague rectal distress, pain or bleeding, are symptoms which may be present in cases of hemorrhoids, anal fissure or ulcer, squamous-cell carcinoma of the anal canal, single or multiple polyps, rectal stricture, chronic ulcerative colitis, tuberculous colitis, amebiasis,
diverticulitis of the sigmoid and functional disorders such as irritable colon.

Thrombosed internal hemorrhoids are usually accompanied by acute rectal pain and are generally multiple. They have an acute onset, are circumscribed tender areas and are covered by smooth rectal mucosa unless ulcerated, while cancer is an indurated growth of the mucosa. Doubtful tumor areas resulting from the injection treatment of internal hemorrhoids can be differentiated by biopsy.

Fissure or ulcer of the anal canal or ulcerated crypts may be found on examination. These may account for the patient's symptoms but one should always do a thorough digital and sigmoidoscopic examination to be sure that adenocarcinoma is not also present. Likewise a hemorrhoidectomy should be preceded by sigmoidoscopy because hemorrhoids as well as other common rectal ailments are often present with cancer.

Squamous-cell carcinoma of the anal canal which involves the lower rectum can be differentiated by biopsy.

In chronic ulcerative colitis, tuberculous colitis or amebiasis, any of which involve the rectum, one will find an inflamed and ulcerated mucosa in the absence of a malignant growth. However, one occasionally finds the ulcerated mucosa studded with multiple polypoid growths which should be considered and observed at weekly intervals for evidence of incomplete healing or recurrence which usually means malignancy.

Rectal stricture is inflammatory and may be due to gonorrhea,
syphilis, or in the colored female, to lymphopathia venereum. It is usually found in young adults and involves the rectum within one or two inches of the anal canal. The constriction is rigid, more or less tubular and usually the surface is pitted by ulcerations. The Wasserman and Frei tests and a study of smears will aid in the differentiation. In suspected diverticulitis of the sigmoid causing obstruction, a malignant growth may not be visualized but must always be considered. X-ray study and even exploratory operation may be necessary to make a positive differentiation.

Occasionally diseases of the pelvic structures outside of the rectum produce confusing symptoms. In these conditions sigmoidoscopy generally shows a localized inflammatory involvement of the bowel wall with partial obstruction.
PROGNOSIS

Prognosis in cancer of the rectum as in cancer in other parts of the body is dependent upon the general condition of the patient as well as the local lesion. In a patient where the growth has become far advanced and spread to the viscera, and he shows definite signs of a toxic action such as anemia, it is not so difficult to determine the prognosis. However, in early cases, where biopsy examination is done and radical surgical treatment can be instituted, this is one type of cancer in which a fairly accurate, and very helpful prognostic instrument is available.

First, however, it would be best to examine the clinical methods of determining a prognosis. Gabriel(20) has summed up the points which are helpful in a clinical examination. He states that in general the smaller, the more movable, and the more protuberant and superficial the growth the more likely it is to be removable. A deeply ulcerating growth is likely to have penetrated the rectal wall with risk of extrarectal spread; and for anatomical reasons an ulcerating growth anteriorly is more dangerous than a similar growth posteriorly. As a general rule the immediate prognosis of a growth high up in the rectum is less favorable than a growth lower in the rectum due to technical difficulties involved in removal, and a rectosigmoid growth is liable to produce some degree of obstruction with its attendant dangers.

He lists the following important points on rectal
examination:

1. In a small deeply ulcerated growth in the lower third of the rectum, if hard glands or any extrarectal induration can be made out digitally on the posterior or postero-lateral aspects of the rectum, this is a certain indication of such extensive lymphatic spread that cure is unlikely, even by a combined radical operation.

2. Sometimes rectal examination reveals submucous thickening above the main growth, either in the form of nodules or rarely as a generalized brawny infiltration analogous to the leather-bottle stomach. Clinically this may resemble a connective tissue tumor such as a sarcoma or endothelioma, but it is more likely to prove to be a rapidly growing carcinoma. Such a patient is incurable by any method, and even if a palliative perineal excision is done, early pelvic recurrence will inevitably take place.

3. If vaginal examination proves the growth to be bulging into the vagina and to be adherent to the posterior vaginal wall the outlook is poor. A growth which has ulcerated through into the vagina is inoperable, and the same estimate applies to a high rectal carcinoma which can be felt invading the posterior vaginal fornix; a combined excision of the rectum in conjunction with a total hysterectomy is attended by a prohibitive mortality.

4. A low rectal carcinoma which has spread down the anal canal and presents as an ulcerating or fungating anal mass
may justifiably be treated by perineal excision, chiefly as a palliative method, but the prospects of cure are slender and the possibility of extension to the inguinal glands has to be kept in mind.

Influence of age: In general the younger the individual the better the immediate outlook, Lockhart-Mummery (31) writes "I have no record of any patients under 30 who has not died of prompt recurrence", and Mechling (39) states that persons under 30 do not recover from rectal cancer. So, perhaps it should be said that the younger the patient the better the outlook if he is not in the first three decades. The reason for this is probably due to the fact that the tissues of the young are more elastic and have a richer blood supply, and their lymphatics are more open, factors that are favorable to the rapid growth and dissemination of a neoplasm, while the fibrotic, sclerosing changes accompanying senescence tend to retard the development and spread of a malignant condition. Therefore, in the young the growth is usually of a high grade of malignancy, and of a more rapid growth and metastasize early.

Influence of sex: In general the operative risk is greater in the male than in the female. This is probably due to the fact that the female pelvis is roomier and permits an easier and more thorough dissection. Yeomans (58) states that the mortality is 7 per cent greater in males.
Rankin and Broders(44) graded and studied a series of 598 cases between the years 1916 and 1925 and arrived at the following conclusions in regard to prognosis:

1. Extrinsic influences such as age, general condition of the patient, duration of the lesion with its attendant signs and symptoms, and various local conditions associated with the neoplasm, such as its size, situation and mobility, the presence or absence of metastasis both lymphatic and visceral, fibrosis, lymphocytic infiltration, and hyalinization, are in the main modifying in type, age being one that definitely prejudices successful prognosis.

2. Duration of the growth is important but its exact duration is difficult to determine.

3. Fixation influences operability, and in consequence, operative mortality and successful outcome. Fixation in some instances may be the result of inflammatory changes rather than extension of malignancy, so that radical manoeuvres give surprisingly successful results, although this is the exception rather than the rule.

4. Site of the growth influences outcome because of pathological type and early detection, epitheliomata of the anal canal are early recognizable and easily removed by local operation, while the type of neoplasm situated higher in the rectum is almost always adenocarcinomatous.

5. The grade of malignancy has a direct bearing on the percentage of metastasis, and absence of metastasis since
the percentage of cases showing metastasis increase in proportion to the grade and the percentage of cases without metastasis increases in inverse proportion to it.

6. The influence of the grade of malignancy on the ultimate result is indicated by the fact that the total of good results decreases in inverse proportion to the grade, while the total of poor results increases in proportion to it.

7. From a comparison of the influence of metastasis and that of the grade of malignancy it is obvious that the grade of malignancy is the dominant factor since the total of good results decreases in inverse proportion to the grade and the total of poor results increases in proportion to the grade.

8. When the influence of the absence of metastasis and of the grade of malignancy on the ultimate result are considered together, the influence of the grade is still evident but not to such a marked degree as when it is considered with metastasis.

9. If the percentage of metastasis increases as the grade rises, and the influence of the grade of malignancy on the ultimate result has been established beyond doubt, it is reasonable to assume that the total of good results in the presence of metastasis will not be as high as, and the poor results higher than, when metastasis is absent; furthermore the total of good results when metastasis is absent should be higher, and the total of poor results lower, than when
metastasis is present. Actually the total of good results when metastasis was present was 20.68 per cent and the total poor results was 79.31 per cent. When metastasis was absent the total good result was 57.87 per cent and the total of poor result was 42.12 per cent.

10. It will also be noted that almost as good a result is obtained in the case of carcinoma of the rectum graded I with metastasis, as in the case of carcinoma graded III or IV without metastasis. Furthermore there has not been a good result in this series when malignancy was graded IV and metastasis was present.

11. The influence of the grade of malignancy on the duration of life after operation in cases in which death occurred from the carcinoma is shown by the fact that the average duration decreased as the grade increased.

Dukes(17) in a follow up study of 200 cases followed for five years, and 300 cases followed for three years found a close correlation between grade of cancer and duration of life. The death rate in the first three years was 20 per cent for Grade I, 36 per cent for Grade II, 48 per cent for Grade III, and 66 per cent for Grade IV, for colloid cases it was 40 per cent. For the five year period the death rate was 40 per cent for Grade I, 56 per cent for Grade II, 76 per cent for Grade III, and 100 per cent for Grade IV, for colloid cases it was 63 per cent. Studies using the classification A, B, and C as explained in the section on
pathology showed the following survival rates: 93 per cent for A cases, 65 per cent for B cases, and 23 per cent for C cases.

Shedden(50) in his collection of cases in persons below 20 years of age found that 43 per cent of those in Grade I were alive after five years, and the others died on an average of 25 months.

Gabriel, Dukes, and Bussey(21) using the A, B, and C grouping cited above found the following survival periods: for group A there was a five year survival of 91 per cent, for group B a five year survival of 64 per cent, and for group C a five year survival of 16 per cent.

Daland, Welch, and Nathanson(12) made a detailed study of 100 untreated cases of carcinoma of the rectum. This group was compared to a series of 80 cases which received a palliative colostomy, 32 case which received a palliative colostomy plus x-ray treatment, and 42 cases that were treated by radical resection. The average length of life from the onset of symptoms to death in the untreated series was 17.2 months, the shortest being 11.4 months and the longest being 25 months. In the series of 80 cases treated only with a palliative colostomy the shortest duration of life was 11 months and the longest was 23 months with an average duration of 16.9 months. In the series of 32 cases treated with a palliative colostomy and x-ray the shortest duration
of life was 4 months and the longest duration was 33 months
with an average duration of life of 18.8 months. In the
series of 42 cases treated by radical resection the number
of five year cures was 30 per cent with an operative
mortality of 26.2 per cent. This operative mortality is
higher than that reported by some clinics. Brindley(5)
in a series of 76 operations had a mortality of 3.9 per
cent for all types of operations. Dixon(13) states that
the average mortality for the combined operation is 12 per
cent and in his series of posterior excisions the mortality
was 4 per cent.
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